Questioning Practices to Support Mathematical Practices

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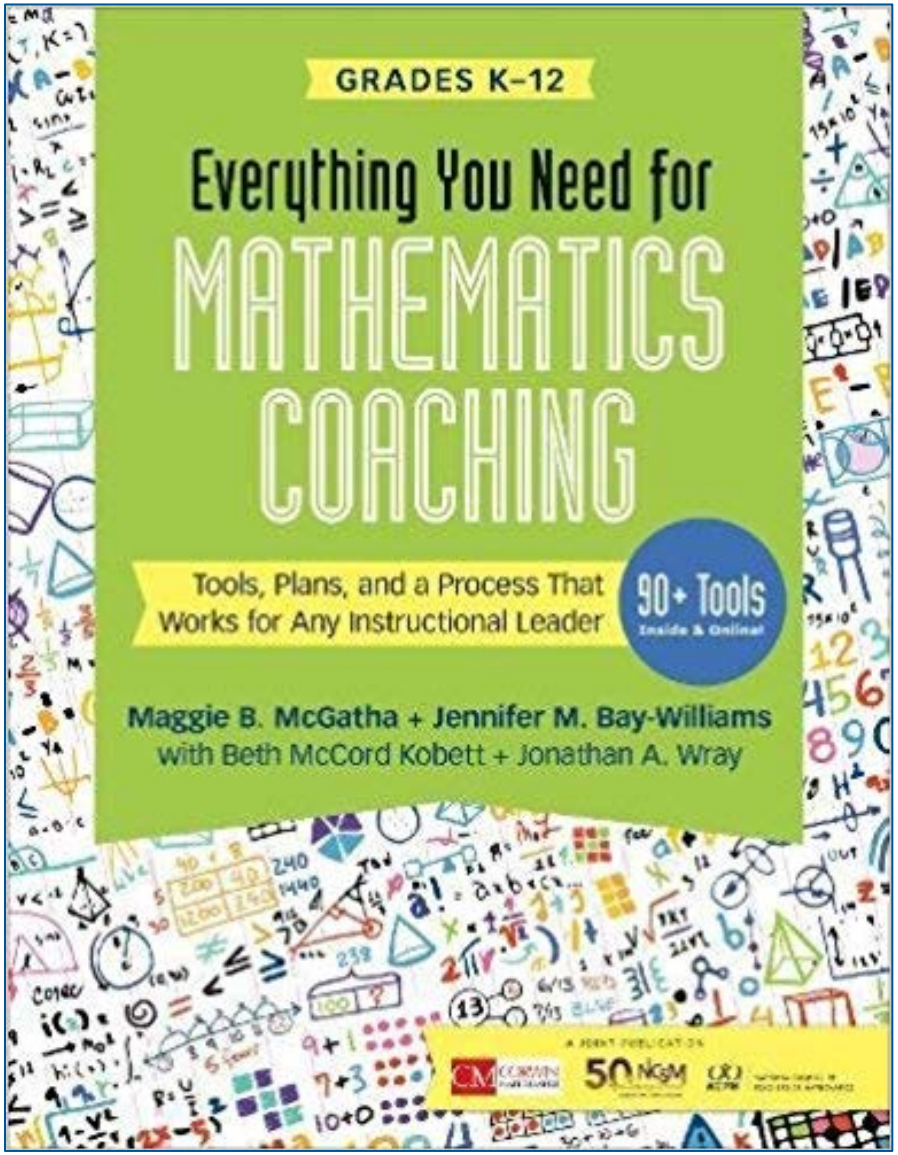


Joint publication of Corwin, NCTM & NCSM

Coach

Teacher

Tips for Posing Questions

Tips for Posing Questions, p. 1

- Plural forms
- Tentative language
- Open-ended
- Positive presuppositions
- Higher-order thinking
- Approachable voice

Tips for Posing Questions, p. 1

- Plural forms

What strategy will you use?

vs.

What strategies will you use?

Tips for Posing Questions, p. 1

- Plural forms

How will you solve this problem?

vs.

What are some ways you might solve this problem?

Tips for Posing Questions, p. 1

- Tentative language: might, seem, some

Why is Ryan struggling?

vs.

What might be some reasons Ryan is struggling?

Tips for Posing Questions, p. 1

- Open-ended

Have you thought about…

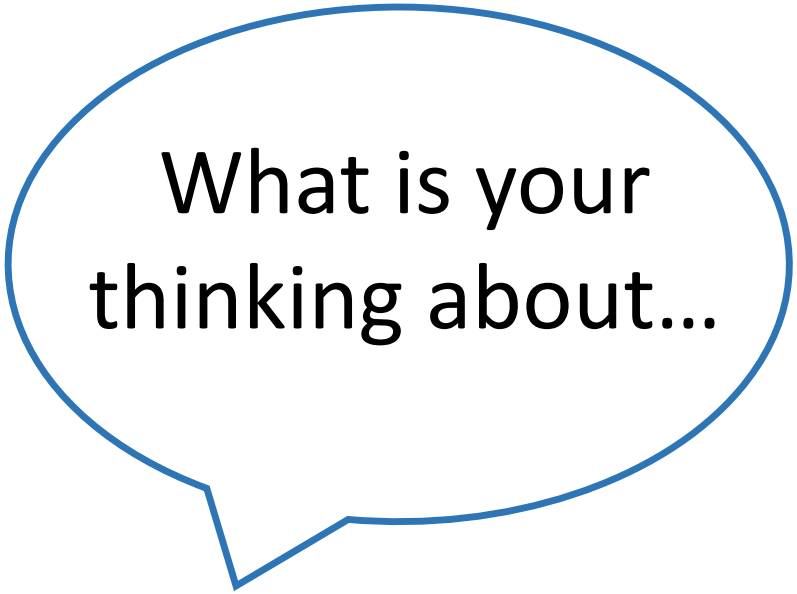
vs.

