CHAPTER 16
Metric Measure

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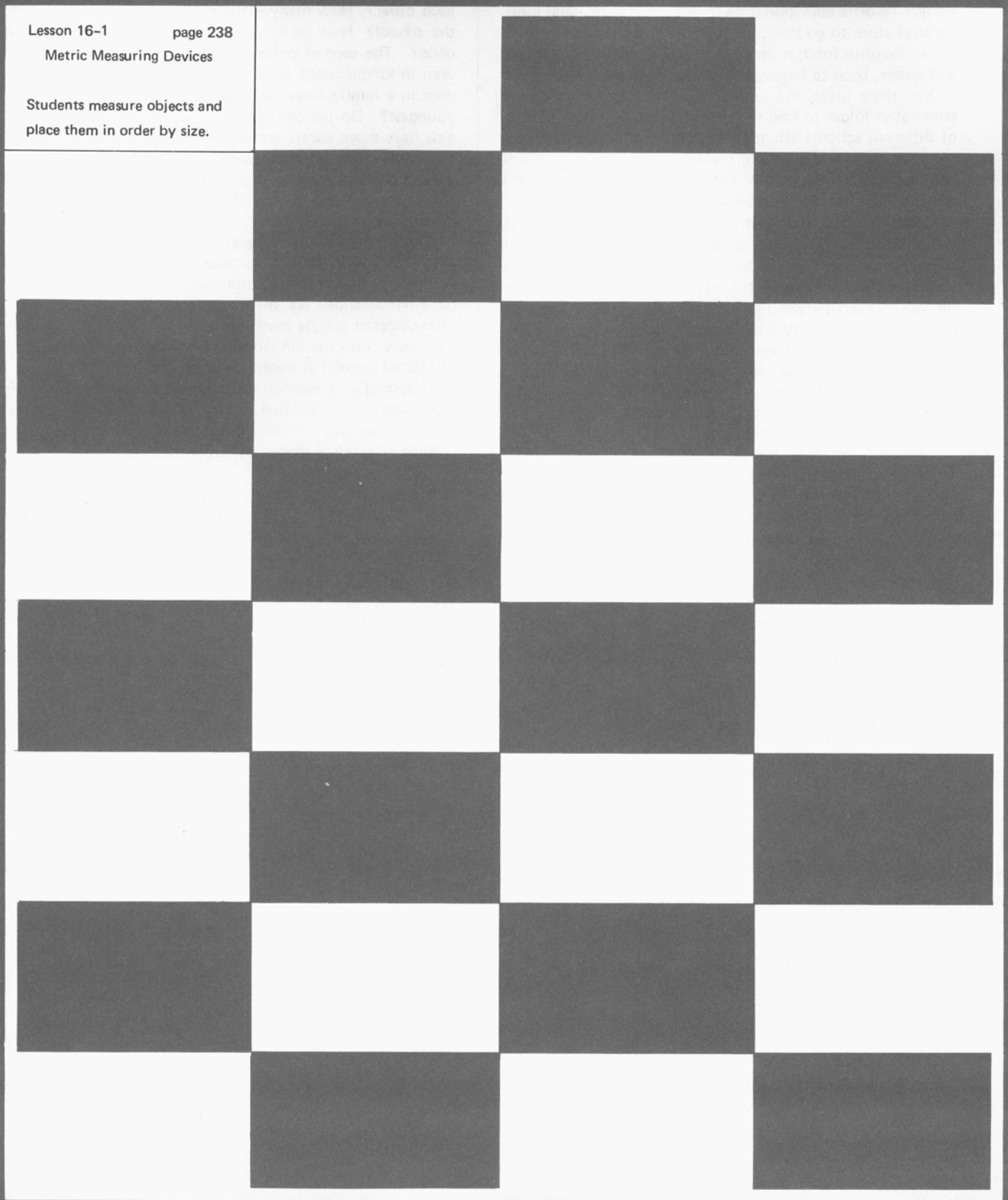
Metric Measuring Devices

Students measure objects and place them in order by size.



