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Drawing Inferences to Inform Instruction for Struggling Learners

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Session Overview

- Background
- Dimensions of Assessment Framework
- Video Analysis of Student Responses
 - Analyze Student Response
 - Consider Instructional Tasks
- Summarize

Background

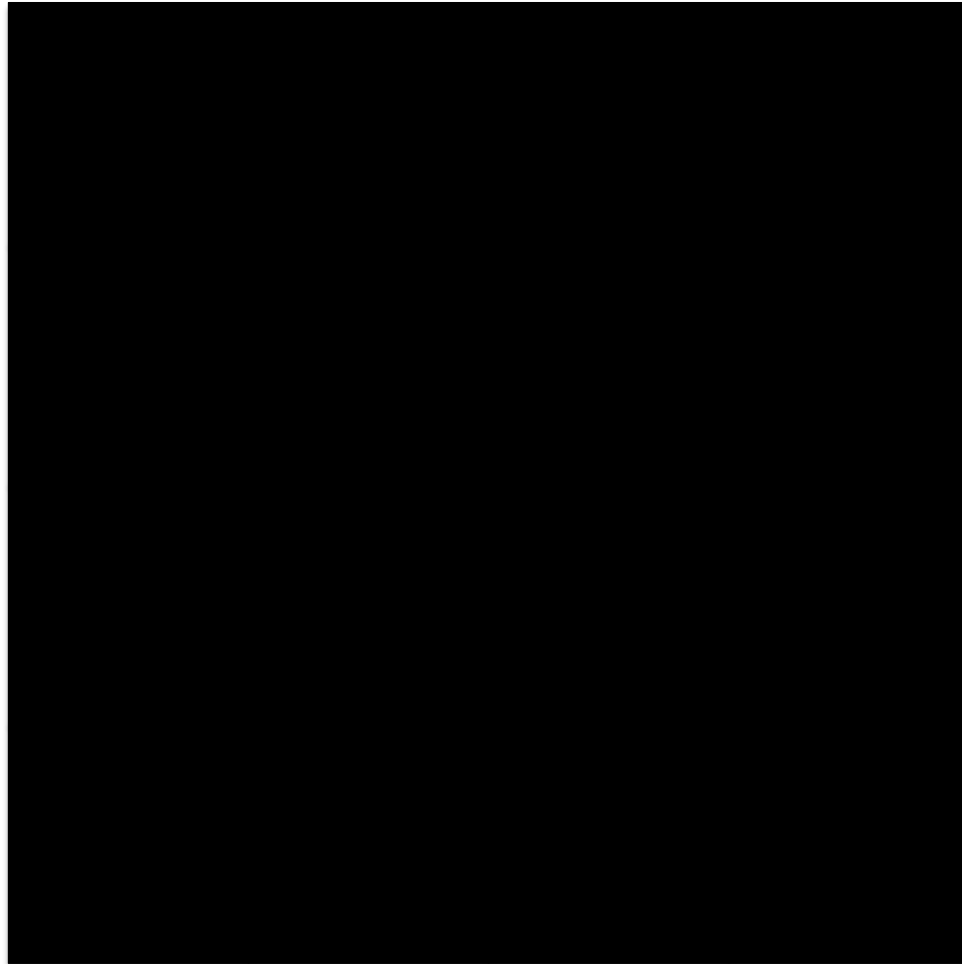
- Assessed all 1st and 2nd grade students
 - Pre- and post-assessment each year
- Followed struggling students
 - 20-25 sessions each year
- Assess students, design tasks, implement tasks, evaluate progress



Key Themes

- Need to assess and target instruction toward specific mathematical constructs.
- Students are in different places in their understanding of these constructs.
- **The intentional design of assessment tasks can improve the inferences we make about student understanding.**