What is your thinking about…

Tips for Posing Questions, p. 1

- Open-ended

vs.



Tips for Posing Questions, p. 1

- Positive presuppositions

As you focus on ELLs in this lesson, what strategies might you use?

&

What are you learning that you want to remember?

Tips for Posing Questions, p. 1

- Higher-order thinking

What else can you tell me about that idea?

vs.

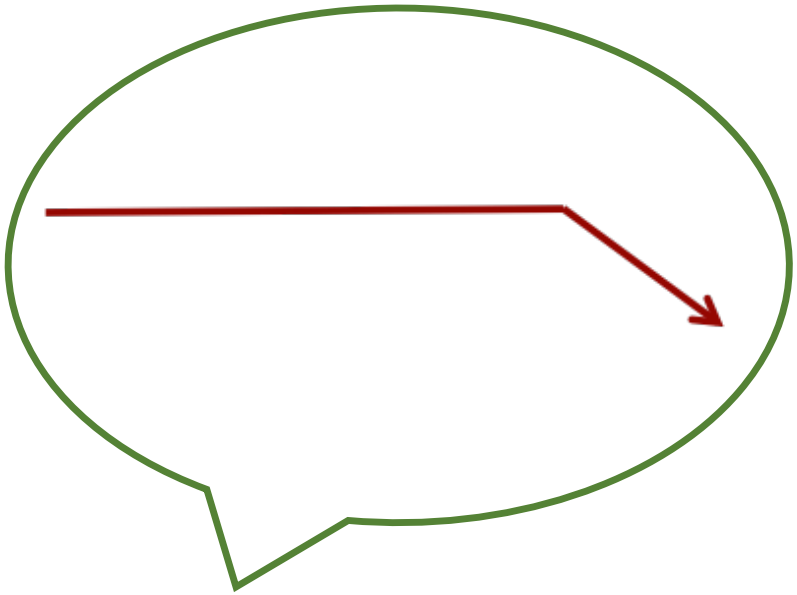
How does that idea compare with others you generated?

Tips for Posing Questions, p. 1

- Approachable voice

Approachable Voice

vs.



Credible Voice

Coach

Teacher

Posing Questions: Teachers, p. 1

- ◯ Plurals
- — Tentative
- * Positive presuppositions
- × Higher-order thinking
- Open-ended

Posing Questions: Teachers, p. 1

- ⬭ Plurals
- — Tentative
- ✱ Positive presuppositions
- × Higher-order
- Open-ended

1. What might be some strategies you have tried before that were successful?
2. What are some connections between this goal and the standards?
3. What seems most useful in this situation?
4. What might be some of your choices?
5. In what ways might you sequence those ideas?

Posing Questions: Teachers, p. 1

1. What might be some strategies you have tried before that were successful? * ✓
2. What are some connections between this goal and the standards? * X ✓
3. What seems most useful in this situation? * ✓
4. What might be some of your choices? * ✓
5. In what ways might you sequence those ideas? * X ✓


PRACTICE

Using the Tips for Posing Questions, p. 2

Statement a Teacher Might Make	Statement a Student Might Make
A. My students can't work together in groups. I give them topics to discuss, but they are off task when I listen to their conversations. I feel like I am losing control of the room when the students talk with each other." **Coaches, first name beginning with A - H**	B. "I don't understand how to do this." **Teachers, first name beginning with A - H**
C. "I have really been thinking about Mathematical Practice #4, Model with mathematics. I am not quite sure how it is different from Mathematical Practice #5, Use appropriate tools strategically." **Coaches, first name beginning with I-P**	D. "When I read a word problem, I don't know which operation to use." **Teachers, first name beginning with I - P**
E. "I've tried think-pair share. I can get my students in groups and I give them prompts to discuss but I am not sure if they are staying on task." **Coaches, first name beginning with Q-Z**	F. "I have the answer, but I don't know how I got it." **Teachers, first name beginning with I - P**

Coach

Teacher

Write a question for your assigned statement that includes as many of the tips for posing questions as appropriate.

Using the Tips for Posing Questions, p. 2

A. “My students can’t work together in groups. I give them topics to discuss, but they are off task when I listen to their conversations. I feel like I am losing control of the room when the students talk with each other.”

If you were assigned statement A, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

A. “My students can’t work together in groups. I give them topics to discuss, but they are off task when I listen to their conversations. I feel like I am losing control of the room when the students talk with each other.”

“How does their off-task behavior in groups compare to when they work independently?”

Using the Tips for Posing Questions, p. 2

B. “I don’t understand how to do this.”

If you were assigned statement B, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

B. “I don’t understand how to do this.”

“If you did know what to do, what might you try first?”

Using the Tips for Posing Questions, p. 2

C. “I have really been thinking about Mathematical Practice #4, Model with mathematics. I am not quite sure how it is different from Mathematical Practice #5, Use appropriate tools strategically.”

If you were assigned statement C, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

C. “I have really been thinking about Mathematical Practice #4, Model with mathematics. I am not quite sure how it is different from Mathematical Practice #5, Use appropriate tools strategically.”

“Which aspects of these two mathematical practices seem similar to you?”

Using the Tips for Posing Questions, p. 2

D. “When I read a word problem “I don’t know which operation to use.”

If you were assigned statement D, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

D. “When I read a word problem “I don’t know which operation to use.”

“When you read a word problem, how might you make decisions about what to do first?”

