Formative Assessments in Geometry and Measurement: Putting Essential Understanding into Practice

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 NCTM Annual Meeting 4/26/2018

Overview

- Introduction
- Formative assessment tasks
  - Finding Right Angles in Shapes
  - Characterizing Obtuse Angles
  - Using Clues to Classify Rectangles
  - Is it a Square?
- Helping students move forward

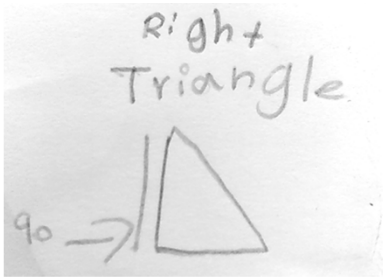
Formative Assessment

- Gathering evidence about students' knowledge during instruction
  - Asking questions and listening to responses
  - Presenting tasks and analyzing students' work
- Using that evidence to adjust instruction to meet students' needs

A bit about me

- High school mathematics teacher
- Mathematics education researcher/ Mathematics teacher educator
- Parent of three children
- Fourth-grade teacher

From my daughter, at age 7



Driving Questions

1. How will you collect evidence on what your students understand?
2. What will you do with that evidence to inform future instruction?

Angle Measurement Tasks

- How can this task help us?
- How might students respond?
- How did students respond?

Finding Right Angles in Shapes

Which of these shapes have at least one right angle?

Circle the shape or shapes that have a right angle.

- How can this task help us?
- How might students respond?

How did students respond?

Grade \ Shape	Percentage of students identifying right angle(s) in shapes A–D			
	A	B	C	D
3 (39 students)	36 (92%)	13 (33%)	34 (87%)	27 (69%)
4 (20 students)	18 (90%)	15 (75%)	19 (95%)	18 (90%)
5 (36 students)	36 (100%)	28 (78%)	36 (100%)	35 (97%)
Total (95 students)	90 (95%)	56 (59%)	89 (94%)	80 (84%)

Typical student responses

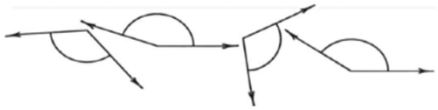
Matthew was in 3rd grade.

Addie was in 4th grade.

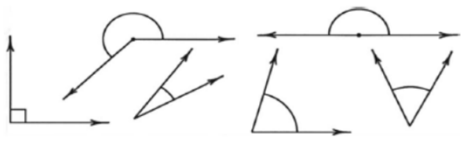
Eli was in 3rd grade.

Characterizing Obtuse Angles

All the angles shown below are obtuse:



All the angles below are *not* obtuse:



After looking at all these angles, write a description of an obtuse angle:

Characterizing Obtuse Angles

All the angles shown below are obtuse:

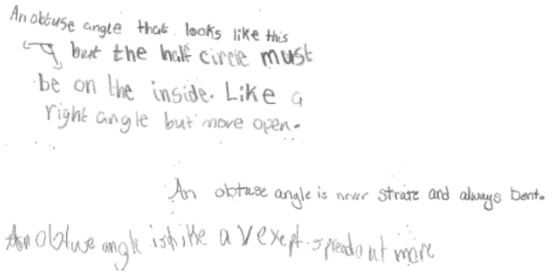
All the angles below are *not* obtuse:

After looking at all these angles, write a description of an obtuse angle:

- How can this task help us?
- How might students respond?

From *Maneuvers with Angles*, by David A. Page, Philip Wagreich, and Kathryn Chval (Parsippany, N.J.: Dale Seymour,1993a, p. 12).

How did students respond?



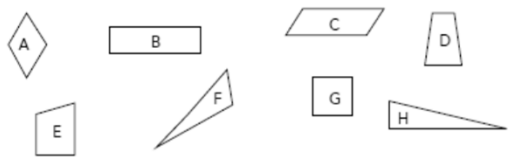
How did students respond?

- Examine my students' responses.
  - What do students understand about obtuse angles?
  - What additional information would you like to know?
  - Where do we go next?

A possible next step

Identifying Obtuse Angles

Which of the shapes below have at least one obtuse angle?



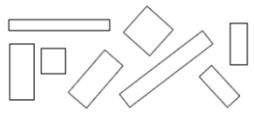
Write the letters for those shapes.

Shape Classification Tasks

- How can this task help us?
- How might students respond?
- How did students respond?