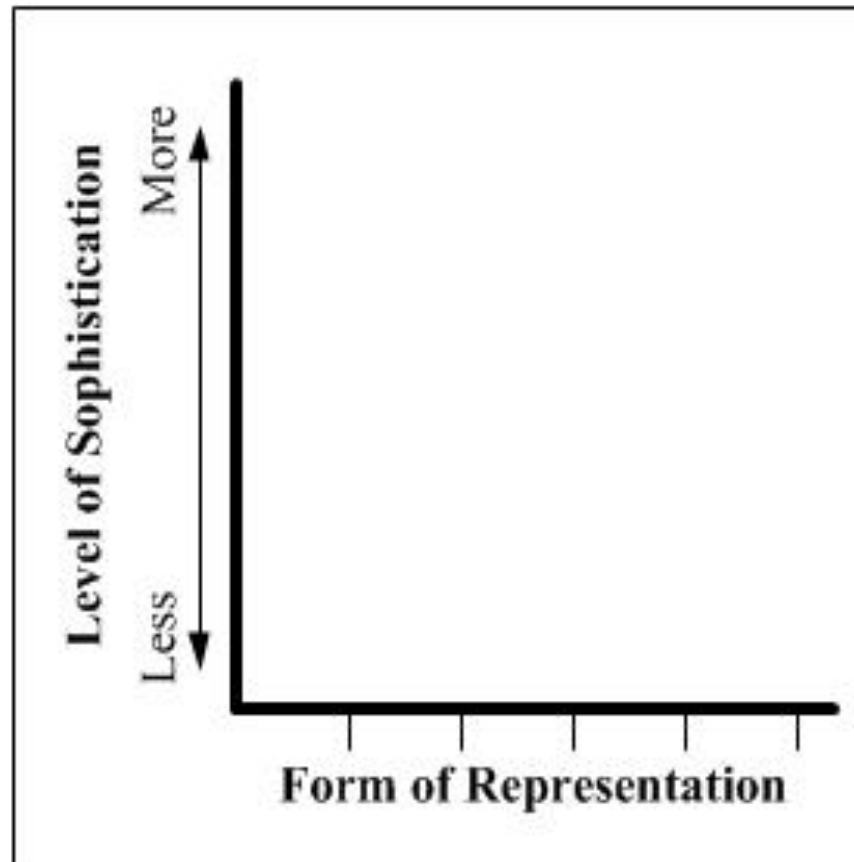
Intentional Task Design



Consider Your Students

- How could/do you **vary assessment tasks** to reveal student understanding of number and operations?

Dimensions of Assessment



Overarching Questions

- **Attending:**
Describe what the student did in response to the assessment task.
- **Inferring:**
Explain what you learned about this student's understanding.
- **Predicting:**
Predict performance on subsequent task.

Allison: 27 and 10 more



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you expect from Allison if she were asked to determine $27 + 10 = \underline{\quad}$ when written symbolically?