Using the Tips for Posing Questions, p. 2

E. “I want to try number talks in my classroom but am not sure how to get started.”

If you were assigned statement E, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

E. “I want to try number talks in my classroom but am not sure how to get started.”

“What resources might you have available to help you get started?”

Using the Tips for Posing Questions, p. 2

F. “I have the answer, but I don’t know how I got it.”

If you were assigned statement F, please hit submit in the chat box.

Everyone else, take a moment to read a few of the questions, looking for the tips we discussed.

Using the Tips for Posing Questions, p. 2

F. “I have the answer, but I don’t know how I got it.”

“What might be the first thing you did in solving the task? Second?”

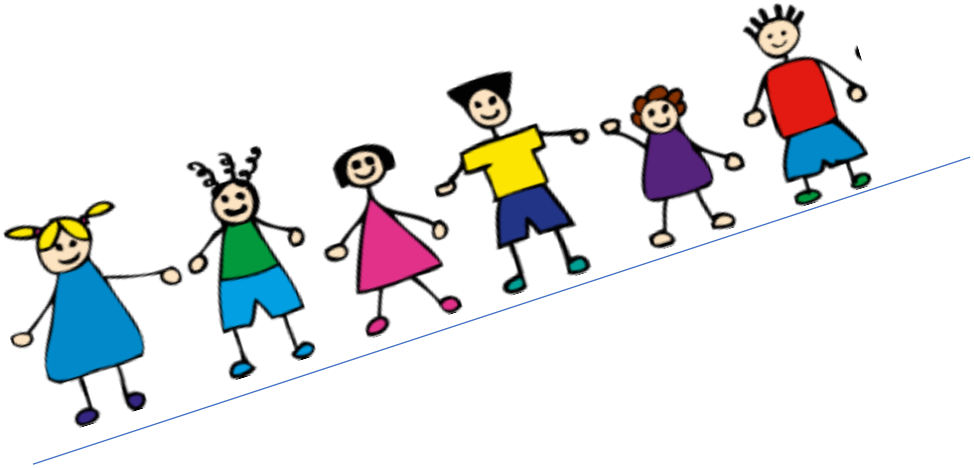
Posing Questions about Mathematical Reasoning

Red Light, Green Light, pp. 3-4

Who is winning the race?

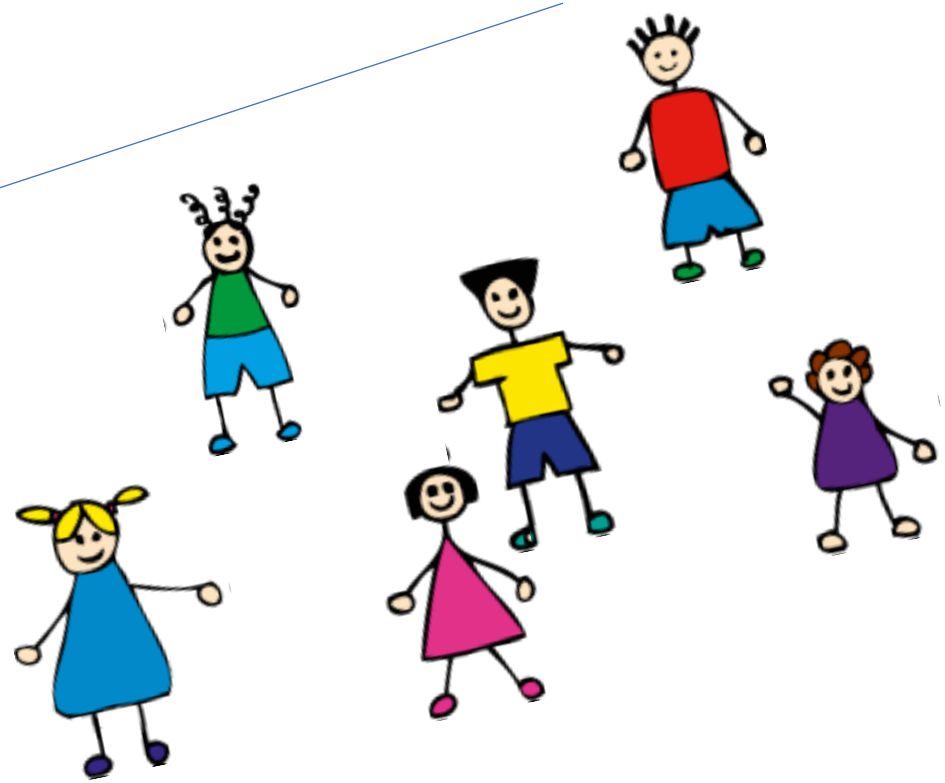
Mary: $\frac{3}{4}$ Larry: $\frac{1}{2}$ Carrie: $\frac{5}{6}$

Han: $\frac{5}{8}$ Shawn: $\frac{5}{9}$ Juan: $\frac{2}{3}$



Red Light, Green Light

Red Light, Green Light



Red Light, Green Light, pp. 3-4

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Red Light, Green Light

Teacher

Mary: $\frac{3}{4}$	Larry: $\frac{1}{2}$
Carrie: $\frac{5}{6}$	Han: $\frac{5}{8}$
Shawn: $\frac{5}{9}$	Juan: $\frac{2}{3}$

What questions might you ask students about this task?

Record at the bottom on p.4

Red Light, Green Light – Possible Questions for Students

- What fraction comparison strategies do you know that might be useful in solving this problem?
- What are some ways you might rule out some of the runners?
- Which fractions are easy to compare and which are difficult (and why)?
- How does using common denominators compare to using benchmark fractions for figuring out this task?

Coach

Red Light, Green Light

Mary: $\frac{3}{4}$	Larry: $\frac{1}{2}$
Carrie: $\frac{5}{6}$	Han: $\frac{5}{8}$
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What questions might you ask teachers about this task?