Using Clues to Classify Rectangles

The following figures are rectangles:



The following figures are *not* rectangles:

a. How would you describe a rectangle?

b. A square is a special kind of rectangle. Explain why it is special.

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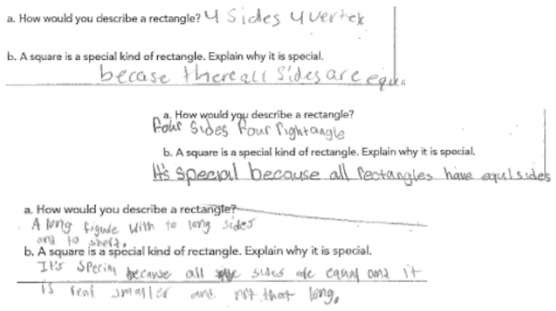
How did students respond?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Four Sides Four Rightangle

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It's special because all rectangles have equal sides

a. How would you describe a rectangle?
A long figure with to long sides and to short.

b. A square is a special kind of rectangle. Explain why it is special.
It's Speria because all ~~the~~ sides are equal and it is real small and not that long.

How did students respond?

- Examine my students' responses.
  - What do students understand about rectangles?
  - What additional information would you like to know?
  - Where do we go next?

A possible next step

Is This a Rectangle?

Mary and Jeremiah were talking about this shape:

a. Mary says that the shape is a rectangle because the shape has 4 right angles and the opposite sides are the same length. Since this shape has these, it must be a rectangle.

Do you agree with Mary? Circle one: yes no
Explain your thinking.

b. Jeremiah says that it is not a rectangle because rectangles have two long sides and two short sides.

Do you agree with Jeremiah? Circle one: yes no
Explain your thinking.

Is It a Square?

Some students were talking about this shape:

This is what they said:

Sarah: The shape is a square because it has all sides the same length and 4 right angles.

Do you agree with Sarah? Circle one: Yes No
Explain your thinking.

Dudley: The shape is NOT a square, but if you turn it, then it could be a square.

Do you agree with Dudley? Circle one: Yes No
Explain your thinking.

Marissa: The shape is a diamond; it is not square.

Do you agree with Marissa? Circle one: Yes No
Explain your thinking.

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Do you agree with Sarah? Circle one: Yes No
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Do you agree with Marissa? Circle one: Yes No
Explain your thinking.

- How can this task help us?
- How might students respond?

How did students respond?

Response	Number of third graders
Disagreed with Sarah, but agreed with Dudley and Marissa	11 (28%)
Agreed with Sarah and Dudley, but disagreed with Marissa	9 (23%)
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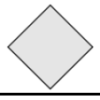

How did students respond?

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Dudley: The shape is NOT a square, but if you turn it, then it could be a square.

Marissa: The shape is a diamond; it is not square.

- Examine my students' responses.
  - What do students understand about squares?
  - What additional information would you like to know?
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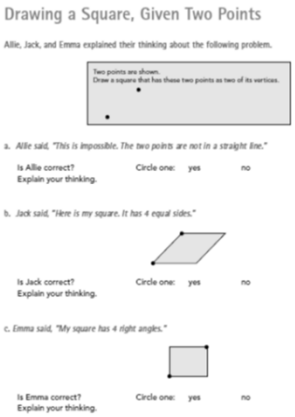
A possible next step



Drawing a Square, Given Two Points

Allie, Jack, and Emma explained their thinking about the following problem.

Two points are shown.
Draw a square that has these two points as two of its vertices.

a. *Allie said, "This is impossible. The two points are not in a straight line."*

Is Allie correct? Circle one: yes no
Explain your thinking.

b. *Jack said, "Here is my square. It has 4 equal sides."*

Is Jack correct? Circle one: yes no
Explain your thinking.

c. *Emma said, "My square has 4 right angles."*

Is Emma correct? Circle one: yes no
Explain your thinking.

Driving Questions

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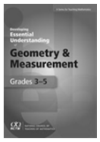
2. What will you do with that evidence to inform future instruction?

Resources from NCTM



Developing Essential Understanding of Geometry and Measurement for Teaching Mathematics in Grades 3-5

Lehrer & Slovin 2014

Putting Essential Understanding of Geometry and Measurement into Practice in Grades 3-5

Chval, Lannin, & Jones 2016

Questions? Comments?

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