Allison: 27 and 10 more



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

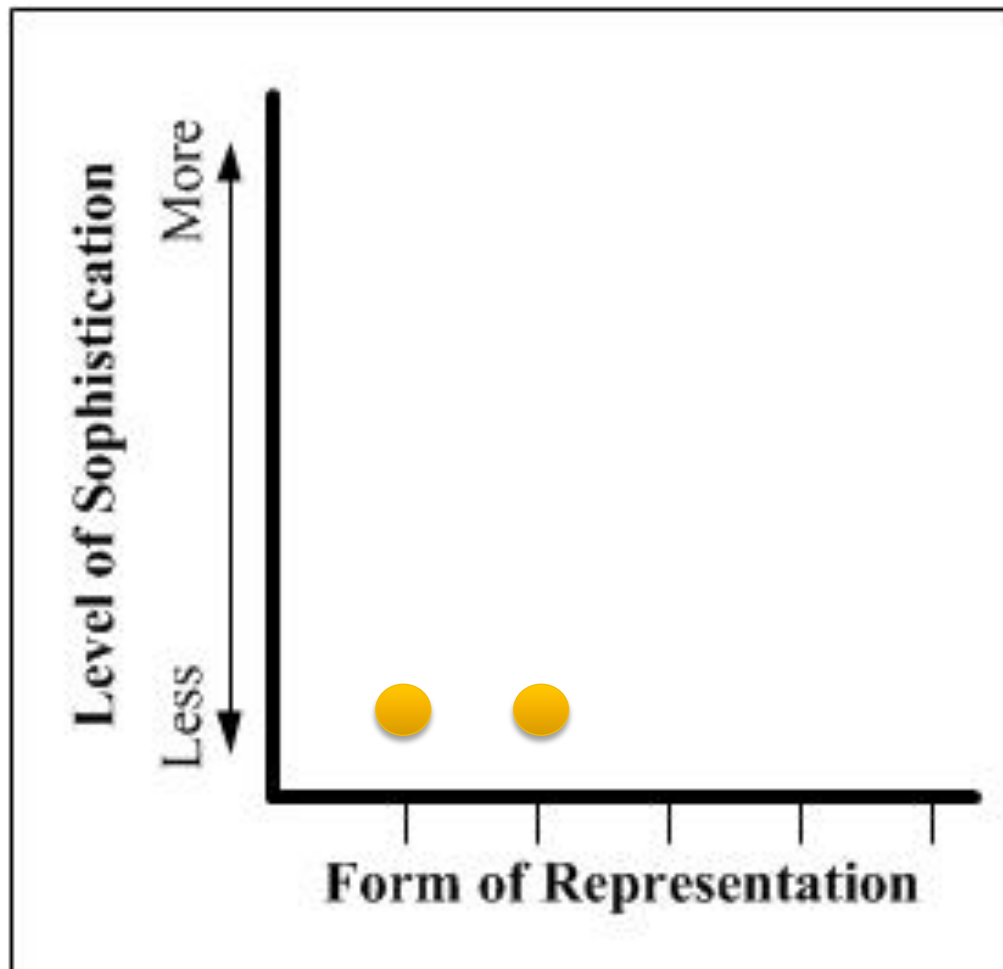
Discuss Instructional Tasks

- What instructional tasks would you design to support Allison?

(Think about this, we will return to this idea following discussion of the next student.)

Dimensions of Assessment

Allison: 27 and 10 more



Meghan: One Less Than 24

Teacher: What is one less than 24?

Meghan: [*Immediately*] 23.



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you expect from Meghan when she observes 24 fingers up, and then observes one put down. She is asked, "How many fingers do we have up?"

Meghan: One Less Than 24

Teacher: *[The two teachers and Meghan work together to put up 24 fingers. The two teachers put up ten fingers each, and the student puts up four fingers.]*
How many fingers do we have up?

Meghan: 24.

Teacher: What if I put down this finger? *[Teacher puts down one finger from the hand that originally held up four fingers.]* How many fingers do we have up?

Meghan: *[The student counts all fingers by one.]* 1, 2, 3, 4, 5, 6, 7, 8, 9, 10... 23. Twenty-three fingers.



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you expect from Meghan when she observes 24 counters put out, and then observes one taken away. She is asked, "How many counters are there now?"

Meghan: One Less Than 24

Teacher: [*The teacher places 24 counters on the table. The counters are arranged in two piles of ten and a pile of four.*] How many counters are there in all?

