



Measure Up

Purpose

- To practice making standard and non-standard measurements.
- To learn the purpose of making linear measurements and how to apply them to scientific investigations.

Overview

Students will use various objects in the classroom to experiment with nonstandard measurement. They will make estimates and test them out. Then, working in pairs or small groups, students will use a ruler or a measuring tape to become familiar with how to use these tools for standard linear measurement.

Student Outcomes

Students will learn how to make measurements, both nonstandard and standard (with a ruler). They will test their estimates and record their results.

Science Content Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry

Science Content Standard B: Physical Science

- Properties of objects and materials

Scientific Content Standard E: Science and Technology

- Understanding about science and technology

Mathematics Standard: Number and Operation:

- Use computational tools and strategies fluently and estimate properly

Mathematics Standard: Measurement

- Understand attributes, units, and systems of measurement
- Apply a variety of techniques, tools, and formulas for determining measurements

Time

- Part 1: One 30-45 minute class period
- Part 2: One 30-45 minute class period

Level

Primary (most appropriate for grades K-4)

Materials

- Elementary GLOBE book: *Discoveries at Willow Creek*

Part 1:

- Various items from the classroom to measure
- Copies of the *Measure Up Student Activity Sheet 1*

Part 2:

- Metric rulers
- Various items from the classroom to measure
- Plant seeds, soil, containers
- Copies of the *Measure Up Student Activity Sheets 2*

Prerequisites

- Students should have an understanding of the following concepts: *as many as*, *more than*, *the same as*, and *as long as*. Younger students may need practice with these terms prior to doing this activity.



Preparation

Read the Elementary GLOBE book *Discoveries at Willow Creek* - either read it to the class or have students read it to themselves. The books can be downloaded from www.globe.gov/elementaryglobe.

You will need plants grown from different seeds for the second part of this activity. Before doing the activity with your students, plant 3-5 containers with different types of seeds. You might want to have the students help you plant the seeds. The reason you need to have different kinds of plants is because the students will be measuring the plants as they grow.

Teacher's Notes

There are two categories for units of measurement - standard and nonstandard. Standard units of measurement are units that are used universally and include units from the metric system (millimeters, centimeters, meters, kilometers) and English units, which are commonly used in the United States (inches, feet, yards). Nonstandard units are items you can use for measurements that don't have a standard that is universally accepted. For example, some nonstandard units could be: paperclips, shoes, marbles, pencils, leaves, hands, tennis balls, etc. You can ask your students the question "How long is it?" and they can answer "As long as..." In this way, even without standard measurement units, there is still something with which to compare an item.

Both nonstandard and standard units can be used for measurement. Introducing nonstandard units first to primary grade students is a good way to make them comfortable with the concept of measurement before introducing rulers and measuring tapes. Provide a frame of reference by having students measure with objects such as a pencil or a paper clip. The only requirement is that a measurement always has two parts: a number and a unit. For example, a desk might be 1 meter long, where "1" is the number and "meter" is the unit. Also, a measurement must be end-to-end for it to be accurate. Note: younger students will need time to practice measuring from end to end. Once students have this frame of reference, discuss

with them why standard units would be helpful; then have them practice. For example, point out that there are two common sizes of paper clips and you might not know which kind someone else was using when they measured an item. With standard units, the measurement is universal and consistent.

Rulers and measuring tapes use standard units, which are often in millimeters (mm), centimeters (cm), or inches (in) and are used to make linear measurements. The GLOBE Program uses the metric system (millimeters, centimeters, meters, kilometers) as the standard unit of measurement.