Prerequisite chapters:

Chapter 14

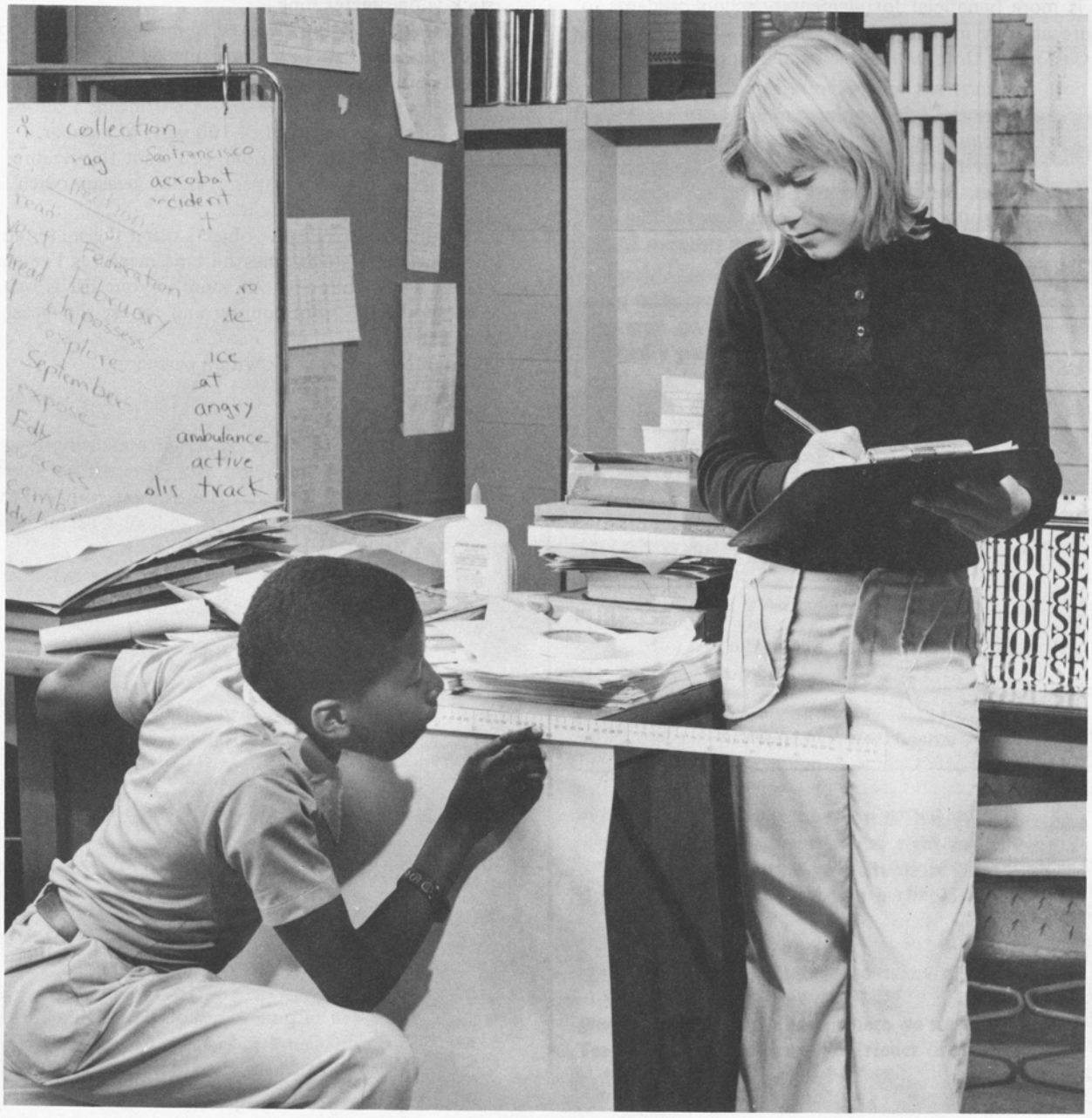
MATERIALS

For overhead projector:

None

Student materials:

Spelling notebooks — Materials chapter, page 296
Metric rulers and tape measures of assorted lengths — Materials chapter, page 298
Objects in the classroom
Paper



The activities in this chapter introduce students to the International System of Units (SI), more commonly known as metric units. The lessons in Chapter 14 on measurement prepared them for acceptance of standardized units of measure by allowing them to experience the inconvenience of not having commonly agreed upon units with which to measure.