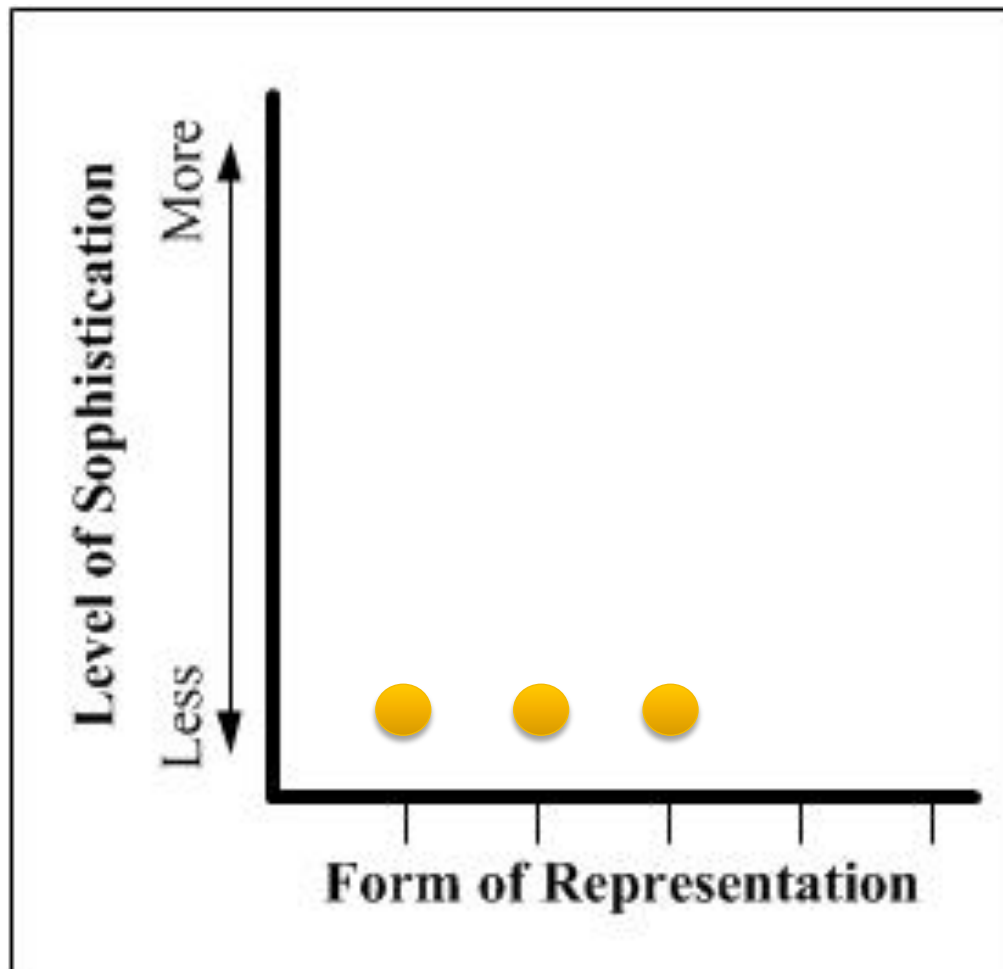
Meghan: 24.

Teacher: What if I take away this counter? [*The teacher removes a counter from the pile of four.*] How many counters are there now?

Meghan: [*The student pauses and looks at the pile.*] 10, 20, 21, 22, 23.

Dimensions of Assessment

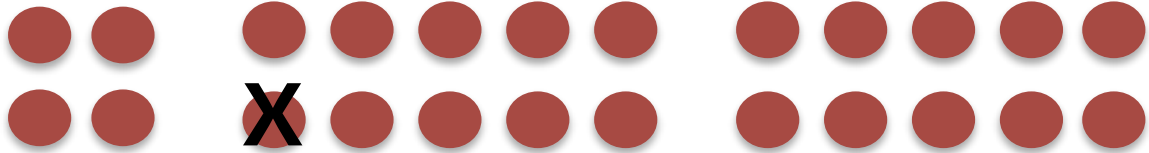
Meghan: One Less Than 24



Discuss Instructional Tasks

- What instructional tasks would you design to support Meghan?

Dimensions of Assessment: Across Representations

Representation	Example
Oral Language	Say: What is one less than 24?
Written Symbols	Show: $24 - 1 = \underline{\quad}$.
Diagrams (with Symbols provided)	Show: Consecutive numbers 1-24 on a piece of paper. Beneath each number provide an image of a circle, but omit one circle from the end.
Manipulative Models	
Contextual Situation	Show/Read: Kelley has 24 marbles. She gives one marble to her friend. Now, Kelley has one less marble. How many marbles does Kelley have?

Dimensions of Assessment: Within Representations

Representation	Example One	Example Two	Example Three
Manipulative Models	<p>Show: A line of 24 counters.</p> <p>Say: How many counters are in the line?</p> <p>Do: Remove one counter from the end of the line.</p> <p>Ask: How many counters are there now?</p>	<p>Show: Twenty-four Unifix cubes (i.e., one ten stick and four ones).</p> <p>Say: How many cubes are there?</p> <p>Do: Remove one cube from the ones.</p> <p>Ask: How many cubes are there now?</p>	<p>Show: Three ten-frames with 24 counters.</p> <p>Say: How many counters are there?</p> <p>Do: Remove one counter from the last ten-frame.</p> <p>Ask: How many counters are there now?</p>

Meghan: One Less Counter



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you predict when one counter is removed from 20, and Meghan is asked, "How many are there now?"