Record at the bottom on p.4

Red Light, Green Light – Possible Questions for Teachers

- As you make sure the task keeps it rigor, how might you make it accessible to all students?
- What are some questions you might pose as students are working to deepen their reasoning?
- What strategies are you considering for ensuring all students are doing their own thinking?

Connecting Questioning to Mathematical Practices

Mathematical Practices & Student Look Fors

1. Make sense of problems and persevere in solving them.

- ☐ Analyze information (givens, constrains, relationships).
- ☐ Make conjectures and plan a solution pathway.
- ☐ Use objects, drawings, and diagrams to solve problems.
- ☐ Monitor progress and change course as necessary.
- ☐ Check answers to problems and ask, "Does this make sense?"

2. Reason abstractly and quantitatively.

- ☐ Make sense of quantities and relationships in problem situations.
- ☐ Create a coherent representation of a problem.
- ☐ Translate from contextualized to generalized or vice versa.
- ☐ Flexibly use properties of operations.

3. Construct viable arguments and critique the reasoning of others.

- ☐ Make conjectures and use counterexamples to build a logical progression of statements to support ideas

Kentucky Academic Standards (2019)

Standards for Mathematical Practice	
MP.1. Make sense of problems and persevere in solving them. MP.2. Reason abstractly and quantitatively. MP.3. Construct viable arguments and critique the reasoning of others. MP.4. Model with mathematics.	MP.5. Use appropriate tools strategically. MP.6. Attend to precision. MP.7. Look for and make use of structure. MP.8. Look for and express regularity in repeated reasoning.

Cluster: Extend understanding of fraction equivalence and ordering.

Standards	Clarifications
KY.4.NF.1 Understand and generate equivalent fractions. a. Use visual fraction models to recognize and generate equivalent fractions that have different numerators/denominators even though they are the same size. b. Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{(n \times a)}{(n \times b)}$. **MP.4, MP.7, MP.8**	Students draw fractions and see equivalent fractions.  Coherence KY.3.NF.3→ KY.4.NF.1→KY.5.NF.1
KY.4.NF.2 Compare two fractions with different numerators and different denominators using the symbols <, =, or >. Recognize comparisons are valid only when the two fractions refer to the same whole. Justify the conclusions. **MP.2, MP.3**	Students use a variety of representations to compare fractions including concrete models, benchmarks, common denominators and common numerators. Note: Students determine which strategy makes the most sense to them, realizing they use different strategies for different situations. Coherence KY.3.NF.3d→ KY.4.NF.2→KY.5.NF.2

Illustrative Mathematics®

LESSON 1

One of These Things Is Not Like the Others

PREPARATION LESSON PRACTICE

1.1: Remembering Double Number Lines (5 minutes)

CCSS Standards

Building On

6.RP.A

Required Preparation

Instructional Routines

Think Pair Share

Source: https://www.illustrativemathematics.org/curriculum/im-6-8-math-curriculum/

GaDOE Georgia Department of Education | GeorgiaStandards.org

SCAFFOLDING TASK: ARRAYS ON THE FARM

Return to Task Table

In this task, the students use arrays to solve multiplication problems. Farmers grow their crops in arrays to make them easier to look after and to harvest. Additionally, students are asked to be involved in guessing and estimating. These are both useful skills that take time to develop. This task provides some practice for these skills.

APPROXIMATE TIME: 3-4 days

CONTENT STANDARDS

MGSE3.OA.5. Apply properties of operations as strategies to multiply and divide.[6] Examples: If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.) $3 \times 5 \times 2$ can be found by $3 \times 5 = 15$, then $15 \times 2 = 30$, or by $5 \times 2 = 10$, then $3 \times 10 = 30$. (Associative property of multiplication.) Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$, one can find 8×7 as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. (Distributive property.) Use arrays, area models, and manipulatives to develop understanding of properties.

STANDARDS FOR MATHEMATICAL PRACTICE (SMP)

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.

Source: https://www.georgiastandards.org/Pages/default.aspx

BetterLesson | Search | Home | Professional Learning | Instructional Strategies | Lesson Plans | Log In

Math | English Language Arts | Science | Blended Learnin

Second Grade | Number & Operations in Base Ten | 2.NBT.B.5

2.NBT.B.5

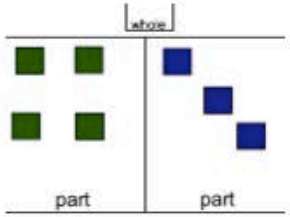
Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

56

View child tags

Domino Addition: Understanding the Part/Part/Whole Relationship

2nd Grade Math » Unit: Addition and Subtraction Basic Training



Big Idea: The big idea of this lesson is the understanding that addition can be represented as parts of a whole and that we can use addition sentences to represent those parts.

