The background of the slide is a spiral-bound notebook with a light beige, textured cover. The metal spiral binding is visible on the left side. The text is centered on the page.

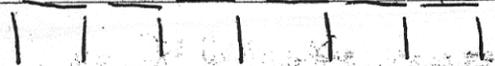
Implementing High-Level Tasks: Using Student Work to Reflect on Instruction

Melissa Boston,
Duquesne University

A silver metal spiral binding is visible on the left side of the page, looping through a series of holes.

What do you notice about the set of
patterning tasks from the the 6th grade
classroom and the 8th grade classroom?

19 toothpicks ↴



301 toothpicks

Explanation: If the pattern were continued, 301 toothpicks would be needed for 100 squares. There are 6 squares for the example. On the top there are 6 toothpicks and 6 toothpicks on the bottom. So if there were 100 boxes there would be 100 toothpicks on both the top and bottom. So far that's 200 toothpicks all together. On the example there are 7 toothpicks in the middle. The number of toothpicks in the middle is 1 greater than the number of boxes. 1 greater than 100 boxes is 101 toothpicks. There are 101 toothpicks in the middle of the 100 boxes. $100 + 100 + 101 = 301$ toothpicks. If the pattern were continued, 301 toothpicks would be needed for 100 squares. Yay!

March 8, 2005

pattern were continued, how many would be needed for 100 square

toothpicks will be needed for 100 squares each triangle really uses 3 toothpicks

until you get to the last one to close it up.

Example! $\begin{array}{c} 2 & 2 & 2 \\ \square & \square & \square \\ 3 & 3 & 3 \end{array}$ ← The last one needed to close it up.

$$3 \times 100 + 1 = 301$$

$$3x + 1 = 301$$

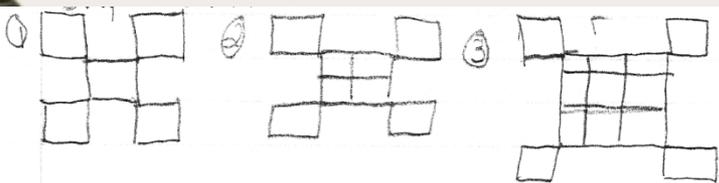


Figure	Number of squares	Points
1	5	1, 5
2	8	2, 8
3	13	3, 13
4	20	4, 20
5	29	5, 29
6	40	6, 40

b) The number of the figure multiplied by itself plus 4 equal to the pattern.

$$E) y = \text{Any number (by itself)} + 4$$

$$y = \text{Any } \# (I) + 4$$

$$y = \# (I) + 4$$

$$f) 25(25) = 625 + 4 = 629$$

$$75(75) = 5625 + 4 = 5629$$

$$100(100) = 10000 + 4 = 10004$$

g) $9 \times 9 = 81 + 4 = 85$ the answer is figure 9

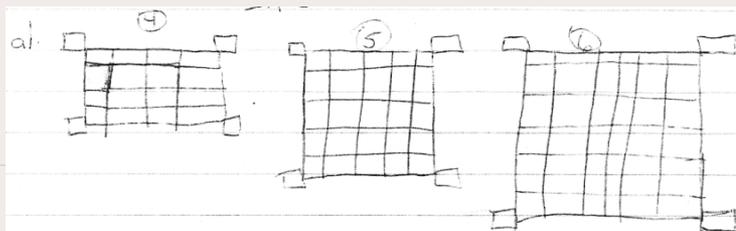


Fig #	# of squares	Points
1	5	(1, 5)
2	8	(2, 8)
3	13	(3, 13)
4	20	(4, 20)
5	29	(5, 29)

c) The pattern is: $\text{fig } \# \times \text{fig } \# + 4 =$

d) Figure Number times itself plus four will give you the Number of squares.

e) $A \# (A \#) + 4 =$

Fig #	# of squares	Points
25	629	(25, 629)
75	5624	(75, 5629)
100	10004	(100, 10004)

A silver metal spiral binding is visible on the left side of the page, looping through a series of holes. The page is white with a faint horizontal line near the top.

What ‘window’ into the classroom is provided by the student work samples from the 6th grade and 8th grade patterning tasks?