Meghan: One Less Counter



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you predict when one counter is removed from 25, and Meghan is asked, "How many are there now?"

Meghan: One Less Counter



- **Attend:**

Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

- **Predicting:**

What response would you predict when one counter is removed from 37, and Meghan is asked, "How many are there now?"

Meghan: One Less Counter



- **Attend:**

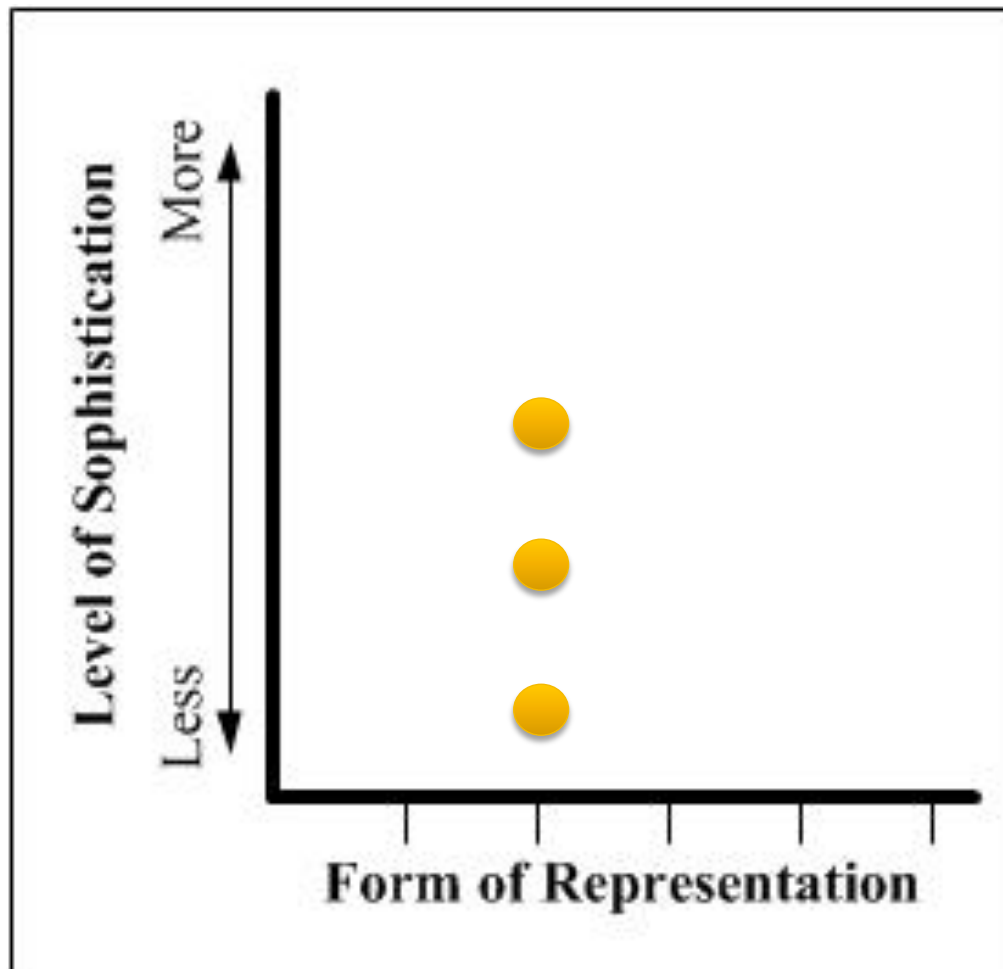
Describe what the student did in response to the assessment task.

- **Infer**

Explain what you learned about this student's understanding.