Standards

2.NBT.B.5 | 2.NBT.B.6 | 2.NBT.B.9 | MP1 | MP4

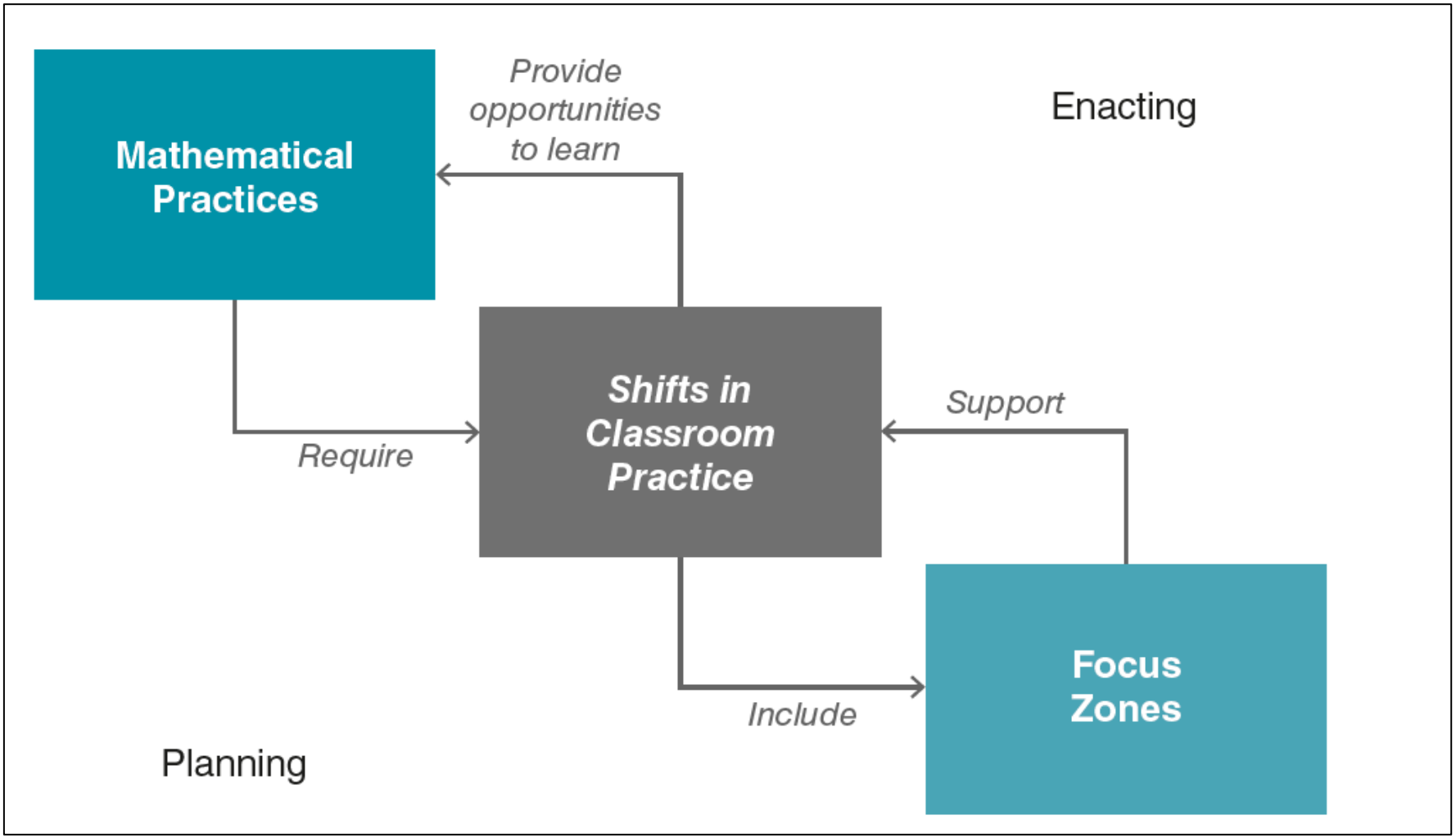
Kristen O'Connor
Rural Env.

20 RESOURCES

22 FAVORITES

Source: https://betterlesson.com/

Leading for Mathematical Proficiency (LMP) Framework



Shift #5: From questions that seek expected answers toward questions that illuminate and deepen student understanding.

Shift #5: From questions that seek expected answers toward questions that illuminate and deepen student understanding.

Teacher poses closed and/or low-level questions, confirms correctness of responses, and provides little or no opportunity for students to explain their thinking.

Teacher poses questions that advance student thinking, deepen students' understanding, make the mathematics more visible, provide insights into student reasoning, and promote meaningful reflection.

See Tool 2.1Shifts Self-Assessment in Handout

Mathematical Practices & Student Look Fors

1. Make sense of problems and persevere in solving them.

- ☐ Analyze information (givens, constrains, relationships).
- ☐ Make conjectures and plan a solution pathway.
- ☐ Use objects, drawings, and diagrams to solve problems.
- ☐ Monitor progress and change course as necessary.
- ☐ Check answers to problems and ask, "Does this make sense?"

2. Reason abstractly and quantitatively.

- ☐ Make sense of quantities and relationships in problem situations.
- ☐ Create a coherent representation of a problem.
- ☐ Translate from contextualized to generalized or vice versa.
- ☐ Flexibly use properties of operations.

3. Construct viable arguments and critique the reasoning of others.

- ☐ Make conjectures and use counterexamples to build a logical progression of statements to support ideas