Student work as a reflection on practice

- What does the set of work indicate about the quality of instruction and students' learning opportunities?
 - instructional tasks and task implementation?



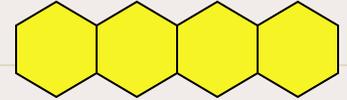
on norms and practices?
Effective teaching

tical residue?
practice:

standards for assessment?
Implement tasks that

*promote reasoning and
problem-solving*

The sixth-grade lesson



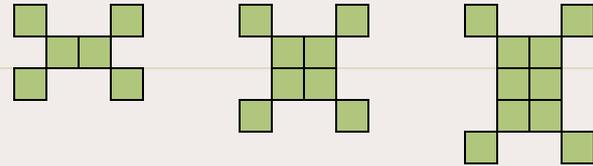
- Students seated at tables. Asked to work on ‘Hexagon Pattern Train’ task
- Teacher circulates as students work; presses for explanations and reasoning
 - “What do you think S1? How does it relate to yesterday?”
- Whole group discussion illuminates 4 strategies
 - “So if x equals the numbers of trains..., Why do you think that works?”

The sixth-grade student work

The Toothpick Pattern:

- All 4 provided unique written explanations
- 3 different strategies present in the 4 samples of student work
- All student work samples used multiple representations
 - 3 of the 4 included an equation
 - 3 of the 4 used a diagram

The eighth-grade lesson



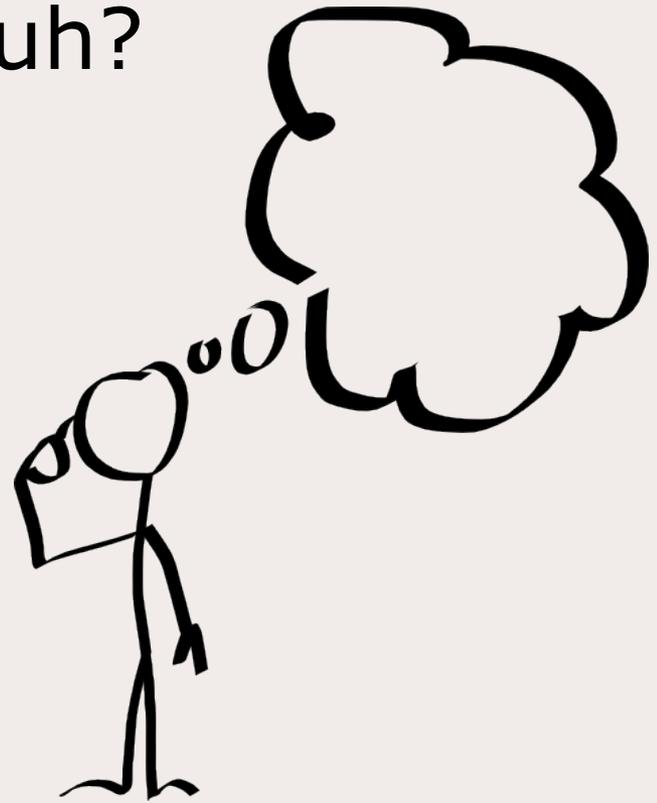
- Students seated in rows. No collaboration or talking permitted.
- Very specific directions given to students for solving a pattern task
- Teacher circulates; reminds students to follow directions; warns students to work faster to finish before the end of class.
- No whole-group discussion.

The eighth-grade student work

- Student work followed a ‘template’
- No unique explanations
- No references to the diagram of the pattern
- The pattern itself does not encourage multiple strategies

