# Task Sheet:

In this activity, you will practice implementing the "five practices" with a focus on Monitoring, Selecting, Sequencing, and Connecting.

At the same time, you will be engaging in some challenging (even for adults!) measurement tasks that are intended to support students' conceptual understanding of measurement and to support students in confronting their misconceptions about measurement.

Please approach these problems as if you are a younger student – but also think about your own understanding.

Timeline of the activity:

- (30 minutes) Each group will monitor the other groups as they engage in a measurement task. You will have about five minutes, so stay focused!
    - If you are in a group trying out the task, you should take turns "driving" and you should all be making decisions for solving the task!
    - If you are monitoring, decide how your group will "divide and conquer" – each of you should look at two groups' work & ask them questions about their thinking.
- (10 minutes) Your group should make decisions about how you will lead a discussion – which students will you call on to share their solution strategies? In what order will you ask them to share their strategies? How will you connect what you see as the "big ideas"?
- (40 minutes) Each group will lead a brief (5-7 minute) discussion. Tell me which strategies you'd like to share and I'll run the overhead. For the strategies you share, ask the "driver" of the group for that task to explain their strategy. Save a minute or two to explain *why* you chose the groups that you chose.

# Monitoring Sheet – Length of a Pencil http://tinyurl.com/STEM-Task1

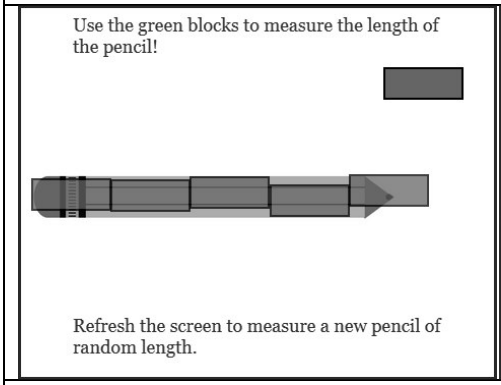
**Things to look for:**

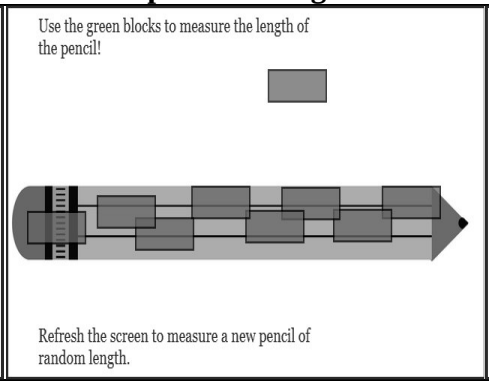
- Numerical answer: are they overestimating, underestimating, using fractions, accurate?
- Units: "units," "rectangles," "side of a rectangle"
- **Note:** the length of the pencil changes every time you refresh the screen, so different groups may have different correct answers; So if students struggle with a long pencil, you can encourage them to refresh until they have a shorter pencil.

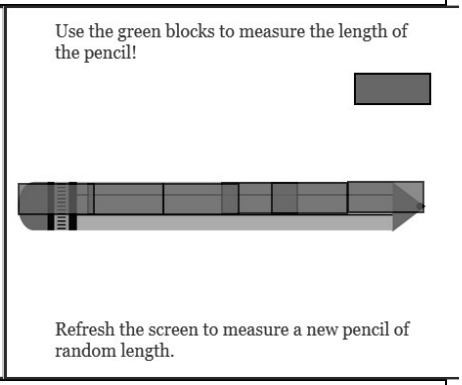
**Mathematical Goal(s) of task:** reveal measurement misconceptions (mistaken conceptions) and then push students to confront their misconceptions to build their understanding of measurement.

- The tile that is being used to measure the length has two dimensions, but length is only one dimension, so students might not realize that the unit is the *length* of the tile not the tile itself. So (being nit-picky) the unit should be "long side of a rectangle."
- Student are dealing with competing objectives: filling the space (not leaving gaps or overlaps) and hitting the boundaries. Kids usually would rather hit the boundaries than fill the space.
- These tiles are difficult to maneuver and so some amount of gaps/overlaps/not hitting boundary may happen without it being a misconception! So how do you know? You must ask questions to get at their thinking!