Questioning and the Mathematical Practices, p. 5

Mathematical Practices Placemat

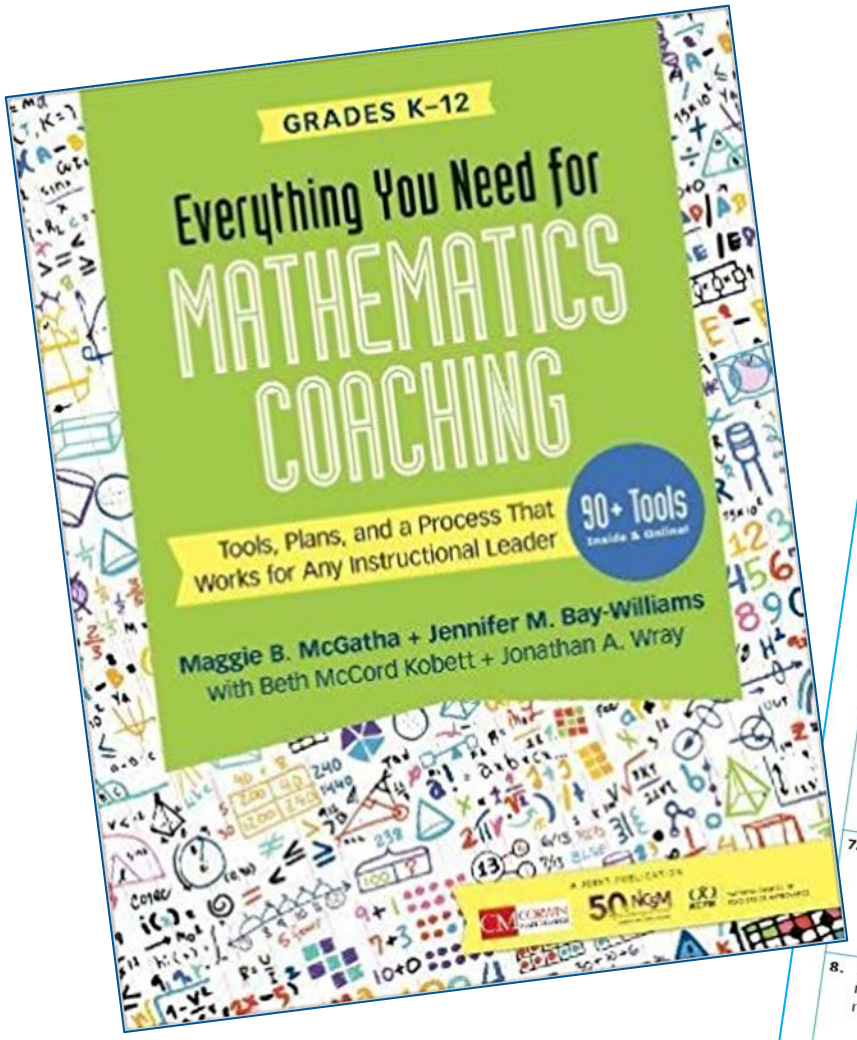
Focusing Questions on Student Reasoning

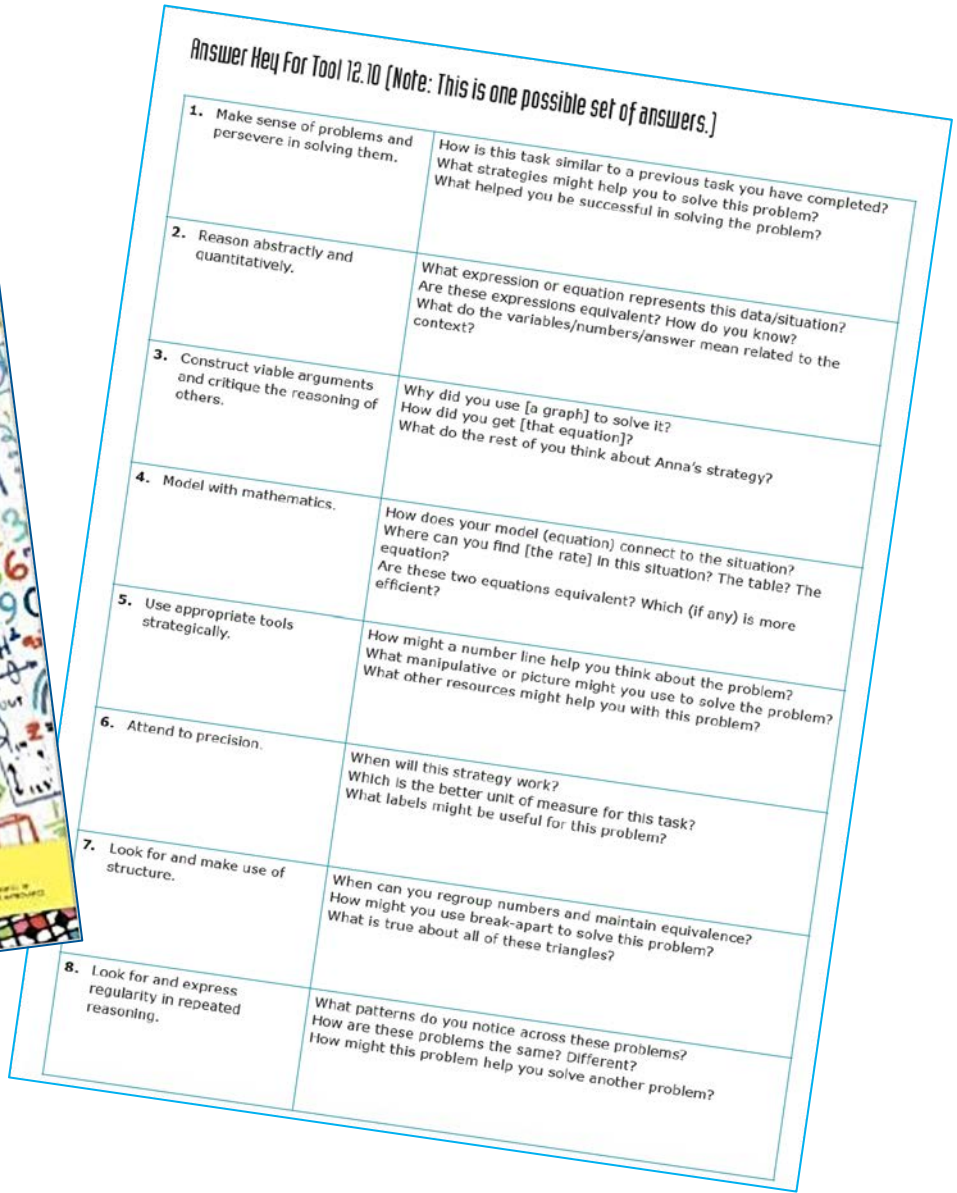
Mathematical Practices Placemat	
1. Make sense of problems and persevere in solving them.	
2. Reason abstractly and quantitatively.	
3. Construct viable arguments and critique the reasoning of others.	
4. Model with mathematics.	
5. Use appropriate tools strategically.	