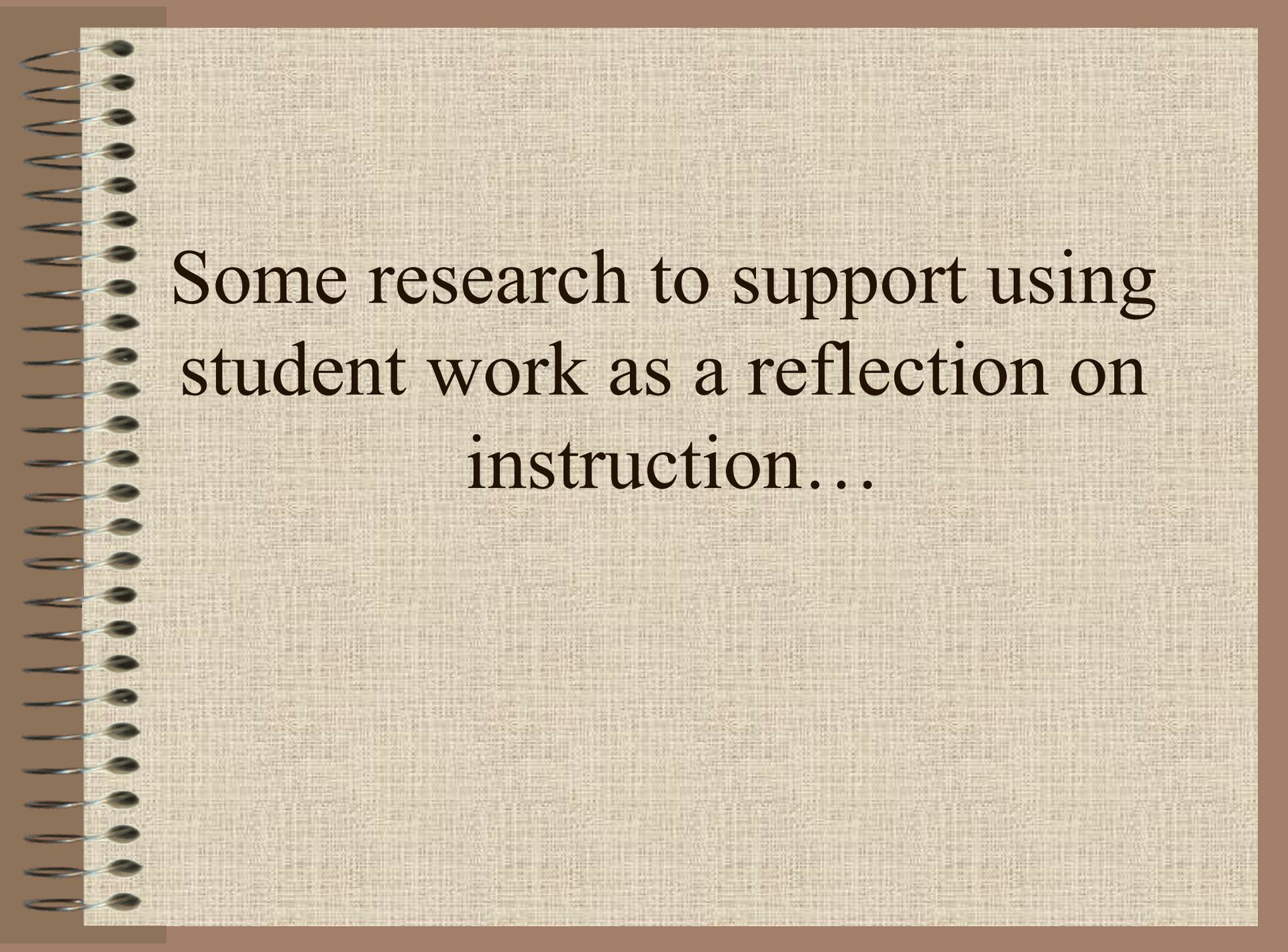
Pretty consistent, huh?

So we wondered....



What does it indicate about instruction if...