## Anticipated Strategies:




## Notes: (Student names, interesting differences, ordering)

**General questions to ask:** *What is your answer? What is the unit? What are you counting? How did you figure it out? How do you know that you're right? Will your strategy always work? How do you know?*

# Monitoring Sheet – Length of Jagged Paths http://tinyurl.com/STEM-Task2

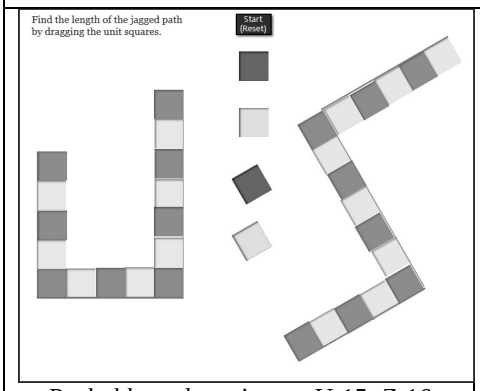
**Things to look for:**

- Numerical answer: are they overestimating, underestimating, using fractions, accurate?
- Units: "units," "squares," "side of a square"
- **Note:** the "U" and "Z" shapes are the same length

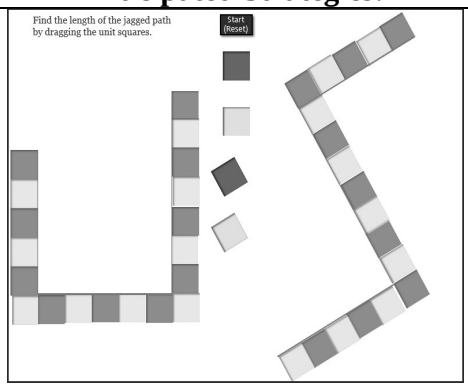
**Mathematical Goal(s) of task:** reveal measurement misconceptions (mistaken conceptions) and then push students to confront their misconceptions to build their understanding of measurement.

- The tile that is being used to measure the length has two dimensions, but length is only one dimension, so students might not realize that the unit is the *length* of the tile not the tile itself. So (being nit-picky) the unit should be "side of a square."
- Because students see the unit as the whole square, the tile in a corner is often counted once when it should be counted twice (if it sits inside the corner) or not counted at all (if it sits outside the corner).
- Student are dealing with competing objectives: filling the space (not leaving gaps or overlaps) and hitting the boundaries. Kids usually would rather hit the boundaries than fill the space.
- These tiles are difficult to maneuver and so some amount of gaps/overlaps/not hitting boundary may happen without it being a misconception! So how do you know? You must ask questions to get at their thinking!

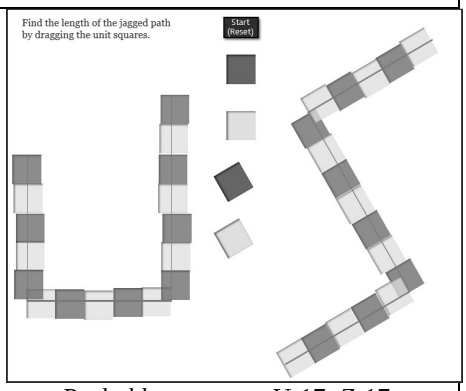
## Anticipated Strategies:




*Probably underestimate: U-15; Z-16*




*Probably overestimate: U-19; Z-18*




*Probably accurate: U-17; Z-17*

## Notes: (Student names, interesting differences, ordering)

**General questions to ask:** *What is your answer? What is the unit? What are you counting? How did you figure it out? How do you know that you're right? Will your strategy always work? How do you know?*