Dimensions of Assessment

Meghan: One Less Than



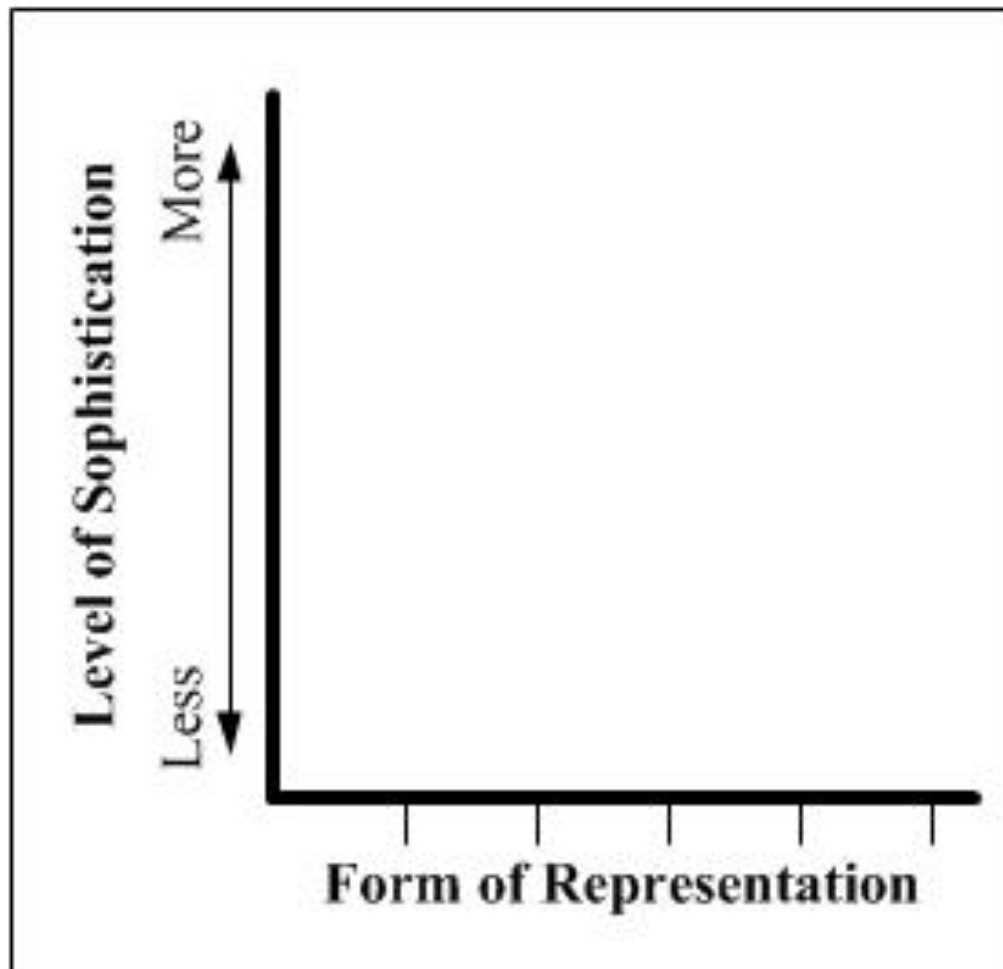
Discuss Instructional Tasks

- What instructional tasks would you design to support Meghan?

Dimensions of Assessment: Levels of Sophistication


Level of Sophistication	Using <u>10</u> counters	Using <u>20</u> counters	Using <u>24</u> counters
Example	<p>Show: A line of 10 counters.</p> <p>Say: How many counters are in the line?</p> <p>Do: Remove one counter from the end of the line.</p> <p>Ask: How many counters are there now?</p>	<p>Show: A line of 20 counters.</p> <p>Say: How many counters are in the line?</p> <p>Do: Remove one counter from the end of the line.</p> <p>Ask: How many counters are there now?</p>	<p>Show: A line of 24 counters.</p> <p>Say: How many counters are in the line?</p> <p>Do: Remove one counter from the end of the line.</p> <p>Ask: How many counters are there now?</p>

Dimensions of Assessment Framework



Key Themes

- Need to assess and target instruction toward specific mathematical constructs.
- Students are in different places in their understanding of these construct.
- **The intentional design of assessment tasks can improve the inferences we make about student understanding.**

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- Varied tasks along both dimensions are helpful
 - Create instructional tasks to help students make connections
 - Use strings of tasks to help students see connections

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