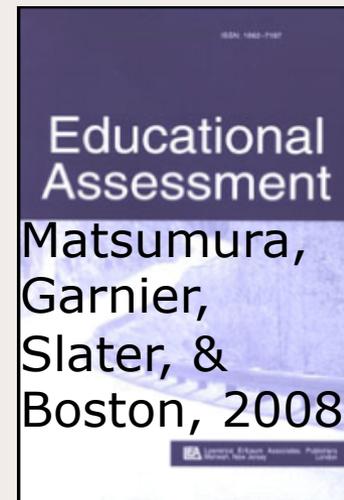
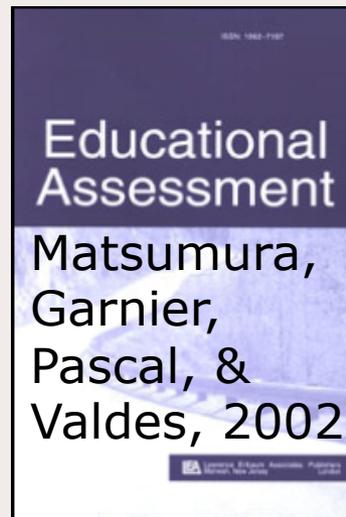
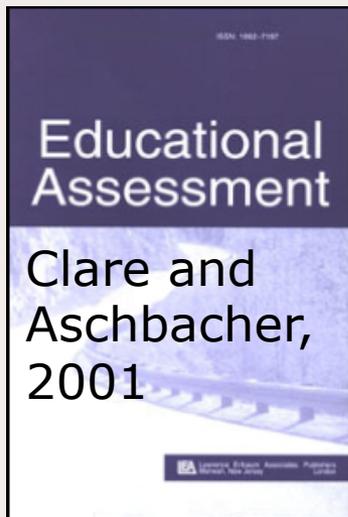
- students solved the task in more than one way even though the directions did not specifically request multiple strategies?
- all or most of the students did not complete the cognitively challenging parts of the task or the explanation?
- many students provide explanations similar in wording or all student work samples look ‘template’ ?
- many students provide explanations, even though not required by the task directions?

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Some research to support using
student work as a reflection on
instruction...

Research Background: Using Student Work

- Validity studies: Collections of student work provide stable indicators of classroom practice, highly correlated with observed instruction ($r = .68, p < .01$).



Instructional Quality Assessment Mathematics Assignment Rubrics

- Four sets of assignments
- Teacher provides:
 - At least four samples of students' work per assignment (2 high, 2 medium)
 - Copies of tasks, rubrics, etc.
 - A cover sheet explaining expectations for high-quality work
- Rated by 2 raters

Instructional Quality Assessment Mathematics Assignment Rubrics

Academic Rigor:

- Potential of the Task
- Implementation of the Task
- Rigor of students' written responses
- Rigor of Teacher's Expectations

Clear Expectations:

- Clarity and Detail of Expectations
- Students' Access to Expectations

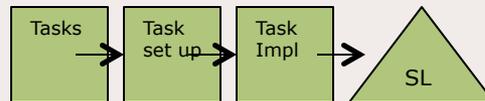
Research Background: IQA Rubrics

Conceptual Basis:

- Levels of Cognitive Demand
 - Score levels for AR rubrics

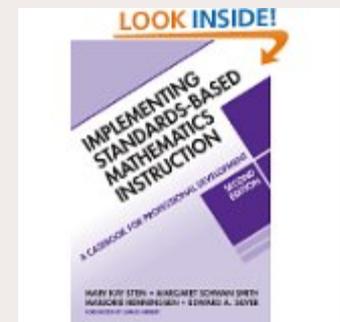
LL	HL
MEM	DM
PWOC	PWC

- Mathematical Tasks Framework
 - Task Potential and Implementation



- Principles of Learning
 - Teacher's Expectations

 Resnick & Hall, 2001



Stein, Smith,
Henningesen, &
Silver, 2009

Instructional Quality Assessment Mathematics Assignment Rubrics

Academic Rigor:

- Potential of the Task
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- Rigor of Teacher's Expectations

Clear Expectations:

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Instructional Quality Assessment Mathematics Assignment Rubrics

Sample Rubrics:

- AR1 Potential of the Task
- AR2 Implementation of the Task

Sample Tasks

Let's practice!

