Building to Measurement with a Ruler
Transcript

Instructional Coach: I would like to welcome you to today's vertical math team meeting. Many of you are new to your grade level, so we are going to discuss the measurement student expectations found in second grade, third grade, fourth grade, and fifth grade, which are coming up next in our scope and sequence.

Voice-over: To help see the connections among the grade levels, we will discuss how students develop their understanding of measuring length and perimeter.

Students come from first grade with the understanding that objects, when laid end to end with no gaps and no overlaps, can be used to measure the length of an object.

In second grade, the students are measuring objects using tools, such as inch tiles and centimeter cubes. These concrete models represent standard units of length.

Instructional Coach: What might these experiences look like with second-grade students? Let's look at one way that we could allow second-grade students to explore these ideas.

Students can use centimeter cubes to measure the length of the pencil, like this: (*Starts counting)* One, two, three, four, five, six, seven, eight, nine, 10, 11, 12, 13, 14, 15, 16, 17. So, the length of this pencil is about 17 centimeter cubes placed face to face.

In the same way, students can also use inch tiles to measure the length of the pencil: (*Starts counting*) One, two, three, four, five, six, seven inch tiles.

Voice-over: This experience of measuring with concrete models allows second-grade students to deepen their understanding of the inverse relationship between the size of the unit used to measure an object and the number of those units needed to equal the length of the object.

Instructional Coach: When measuring the length of this pencil using both centimeters and inches, questions and discussions should lead students to the understanding that it takes more centimeter cubes to equal the length of the pencil than inch tiles because one centimeter cube is shorter in length than one inch tile.

We could also say that it takes fewer inch tiles to equal the length of the pencil than centimeter cubes because inch tiles are longer than centimeter cubes.

This inverse relationship between the size of the unit and the number of units needed is a critical foundational observation for students as they continue to build and deepen their understanding of measurement.

Centimeter cubes and inch tiles are valuable models to use because their edges or side lengths approximate standard units. Since they are made using standard units, these particular cubes and tiles allow students to make connections to measuring tools, such as rulers, yardsticks, meter sticks, or measuring tapes.

By using inch tiles or centimeter cubes, students are able to relate the length of one side of the inch tile to the one-inch length found on a customary ruler, or the length of one edge of the centimeter cube to the one-centimeter length found on a metric ruler.

With multiple experiences like measuring the pencil, students begin to understand that units of measure are continuous. Over time, students in second grade begin to understand that measuring with a ruler is a more efficient way to determine length than laying objects down end to end.

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A natural connection between a ruler and the number line may be made between measuring experiences and work with a labeled number line.

Students should understand that rulers can be used to represent lengths as distances from zero, just as number lines represent the magnitude of a number as a distance from zero.

Remember that students in second grade are expected to determine the length of an object to its nearest whole unit. In third grade, students might be expected to measure to the nearest fraction of a unit given their work with fractions, such as halves and fourths.

The student expectations in primary grades help develop understanding of linear measurement. This builds to third grade, when students are expected to apply this knowledge to determine the perimeter of a polygon. Perimeter is the distance around the entire polygon, with no gaps and no overlaps.

Students sometimes fail to see that a perimeter is still a measurement of length, because all of the side lengths are not arranged in a single line. It might help students to think about walking the entire distance around the polygon, starting and ending at the same vertex.

The total distance walked is the perimeter of the polygon.

It may also help students to see how the perimeter of a polygon can be "unwrapped" to form a single length.

Again, the total length of all of these sides together is the perimeter of the polygon.

When students become comfortable with the concept of perimeter, they are able to be flexible in their thinking about how to solve problems related to perimeter.

Voice-over: For example, students may be asked to "undo" this process in situations where the perimeter of a polygon is given and the students are expected to determine a missing side length.

In fourth grade, students combine their knowledge of attributes of rectangles and linear measurement to determine the perimeter of rectangles using formulas, including the special formula for determining the perimeter of a square.

Instructional Coach: So far, we have explored the learning progression of concepts related to measuring length, including perimeter.

In addition to these ideas, students in second grade also explore area by using concrete models of square units to determine area of a rectangle.

Students are expected to bridge these experiences with concrete models to form an abstract understanding of area in much the same way that we just did with measures of length.

Also related to measurement, the vertical progression of volume, or capacity, really begins in third grade with the introduction of liquid volume as a unit of measurement. However, students may remember from kindergarten that capacity is the maximum amount of a liquid or a solid that can be contained in an object, such as a bottle.

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Once again, students must have experiences with concrete models of volume and capacity, so that they can then bridge to related abstract understandings, including the use of formulas to determine volume.

What I have shared today is primarily about length and perimeter. Think about your grade level; do you have any questions about these student expectations or about your role in the development of your students' understanding of these concepts? If so, continue to explore resources on the Texas Gateway to address your concerns.