# Monitoring Sheet – Area of a Rectangle (using rectangles) http://tinyurl.com/STEM-Task3

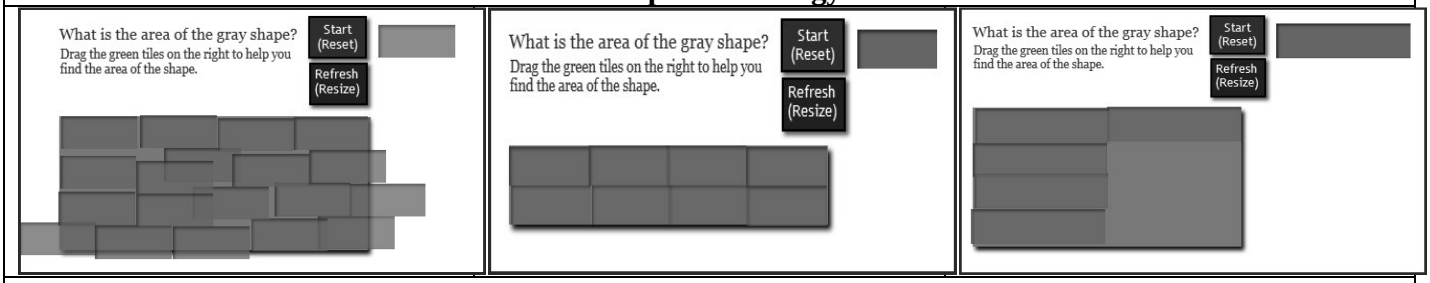
**Things to look for:**

- Numerical answer: are they overestimating, underestimating, using fractions, accurate?
- Units: "square units," "squares," "rectangle squares," (evidence of misconception), "rectangles"
- **Note:** the sizes of the rectangle and tiles change every time you refresh the screen, so different groups may have different correct answers; So if students struggle with one task, you can encourage them to refresh until they have an easier task.

**Mathematical Goal(s) of task:** reveal measurement misconceptions (mistaken conceptions) and then push students to confront their misconceptions to build their understanding of measurement. Main goal: Understanding concepts that will support students' in making sense of the rule that $A = L \times W$.

- Stating that the unit is a square or square unit or rectangle squared is evidence of a misconception (and hence shows the task was successful!) The tile that is being used to measure the area is a rectangle – this shape can push students to understand that measuring area using squares is a choice (a *convention*) but we could choose to measure area using any *tessellation* or *tiling* (filling a two-dimensional space with any shapes that fit tightly together – for example, salamanders! Or hexagons, etc.).
- Students are dealing with competing objectives: filling the space (not leaving gaps or overlaps) and hitting the boundaries. Kids usually would rather hit the boundaries than fill the space.
- These tiles are difficult to maneuver and so some amount of gaps/overlaps/not hitting boundary may happen without it being a misconception! ALSO – the struggle with moving tiles can push students to find other strategies for finding the area rather than covering the whole space (moving toward multiplying area times length). **So how do you know? You must ask questions to get at their thinking!**

## Anticipated Strategy:




## Notes: (Student names, interesting differences, ordering)

**General questions to ask:** *What is your answer? What is the unit? How did you find your answer? How do you know that you're right? Will your strategy always work? How do you know?*

# Monitoring Sheet – Area of a Puddle http://tinyurl.com/STEM-Task4

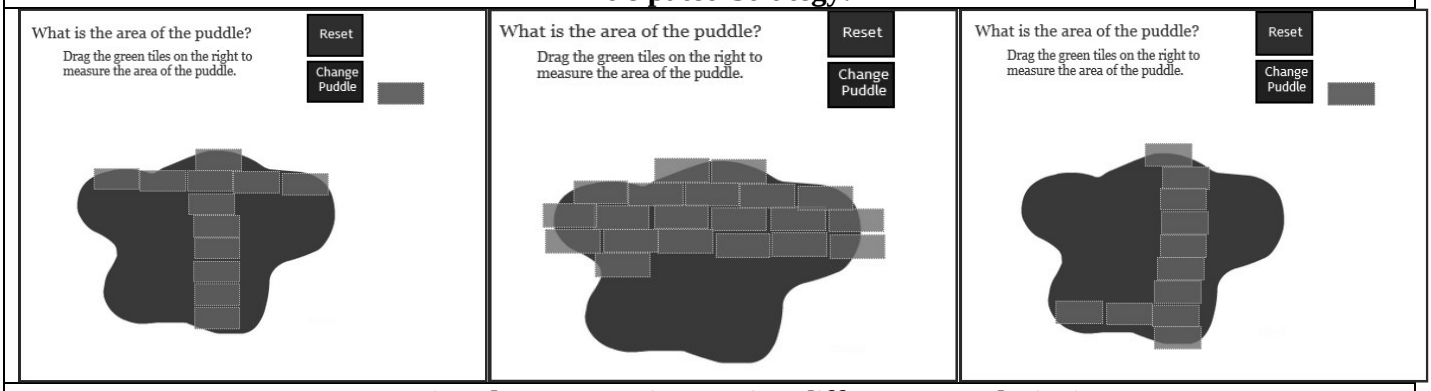
**Things to look for:**

- Numerical answer: are they overestimating, underestimating, using fractions, accurate?
- Units: "square units," "squares," "rectangle squares," (evidence of misconception), "rectangles"

**Mathematical Goal(s) of task:** reveal measurement misconceptions (mistaken conceptions) and then push students to confront their misconceptions to build their understanding of measurement. **Main goal:** Understanding concepts that help students move from finding areas of "nice" shapes to estimating areas of non-regular shapes.