Decide where each question might go on the placemat.

1. How is this task similar to a previous task you have completed?
2. What other resources might help you with this problem?
3. When will this strategy work?
4. How might you use **break-apart** to solve this problem?
5. How are these problems the same? Different?
6. What manipulative or picture might you use to solve the problem?
7. What do the rest of you think about Anna's strategy?

One possible set of answers!

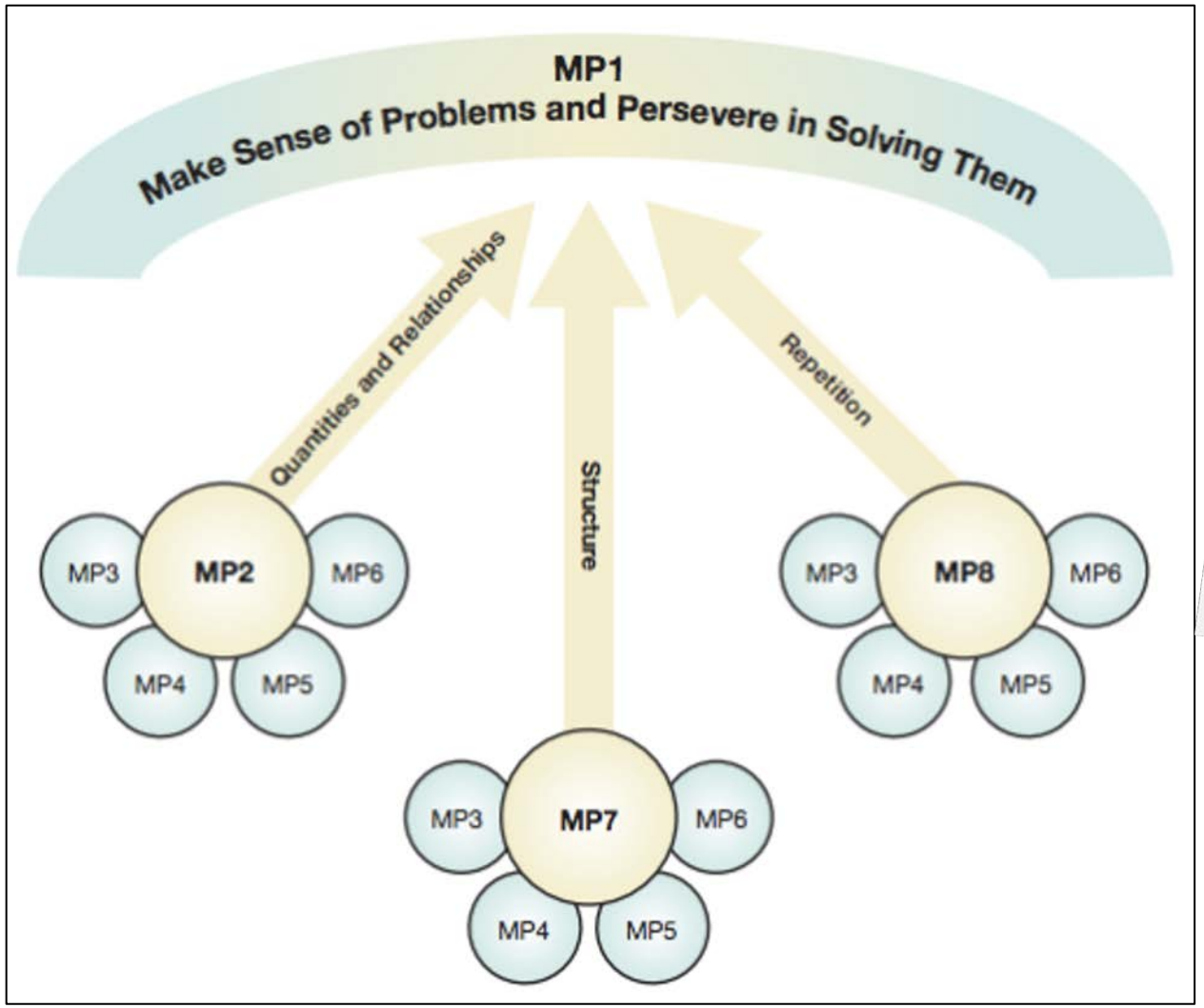


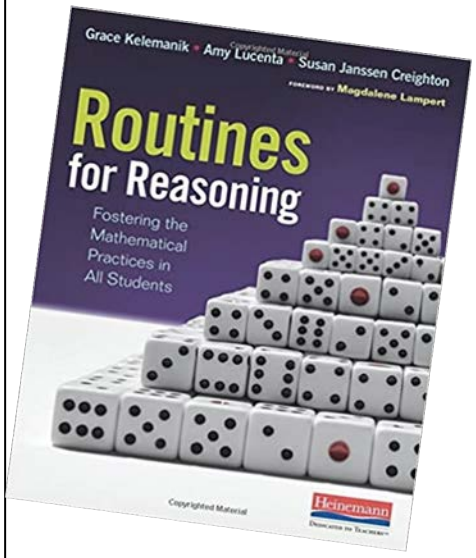


Answer Key For Tool 12.10 (Note: This is one possible set of answers.)