AR1 and AR2 scores

Task	Potential	Implementation
<u>Equation Story Problems</u>		
Inequalities		
<u>Shading Squares</u>		
<u>Decimals to Percents</u>		
<u>Mult & Div Scenarios</u>		
<u>Triangle- Geogebra</u>		

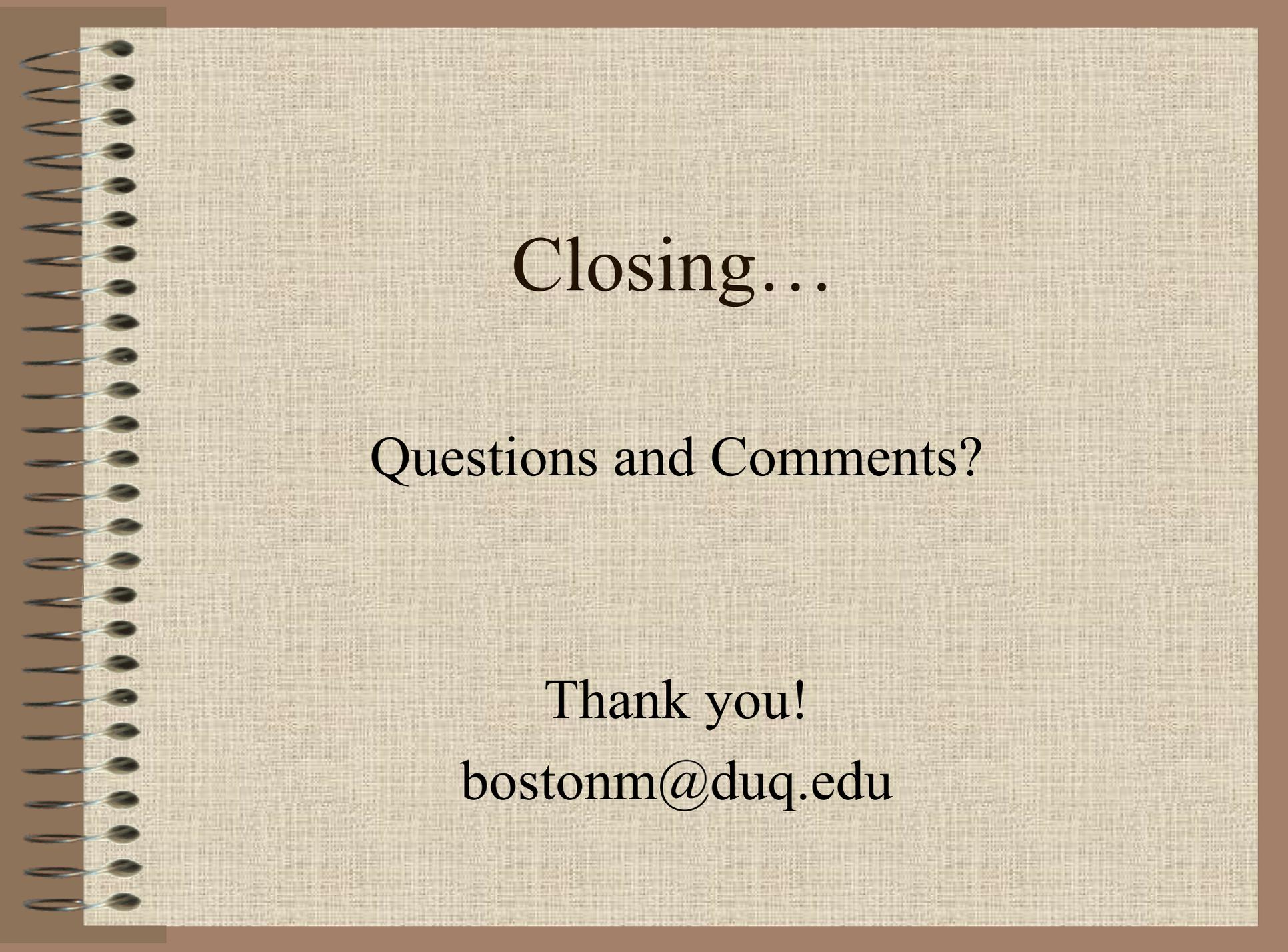
Connecting to P2A

Effective Teaching Practices

- What did the sets of student work indicate about students' opportunities to engage in *tasks that promote reasoning and problem-solving*?
- What did the sets of student work indicate about the *implementation of tasks that promote reasoning and problem-solving*?

Using Student Work as a Reflection on Instruction

- How can the analysis of student work as a reflection on instruction be useful for teacher education?
- What are some advantages of using student work as a reflection on instruction?
- What are some caveats of using student work as a reflection on instruction?

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Closing...

Questions and Comments?

Thank you!

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