



GRADES 3–5

NAVIGATING *through* MEASUREMENT

Chapter 2

Understanding Standard Units of Measurement

Educators generally agree that students should explore and use informal or nonstandard units when they are beginning to develop measurement ideas and skills. Over time, however, students need to make a transition to standard units and conventional or standard measuring tools. Van de Walle (2001) identifies three broad goals that teachers should help students attain as they learn about standard measures. The students should develop—

1. a familiarity with standard units;
2. an ability to select an appropriate unit in a particular context; and
3. an understanding of relationships among units.

The activities in this chapter are designed to help students understand the need for measuring with standard units while making them familiar with some of these standard units in the customary (English) and metric systems. The first activity, Off to the Hardware Store, turns students' attention to standard units. In the second activity, Measurement Scavenger Hunt, students use standard units to measure length, weight, and angle.

It is also important for students in grades 3–5 to have experiences in estimating measures. Such experiences emphasize the process involved in measuring, and they familiarize students with measurement units. Students also need activities that help them develop and use appropriate language for estimating. When presenting estimates, students should make statements such as “This book is *about* 33 grams” and “The area of this carpet is *a little more than* 5 square yards,” for example. Students will

explore the selection and use of benchmarks to estimate measurements in the chapter's third activity, *My Benchmarks*.

In addition, it is important for students in grades 3–5 to begin to understand that the size of the unit is related to the precision with which they can make a measurement. Moreover, students need to recognize that all measurements contain some error and that small units do not automatically guarantee precision in measurement. Students should begin to understand that the degree of precision that is necessary and appropriate in a particular measurement is related to the context and purpose of the measurement task at hand. An engineer measuring components of an automobile engine needs to achieve a higher level of precision than does a homeowner measuring carpet for a living room. The chapter's fourth activity, *How Precise Should My Measurement Be?* helps students understand the idea that all measurements are approximations and that differences in units affect precision.

Principles and Standards for School Mathematics (NCTM 2000) identifies the ability to make simple unit conversions within a system of measurement as one of the skills that students in grades 3–5 should master. Making such conversions helps students develop an understanding of relationships among units. In *Conversion Sense*, the last activity of the chapter, students carry out simple unit conversions within a system of measurement.

Off to the Hardware Store

Grades 4–5

Goals

- Determine units of measure on the basis of the measured attributes
- Recognize the need for measuring in standard units
- Become familiar with units in commonly used systems

Prior Knowledge

Students should have experience with the measurable attributes length, area, perimeter, volume, capacity, weight, temperature, and time.

Materials and Equipment

- Sales catalogs, flyers, or brochures from building supply companies or hardware stores
- One copy of the blackline master “Off to the Hardware Store” for each student

Classroom Environment

The students work in pairs, but each student completes the activity sheet “Off to the Hardware Store” independently. (Alternatively, teachers might assign the activity as a home learning project, with each student visiting a hardware store to complete the activity sheet, or as a class project involving a field trip to a local store.)

Activity

Engage

Tell your students that they are going to investigate the role that measurement plays in the buying and selling of items in hardware stores. Ask the students to create a list of the various measurement attributes that might be of interest to people who operate hardware stores or who shop at them. Students should think about length, area, volume or capacity, weight, and perhaps temperature. Ask them, “Can you think of something in a hardware store that is sold by weight?” Write their answer as the first item on a list that the class will make together. If your students are unable to make suggestions, you might propose such items as nails, washers, birdseed, or grass seed.

Focus on the attributes that hardware stores use in selling particular products. For example, they market carpet by the square foot or yard; therefore, the attribute that they use to sell carpet is area. Explain to your students that sometimes they may need to know the measure of a second attribute of an item, such as its area, perimeter, or volume, in addition to the attribute that the item is sold by, in order to buy the right amount. For example, fiberglass insulation is typically sold by length, but buyers may also need to know how many square feet a roll will cover—its area. The packaging provides this additional information.



