Math Success by DMTI

NEWSLETTER

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Geometric Measurement: What Is the Student Actually Measuring?

DMT Insight 56 · Geometric Measurement: Before the Formulas

In today's edition, we explore:

- **The Classroom Reality:** Why a correct measurement can hide a missing idea, and the one question that reveals it
- **The Profile:** The four developmental understandings behind the Geometric Measurement Math Learning Profile
- **Classroom Tips:** Three Instructional Moves: Ways to build the unit before the tool
- **The Research:** What spatial reasoning predicts about later mathematics achievement

Educators!

Measurement takes up more of the elementary curriculum than almost any strand except number, and students perform worse on it than on almost any other. A measurement counts equal units that fill a quantity, and the number reported names how many of those units the quantity contains. A student can produce a correct measurement without holding that idea, by reading a numeral off a ruler or by multiplying the two numbers printed on the sides of a rectangle.

The change this Insight asks for is small to describe and slow to develop. Students move from reading a measurement off a tool to counting the equal units that fill the quantity. Across geometric measurement, students must establish the unit, reason about the magnitude being measured, organize units spatially, and coordinate related measures such as area and perimeter. On a national assessment, most third- and fourth-graders could not give the length of an object that did not start at the zero mark of a ruler, and more than a third of eighth-graders could not either (Blume, Galindo, & Walcott, 2007). Those students are not careless. They learned the ruler as a row of labeled positions, which works until the object starts somewhere else.

Classroom Tips

Build the unit before the tool—unitizing and Measurement Magnitude. Have students measure with a paper strip they cut themselves, iterating it end to end with no gaps or overlaps, before introducing any ruler. Then hand out rulers and ask what the spaces on the ruler have in common with the strip.

Ask for the array before the formula—spatial Structure. Give students a rectangle with no grid and ask them to draw the square units inside it. Then ask how many are in one row and how many rows there are, and name the total as six rows of eight before anyone writes 6 × 8.

Hold one measure constant and change the other—relational Thinking. Build rectangles with the same area and compare the perimeter. Then hold the perimeter constant and compare the areas. Ask what stayed the same and what changed. Students who expect the two measures to move together will say so out loud, which is where the conversation starts.

A Teacher's Perspective

> *"I used to think my students understood measurement because their answers were right. Then I moved the pencil so it started at 3, and half the class said eight. Now I ask what they counted before I ask for the number, and I can hear which students have the unit and which ones are reading the mark." – Grade 3 teacher.*

The question a teacher asks determines whether a correct answer tells you anything about the student's reasoning.

What Does the Research Say?

Solomon and colleagues found that young children measure accurately when an object starts at the edge of a ruler and drop to chance when it does not, suggesting the obstacle is the idea of equal intervals rather than carelessness (Solomon, Vasilyeva, Huttenlocher, & Levine, 2015). Outhred and Mitchelmore found that children's progress with area depends on constructing a complete array of equal units rather than drawing units of convenient size (Outhred & Mitchelmore, 2000). Battista and Clements documented how students come to see a rectangular prism as layers of rows and columns instead of a collection of visible faces (Battista & Clements, 1996). Across a large body of work, including Gilligan and colleagues' study of more than 12,000 children (Gilligan, Flouri, & Farran, 2017), spatial reasoning predicts later mathematics achievement, which is one reason measurement deserves real instructional time rather than a week at the end of the year.

Keep developing mathematical thinkers!

More Information

Read the full research overview and watch the video at mathsuccess.io/dmtinsights, where the Insight, the Companion for teachers and coaches, and this Newsletter are together in one place.

Use the Geometric Measurement Math Learning Profile (MLP) to identify whether a student needs support with Unitizing, Measurement Magnitude, Spatial Structure, or Relational Thinking, and find Targeted Activities and related resources at mathsuccess.io.

Have a classroom move that works? Send it to contact@dmtinstitute.com, and we may feature it in a future edition.

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