1. Make sense of problems and persevere in solving them.	How is this task similar to a previous task you have completed? What strategies might help you to solve this problem? What helped you be successful in solving the problem?
2. Reason abstractly and quantitatively.	What expression or equation represents this data/situation? Are these expressions equivalent? How do you know? What do the variables/numbers/answer mean related to the context?
3. Construct viable arguments and critique the reasoning of others.	Why did you use [a graph] to solve it? How did you get [that equation]? What do the rest of you think about Anna's strategy?
4. Model with mathematics.	How does your model (equation) connect to the situation? Where can you find [the rate] in this situation? The table? The equation? Are these two equations equivalent? Which (if any) is more efficient?
5. Use appropriate tools strategically.	How might a number line help you think about the problem? What manipulative or picture might you use to solve the problem? What other resources might help you with this problem?
6. Attend to precision.	When will this strategy work? Which is the better unit of measure for this task? What labels might be useful for this problem?
7. Look for and make use of structure.	When can you regroup numbers and maintain equivalence? How might you use break-apart to solve this problem? What is true about all of these triangles?
8. Look for and express regularity in repeated reasoning.	What patterns do you notice across these problems? How are these problems the same? Different? How might this problem help you solve another problem?

Relationship of the Mathematical Practices





http://www.fosteringmathpractices.com/routinesforreasoning/

Red Light, Green Light

Teacher

Take a moment and look at the questions for students you recorded at the bottom on p. 4.

Which mathematical practices might students have the opportunity to demonstrate when answering your questions?

Red Light, Green Light – Possible Questions for Students

1. What fraction comparison strategies do you know that might be useful in solving this problem?
2. What are some ways you might rule out some of the runners?
3. Which fractions are easy to compare and which are difficult (and why)?
4. How does using common denominators compare to using benchmark fractions for figuring out this task?

Let’s be Intentional!

1. Identify the MP
2. Identify questions
3. Remember questioning tips

Cutting Ribbon

1. How many $\frac{1}{4}$ ft. ribbon strips can you make from $2\frac{1}{2}$ feet of ribbon?

2. How many $\frac{1}{8}$ ft. ribbon strips can you make from $3\frac{1}{4}$ feet of ribbon?

3. How many $\frac{3}{4}$ ft. ribbon strips can you make from 6 feet of ribbon?

p. 6

Mathematical Practices & Student Look Fors

1. Make sense of problems and persevere in solving them.

- ☐ Analyze information (givens, constrains, relationships).
- ☐ Make conjectures and plan a solution pathway.
- ☐ Use objects, drawings, and diagrams to solve problems.
- ☐ Monitor progress and change course as necessary.
- ☐ Check answers to problems and ask, "Does this make sense?"

Reason abstractly and quantitatively.

- ake sense of quantities and relationships problem situations.
- eate a coherent representation of a problem.
- nslate from contextualized to generalized ice versa.
- bly use properties of operations.

3. Construct viable arguments and critique the reasoning of others.

- ☐ Make conjectures and use counterexamples to build a logical progression of statements to support ideas.
- ☐ Use definitions and previously established results.
- ☐ Listen to or read the arguments of others.
- ☐ Ask probing questions to other st

Enhance a Task

Cutting Ribbon

1. How many $\frac{1}{4}$ ft. ribbon strips can you make from $2\frac{1}{2}$ feet of ribbon?

2. How many $\frac{1}{8}$ ft. ribbon strips can you make from $3\frac{1}{4}$ feet of ribbon?

3. How many $\frac{3}{4}$ ft. ribbon strips can you make from 6 feet of ribbon?

p. 6

- Which Math Practice might you pick?
- How might you enhance the task to press on selected MP?

Enhance a Task

Cutting Ribbon

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3. How many $\frac{3}{4}$ ft. ribbon strips can you make from 6 feet of ribbon?

p. 6

- **SMP#5:**
- **Provide ribbon, c-rods, paper strips**
- **Ask**
  - **What materials or tools might be helpful in solving this task?**

Enhance a Task

Cutting Ribbon

1. How many $\frac{1}{4}$ ft. ribbon strips can you make from $2\frac{1}{2}$ feet of ribbon?

2. How many $\frac{1}{8}$ ft. ribbon strips can you make from $3\frac{1}{4}$ feet of ribbon?

3. How many $\frac{3}{4}$ ft. ribbon strips can you make from 6 feet of ribbon?

p. 6

- **SMP#8:**
- **Ask**
  - What patterns do you notice across these problems?
  - In what ways are these problems the same? Different?

Enhance a Task

Cutting Ribbon

1. How many $\frac{1}{4}$ ft. ribbon strips can you make from $2\frac{1}{2}$ feet of ribbon?

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3. How many $\frac{3}{4}$ ft. ribbon strips can you make from 6 feet of ribbon?

p. 6

- **SMP#1:**
- **Ask**
  - What is happening in these stories?
  - What do you notice about these situations?
  - In what ways are these problems like other problems you know?

Protocol for Enhance-a-Task

1. Explore the task.
2. Discuss the mathematics with a partner.
3. Decide which MP you will emphasize.
4. Discuss 1-2 adaptions for the task and/or questions to emphasize the MP.

Coach

Teacher

Shifts in Classroom Practice

How might the ideas from this webinar lead to shifting our classroom question posing?

Shift 5:* From *questions that seek expected answers* toward *questions that illuminate and deepen student understanding

Teacher poses closed and/or low-level questions, confirms correctness of responses, and provides little or no opportunity for students to explain their thinking.	→	Teacher poses questions that advance student thinking, deepen students' understanding, make the mathematics more visible, provide insights into student reasoning, and promote meaningful reflection.

WHAT QUESTIONS MIGHT YOU HAVE AS YOU PLAN FOR SUPPORTING EFFECTIVE QUESTIONING?

Let’s stay connected!

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