- Stating that the unit is a square or square unit or rectangle squared is evidence of a misconception (and hence shows the task was successful!) The tile that is being used to measure the area is a rectangle – this shape can push students to understand that measuring area using squares is a choice (a *convention*) but we could choose to measure area using any *tessellation* or *tiling* (filling a two-dimensional space with any shapes that fit tightly together – for example, salamanders! Or hexagons, etc.).
- Students are dealing with competing objectives: filling the space (not leaving gaps or overlaps) and hitting the boundaries. Kids usually would rather hit the boundaries than fill the space.
- These tiles are difficult to maneuver. The struggle with moving tiles can push students to find other strategies for finding the area rather than covering the whole space – especially because there are not enough tiles to cover the whole space. Ask questions to get at thinking!

## Anticipated Strategy:




## Notes: (Student names, interesting differences, ordering)

**General questions to ask:** *What is your answer? What is the unit? How did you find your answer? How do you know that you're right? Will your strategy always work? How do you know?*

# Monitoring Sheet – Volume of a Box (Box #7) http://tinyurl.com/STEM-Task5

**Things to look for:**

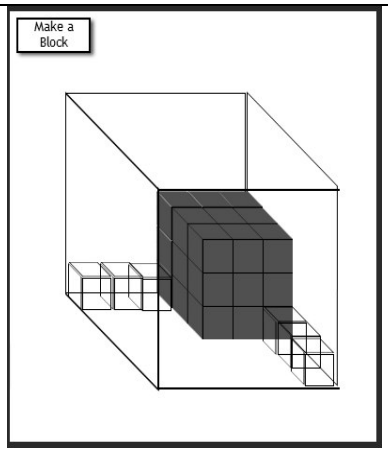
- Numerical answer: are they overestimating, underestimating, using fractions, accurate?
- Units: "cubic units," "cubes"
- **Note:** One "trick" to solving this is noticing that 8 purple 3x3x3 cubes would fit in the box. So 8x27 = 216 cubes. But a student could also find the dimensions are 6x6x6=216 cubes. Another way might be to notice that the bottom layer fits 4x9=36 cubes and there are 6 possible layers – (4x9)x6=36.

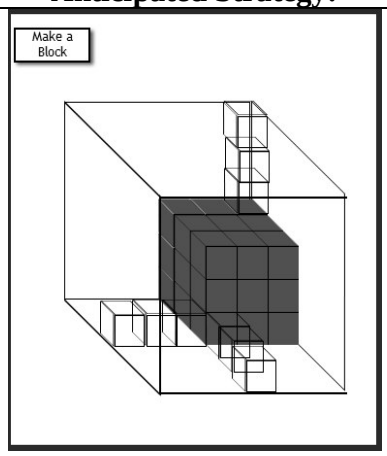
**Mathematical Goal(s) of task:** Push on students' abilities to visualize cubic structures. A big drawback is that we are trying to visualize 3D using a 2D surface!

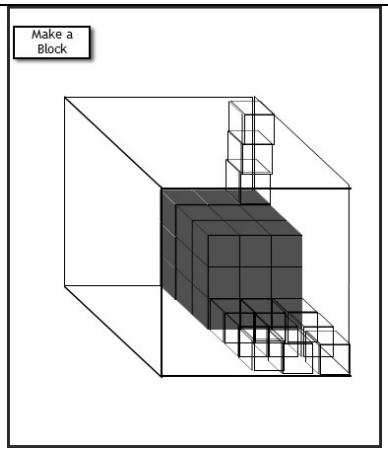
**Main goal:** Understanding concepts that help students move to using volume formulas like $V = LxWxH$ and $V = AxH$ (area times the height).

- Students are dealing with competing objectives: filling the space (not leaving gaps or overlaps) and hitting the boundaries. Kids usually would rather hit the boundaries than fill the space.
- These cubes are difficult to maneuver. The struggle with moving cubes can push students to find other strategies for finding the area rather than covering the whole space. Ask questions to get at the student's thinking!

**Anticipated Strategy:**




**Notes: (Student names, interesting differences, ordering)**