“All students should ... understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.”
(NCTM 2000, p. 170)



pp. 110–11



Explore

Arrange your students in pairs, and distribute to each pair a sales catalog, flyer, or brochure from a hardware store or building supply company. Give each student a copy of the blackline master "Off to the Hardware Store." This activity page asks them to list items that they find that are sold by length, area, perimeter, volume, capacity, weight, or any other measurable attribute. For each item, they must give the unit of measure that is used in marketing it and record the page number of the listing. Before the pairs of students begin work, show them how measurements are listed in the flyers and catalogs. The attributes may appear as headings of columns that give the units used to measure the items. For example, sterilized sand for children's sand boxes, often sold as "play sand," is typically marketed by weight and listed in catalogs in pounds:

Play Sand

Weight	Mfr. No.	Stock. No	Price Each
50 lb.	1113-51	169803	\$2.86

Invite the students to begin looking through the catalogs and other sales materials to find items to list on the blackline master. Tell them that they may find measures that are not specified on the activity page, and they should list these under "Other attribute." For example, roofing shingles are sold by the *bundle* or *square*. Have the students investigate these or any other terms that they find.



Students should find three items for each attribute listed on the activity page. Be sure that they are focusing on the unit of measure that is used in marketing the item. For example, students should write the item "lumber" in the first column on their activity sheet under the attribute "Length." In the second column, "What unit of measure is used to sell the item?" they would write the particular unit of length, such as inches or feet. They should not record all the different widths and lengths of lumber that are available.

Extend

When the students have completed the activity, ask them to share with one another the items that they have listed on their activity sheets. Invite them to talk about the measurement unit and the item and to tell why they think the item is sold by that unit. Students can also explore

the types of items that are sold by metric measure and the frequency with which one system of measurement is used in the hardware store as compared with another.

Assessment Ideas

You might ask your students to select one of the items that they have listed on the blackline master “Off to the Hardware Store” and tell how stores use a particular measurable attribute of the item in selling it to buyers. Ask the students what other measurements, if any, they might need to know in buying the item, depending on how they intended to use it. For example, students choosing lumber from their lists might explain that lumber is sold by length, and they could demonstrate how it is measured. They could describe a task for which a particular quantity of wood would be necessary. If they were building a bookshelf, for instance, they would know how much wood they needed to make a particular number of shelves of a particular length to fit in a particular space in a room.

List the items found for the attributes below.	What unit of measure is used to sell the items?	Page #
<small>Length</small> Sheared Fraser fir	feet	pg. 48 in flyer
Wood bases	feet	pg. 16 in flyer
Fat max tape measure	inch/feet	pg. 26 in flyer
<small>Area</small> Floor tile	Square inches	pg. 19 & 5 book
Ceramic wall Tile	square inches	pg. 12 & 7 book
Tile back board	square feet	pg. 24 & 9 book
<small>Perimeter</small> Palm Mist Area Rug	feet	pg. 36 in flyer
Lions Heart Area Rug	feet	pg. 36 in flyer
Ivory Modern Rug	feet	pg. 36 in flyer
<small>Volume</small> microwave	cubic feet	pg. 13 & 7 flyer
Watt with Turntable	cubic feet	pg. 12 flyer
Watt over the Range	cubic feet	pg. 13 flyer
Refrigerator	cubic feet	pg. 13 & 7 flyer
<small>Capacity</small> Fiberglass Roof Coating	gallons	pg. 55 & 9 book
2 year Gas water heater	gallons	pg. 1 & 13 book
Grout and Tile Sealer	gallons	pg. 125 & 3 book
Grout and Tile Sealer	gallons	pg. 125 & 4 book
<small>Weight</small> Bonding Mortar	pounds	pg. 125 & 0 book
Thin Set Mortar	pounds	pg. 125 & 0 book
White Dry Non-Setting Grout	pounds	pg. 125 & 2 book
Granite Mortar Mix	pounds	pg. 125 & 1 book
Fiberglass step ladder	pounds	pg. 1 in flyer
Level Quik K Underlayment	pounds	pg. 125 & 1 flyer
Fast Curing Bonding	pounds	pg. 125 & 1 flyer

Where to Go Next in Instruction

The activity Off to the Hardware Store introduces students to standard units of measurement by showing their usefulness in daily life. In marketplace transactions, standard units of measurement are as necessary as standard units of currency, providing a common “language” that enables buyers and sellers to conduct business with one another in a manner that ensures equity, accuracy, efficiency, and satisfaction to both parties. The next activity, Measurement Scavenger Hunt, also explores the role of standard units of measurement.