When the present generation of elementary school students is graduated from high school, the United States will have converted to the International System of Units. Adults will have to learn this new system of measurement as they would a second language. They will think of all their measurements in terms of U.S. Customary Units (their present language) and then have to convert the measurements to metric units (their second language).

It is more beneficial for elementary school students to measure entirely in metric from the beginning. For them, U.S. Customary Units will be the second language.

LESSON 16-1

MEASURING WITH SI UNITS

PURPOSE:

To place selected measurements in order by size

MATERIALS:

1. *Metric rulers of various lengths*
2. *Metric tape measures*
3. *Objects in the classroom*
4. *Spelling notebooks*
5. *Paper*

This lesson introduces students to the meter and centimeter units of measure. The assignment is a familiar one: measure ten objects and place them in order by size. The structure used in the earlier lessons in chapter 14 is repeated here so the students may compare the difficulty they faced previously in ordering the measurements with the problems or lack of problems they face now.

Teacher: When you tried to measure your desk with parts of your body, one of the problems you had was that everybody had different size hands, feet, arms and so on. This meant the measurements you made were different even when the objects were the same size.

The problem of getting different measurements for objects that are supposed to be the same size has bothered people for a long time. Over a hundred years ago, a group of scientists faced this same problem when they tried to tell one another of measurements they had made. They did not all live in the same town and whenever one scientist wrote to another scientist about something he or she had measured, that person couldn't tell how big the object measured really was.

The scientist tried to solve the problem by asking everyone to use the same size stick to measure with. They all agreed how long the stick should be and then everyone had a stick made exactly the same length.

This stick is the same size as the ones the scientists decided to use. They called it a *meter stick.* Meter means to measure, so a meter stick was a measuring stick. This stick is one meter long.

The scientists knew they wanted to measure objects shorter than the whole stick, so they divided the stick into 100 equal parts to use in making small measurements. They called each part a *centimeter.* Cent means 1 out of 100 parts, like 1 cent is 1 out of 100 parts of a dollar.

Select ten objects in the room you want to measure, and write them on your paper. Then, measure each item and write down how big it is.

I want you to measure the objects using the meter sticks, the centimeter sticks, and the tape measures I've placed on the front counter. As soon as your list is written, come up to the front counter and choose the measuring devices you wish to use.

If you want, you may work with a partner.

After the students have completed measuring their ten items, they number the items from longest to shortest, starting with one for longest. The lists are turned into the teacher, who selects sample lists and, one list at a time, writes the measurements on the overhead.

3
2
125
75
57
29
16
7
5
4

Teacher: Here is a list of measurements. Are they in the right order?

Student: No.

Teacher: Why not?

Student: The three and the two should go at the bottom.

Teacher: Richard, these measurements are from your paper. Why do you have the three and the two at the top?

Student: Because they are meters. The others are for centimeters.

Teacher: Okay, I'll show you how the scientists indicated which numbers were for meters and which were for centimeters. For meters, they wrote a small *m*. For centimeters, they wrote a small *cm*. I'll add those letters to your list so we can tell which numbers are which.

3m
2m
125
75
57
29
16
7
5
4

What do I put by the 125? Is that 125 meters or 125 centimeters?

Student: It's not either one. That's 1 meter and 25 centimeters.

