Relationships in the Metric System
## A Lesson with Third, Fourth, and Fifth Graders
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The metric system is particularly easy to work with since its units relate to each other in the same way that units in place value relate to each other: powers of ten. This activity helps make that connection for students. Here students compare centimeter cubes, decimeter rods, and meter sticks and find all the ways that they can describe the relationships among these units. Relationships in the Metric System *is excerpted from Chris Confer's new book,* Sizing Up Measurement: Activities for Grades 3–5 Classrooms *(Math Solutions Publications, 2007).*

Instructions

1. Tape a piece of chart paper on the board. Write the title *Metric Relationships.*

2. Explain to the students what you mean by *relationships.* Talk about how we are related or connected to people in our families. Explain that one person can be related to different people in different ways. For example, you may be a daughter to your mother, a sister to your brother, and a wife to your husband. In the same way, a centimeter has many different relationships to other units of measure.

3. Hold up a centimeter cube and a decimeter rod so the class can compare them. Ask the children to talk to their partners about how those two units of measure, or lengths, are related.

4. Have the children share some of their statements with the class. After each child shares, ask the others whether they agree. If so, write these statements on the chart. For example, one statement might be *There are 10 centimeters in 1 decimeter.* Ask a student to make a sketch on the chart to show what that relationship looks like. The sketch might look like this:

decimeter
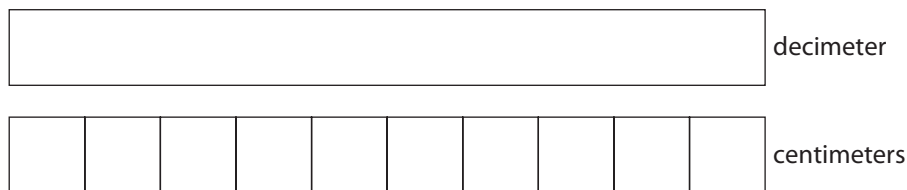
centimeters

5. Ask the students to give you an example of that relationship, for instance, how many centimeters are the same as 2 decimeters. Illustrate this relationship by placing one centimeter cube on top of two decimeter rods lying end-to-end. A student might say that 20 centimeters equal 2 decimeters. When a child explains a relationship, add those words to the chart. Ask for another example, such as how many centimeters would be in 5 decimeters, and add students' ideas to the chart.

6. Now encourage the students to think about how they would explain the first statement in terms of fractions. You may need to restate the question, saying, "What fraction of the decimeter is a centimeter?" Again place a centimeter cube on top of a decimeter rod. Then have partners talk, ask a child to share, and write the statement on the chart. The child may say, "A centimeter is one-tenth of a decimeter."

7. Once again, ask for an example of that relationship. For instance, ask what fraction of 2 decimeters is 1 centimeter. If no one knows, explain why it is one-twentieth.

8. Explain to the students that they are going to work in pairs to find as many different ways as possible to describe how metric units—meters, decimeters, and centimeters—relate to each other. Ask the children to explain each relationship in writing and include pictures as well as examples of how the relationship works. Pass out ten centimeter cubes and ten decimeter rods to each pair of students, and explain that small groups will share meter sticks.

9. As the students work, circulate to offer support. Students may explore relationships such as how centimeters relate to meters or how decimeters relate to meters. They may consider relationships in terms of fractions or multiples. Students may explore how many centimeters or decimeters are in more than 1 meter. Ask key questions such as: "Do you both agree that this statement is true?" and "How can you prove it?" Be sure to have students use the manipulatives to explain their thinking and make diagrams that show the relationships. If students have statements only with whole numbers, encourage them to think about how to describe those relationships in fractions.

10. When the students are finished, gather them into a group to share what they have discovered. Begin by discussing how centimeters relate to decimeters. Invite a pair of students to share a statement that they have written or a diagram that they have made. Each time a pair shares, have the other students decide whether they agree with the statement. If so, add it to the "Metric Relationships" chart. If not, the group may need to help the students revise their statement. Then do the same with how decimeters relate to meters, and then how centimeters relate to meters.

11. Sum up the relationships between the metric units by using terminology that is probably new to the students. Tell the students that when we say that decimeters are ten times larger than centimeters, and that meters are ten times larger than decimeters, the units are increasing by *powers of ten.* If the students have not yet made this observation, note that powers of ten also describe the relationship between units in place value: the tens place is ten times larger than the ones place, the hundreds place is ten times larger than the tens place, the thousands place is ten times larger than the hundreds place, and so on.

12. Finally, make the connection between the units' names and their relationships. Write *centimeter* on the board, and underline *centi.* Ask the students what that reminds them of. Next to *centi,* write *cents* and *century.* Explain that there are one hundred cents in a dollar and one hundred years in a century, just as there are one hundred centimeters in a meter. If the students speak Spanish, make the connection with the words *cien* and *ciento:* one hundred.

13. Now write *decimeter* on the board, and underline *deci.* Ask the students what that reminds them of. Next to *deci,* write *dime* and *decade.* Explain that there are ten dimes in a dollar and ten years in a decade. If the students speak Spanish, make the connection with the word *diez:* ten.

14. Post the chart on the wall. Encourage the students to refer to it when they encounter metric units at school.