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PROFESSIONAL DEVELOPMENT

Building Referents for Metric Units of Length

A Lesson with Sixth, Seventh, and Eighth Graders

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In this lesson, students estimate and measure the metric length of a variety of objects, and then they choose personal referents for each metric unit of length. Building Referents for Metric Units of Length *is excerpted from Ann Lawrence and Charlie Hennessy's new book,* Sizing Up Measurement: Activities for Grades 6–8 Classrooms *(Math Solutions Publications, 2007).*

Instructions

1. Explain to students the importance of estimation in measurement. You might do this by reading the last half of the book *Millions to Measure,* by David Schwartz (HarperCollins, 2003). It contains an engaging description of the metric system and how it works. It also mentions the miscalculation that the U.S. space engineers made when a spacecraft was supposed to orbit Mars but instead was lost in space forever. Ask the students questions to help them provide examples of situations when an estimate of length would be helpful. For example:

   - There is a dead tree in our school yard. Will the dead tree hit our school if the wind blows it over?
   - We want to play a circle game with everyone in the class. Can all the members of our class comfortably form a circle in our classroom?
   - We want to cover our classroom bulletin board with a mural. How long must the piece of paper be to cover the bulletin board?

   Solicit additional examples from the students.

2. Review the units of length in the metric system. Then ask students to think about how many decimeters long the board in your classroom is. Write the estimates and their range on the board.

3. Next, ask the students to think about the length of 1 decimeter and be prepared to hold up their hands to signal the length they estimate when you snap your fingers. After a few moments, snap your fingers and look around the class. Then tell the students to put their hands down.

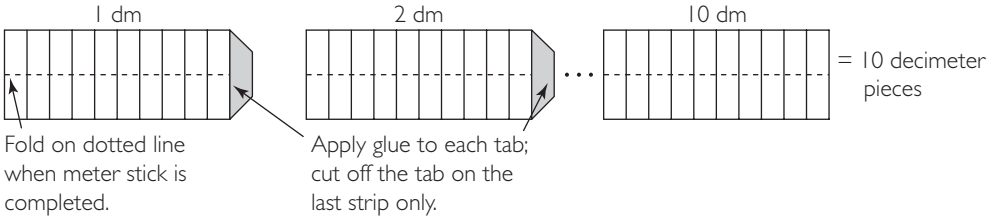
4. Indicate to the students the range of estimates in the class, using your hands. After reminding the class that a decimeter is *10 centimeters long,* have a student show the class the actual length of a decimeter on a meter stick and draw it on the board.

5. Ask the students to estimate again how many decimeters long the board measures. Write the estimates and their range on the board and have students share their strategies for estimating. Compare these new estimates with those the students gave before seeing the length of a decimeter.

6. Talk with students about the importance of having a personal referent for each metric unit of length. Explain that a personal referent is an object you see or use often, so you don't forget it. It is an object that you can think of to help you estimate the length of an unknown object. In the case of metric units of length, it is something that is as close as possible to a millimeter, a centimeter, a decimeter, and a meter in length.

7. If you wish, either in class or at home, have students create their own meter sticks by cutting out ten paper decimeter strips including the tab (see attached Blackline Master), taping or gluing them together, and labeling each decimeter as shown below. After the glue is dry, have students fold their strips of paper in half lengthwise to strengthen them.

   While this activity may take a while, it is very useful for students to actually go through this process. Through this do-it-yourself experience, students are much more likely to strengthen an intuitive feel for metric units of length than by merely using a commercial measuring device.



8. For class work or homework, assign the following:

   a. Use a metric measuring tool to find five common objects that are close to 1 millimeter in length or thickness. List them.

   b. Repeat the task above to find five common objects that are close to each of these units: 1 centimeter, 1 decimeter, and 1 meter.

9. Have students share their lists with a partner, and then have each pair share one object with the class that it thinks is a good referent for each unit of measure. Write these on the board. Suggestions may include the following:

   - millimeter: thickness of a dime; thickness of the point of a thumbtack; thickness of a fingernail

   - centimeter: thickness (or diameter) of a crayon; width of the head of a thumbtack; width of a fingernail

- decimeter: length of a new, unused crayon; total height of a 60-, 75-, or 100-watt light bulb; length of a regular-size (about 55-gram) Snickers, Milky Way, or Twix candy bar
- meter: width of a single front door; height of a volleyball net

10. Review that having personal referents for the metric units of measure will make estimating lengths in metric units easier. Have students choose their personal referents for each metric unit of length. When everyone is ready, tell the students that in order to become a really good estimator, they need to practice. Encourage the students to use their personal referents to make estimates of length on their own, for instance, while taking a walk, waiting for their parents in the car or a store, or doing an errand, and to check their estimates whenever possible using their paper meter sticks or a measuring tape.
11. Complete this activity by asking students to write a reflection about the importance of estimation and how their own personal referents can make it easier for them to make good estimates.

Notes to the Teacher

This activity helps students choose personal referents for most of the commonly used units of metric length. Over time, these referents should help each student become a better estimator of length.

When you use this activity with your students for the first time, you may find the following comments useful:

- Be sure to focus on all the metric lengths. For example, though not often stressed in classrooms, the decimeter is a common length for many crayons and candy bars. Also, remind students that the length of a long rod in a set of base ten blocks is a decimeter and the ones cube is a centimeter along each edge.
- Developing a feel for the size of units in any measurement system requires repeated practice. Throughout the school year, lead brief sessions during which students can engage in estimating the lengths of various objects and discuss referents.
- Post a list of appropriate referents for each metric unit of length on the classroom wall. Add to the list as you or students find new ones throughout the year.

Extension

Gather the following materials for each student:

- 1 decimeter of durable ribbon (wider than 1 centimeter)
- button, 1 centimeter wide and 1 millimeter thick
- needle and about 60 centimeters of thread

- pair of small Velcro squares (one hook piece and one loop piece)

Have students make a personal referent for metric units of length to attach to their backpack or other item by sewing the button onto the ribbon and using the Velcro for fastening the ribbon to the backpack. If a student does not want to fasten the ribbon to anything, she can use it as a bookmark.

Occasionally remind students, through questioning, that the ribbon is 1 decimeter long; the button, 1 centimeter wide; and the button, 1 millimeter thick.

Decimeter Strips

Fasten ten decimeter strips to form one meter-long stick.