The way the students are taught to label measurements that combine meters and centimeters depends on the knowledge they possess at the time. If they have studied decimal notation they may be taught to write the measurement as 1.25 m. If they have studied place value in the chapter on advanced addition and subtraction, they will understand why it can be written as 125 cm. If these activities in measurement precede both knowledge of decimals and place value, the students may be taught to write the measurement as 1 m 25 cm. This last notation should be replaced by either of the first two as soon as the students gain the necessary understanding to make other notations meaningful.

3m
2m
125cm
75cm
57cm
29cm
16cm
7cm
5cm
4cm

Teacher: Now that the measurements have labels, can you tell me if they are in the right order?

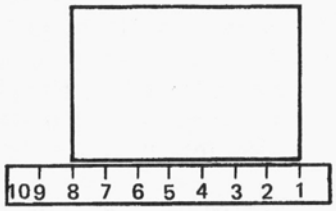
Student: Yes . . . they're in the right order.

Teacher: Then would the ten objects from which these measurements came be in order from longest to shortest if we lined them up in the same order as their measurements on the overhead?

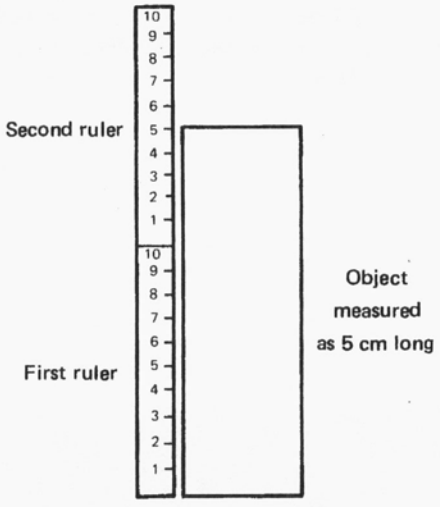
Student: If Richard measured right they would be.

Teacher: Let's place the ten objects next to each other and see. . . .

The teacher's introduction of rulers and tape measures is not designed to make the students skilled in their use. Some students may have made all their measurements by placing the one at the edge of the object to be measured; others may, when placing two sticks together to find a length, read the measurement from the second stick only, forgetting to add the first.



Object measured as 8 cm long.



With the exception of learning how to write the measurements, all the problems the students encounter are well within their abilities to solve without help. The framework for this resolution is placing the ten objects in order by size to verify or disprove the order of the measurements written on the overhead.

If a student says a 15 cm object is only 5 cm long, the discrepancy will be readily apparent when the objects are placed in order. When the order of the objects doesn't match the order of the measurements, the student who did the measuring selects one or two fellow classmates to help check the measurements. The class must decide how each student is to measure with the rulers and tape measures so the order of the measurements matches the order of the objects.

As the students verify the ordering of each new list of measurements the teacher asks them the following questions:

Is there a way you can measure the objects so you can tell by putting the measurements in order if the objects would be in the right order, too?

Is it easier or harder to measure with meters and centimeters than with body parts, sticks, or cubes? Why?

Is it easier or harder to compare measurements of different objects when you use meters and centimeters or body parts, sticks, or cubes? Why?

The purpose of this lesson is to acquaint students with the use of centimeters and meters. As the need arises, other units may be introduced. If the students need to use measurements smaller than centimeters, *millimeters* are explained. If the students, in working with place value or decimals, want to know what the column between meters and centimeters is called, the term *decimeter* is added to their vocabulary.

This lesson may be repeated often to provide students measuring practice. Once the lesson has been presented the first time, the students may use metric units for any measuring activity they face. However, unless the assignment specifies metric units to be used, students may use any measuring units they wish.

A measuring system should not be used simply because we decree its use. If it offers enough advantages on its own, students will choose to use it. The metric system does offer sufficient advantages to students that, without special prompting from us, they will adopt it of their own accord.

As the students expand their use of measurement, the teacher may wish to introduce additional units of metric measure. To insure the students are presented the correct abbreviations and spelling, the teacher should obtain a copy of the following publication:

National Bureau of Standards, *The International System of Units (SI)*, Publication 330, 1972, 45 pages.

This publication is available for 30 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Order by SD Catalog No. C13. 10: 330/2.