What To Do and How To Do It

Part 1:

1. Model for your students how to measure the length of a table using your hand. Ask them for ideas of how to use some other parts of their bodies to measure the table.
2. Allow them to explore this concept. Discuss the idea that a measurement unit can be anything you want it to be as long as you define the unit and only measure with that unit.
3. Have the students find another object to measure.
4. Have them pick something smaller than a shoe box to use for a measurement unit. Some ideas for units are: paperclips, marbles, leaves, pencils, hands/fingers. Once they have selected an object to measure and a measurement unit, have the students fill out the first part of the *Measure Up Student Activity Sheet 1*. Have the students make some observations about their object and compare the object to their measuring unit and write those observations on the student activity sheet.
5. Have the students estimate (guess) how many units long the object they have chosen is. Have them write this estimate down on the *Measure Up Student Activity Sheet 1*.
6. Next, have the students count how many units long the object is (measure the object). They should record this number on the *Measure Up Student Activity Sheet 1*.



7. Have them compare the measurement with their estimate (guess). Have the students write a math statement explaining their measurement and have them share their results with the class. See the *Measure Up Student Activity Sheet 1* for a sample math statement.
8. Ask your students the following questions:
 - How accurate was your estimate?
 - How could you measure your object using a different unit?

Part 2:

1. Show your students a ruler. Ask them the following questions:
 - What are the marks on the ruler for?
 - Why is it important for people to take accurate measurements?
 - Why is it sometimes helpful to have a measuring system that everyone uses?
2. Point out the difference between inches and centimeters/millimeters on the ruler, and let the students know that they will be measuring using centimeters. (Note: this distinction is only necessary in classrooms where both English and metric measurements are used.) Pass rulers out to the students and talk to them about how this tool measures things. Ask for ideas about what people measure with a ruler and what other tools people use to measure different things.
3. Divide the students into groups of 2-3. Have the students practice measuring with a ruler. They can measure items in the classroom with the ruler. Have them record their measurements on the *Measure Up Student Activity Sheet 2*. Note: Younger students will have an easier time measuring smaller objects that are under 100 units long. Numbers bigger than 100 will be harder for them to understand.
4. Now have the students look at the plants that have been growing in the classroom for this activity. Have the students select a plant they want to measure. Before using their ruler to measure the plant, have the students estimate how tall they think the plant is in centimeters. They should record this estimate on the *Measure Up Student Activity Sheet 2*.
5. Next, have the students measure the plant with

their rulers. After they record this number, have them write a math statement comparing their estimate with the measurement.

6. Continue to make these measurements weekly as the plants grow taller.

Adaptations for Younger and Older Students

Younger students can continue to experiment with nonstandard measurement until they are ready to try standard measurement. Read *Measuring Penny* by Loreen Leedy with your students to give them more ideas of how to use nonstandard measurement.

Older students can explore with other types of measurement. For more information go to the "Further Investigations" section below.

Further Investigations

- **Measurements in Nature:** After it has rained, take your students outside. Have them draw a chalk circle around the outside of a puddle. Wait several hours or a day, depending on how quickly the water is evaporating, and draw another circle around the remaining puddle (see Figure 1 below). Use a

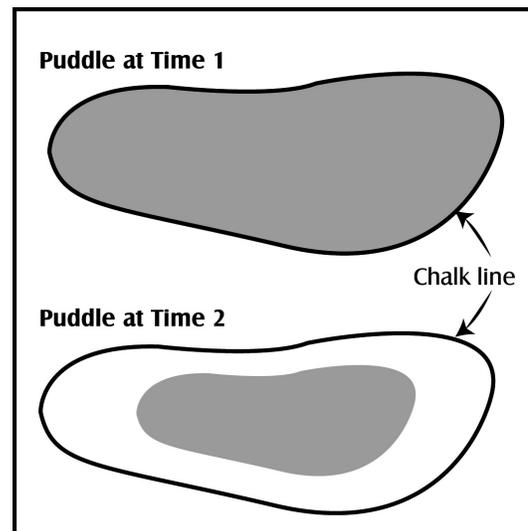


Figure 1. The chalk circle remains as the puddle dries.



ruler or measuring tape to record the length of the narrowest and widest parts of the puddle. Have the students record this information in a journal. If it is a big puddle, do this several times until all of the water has evaporated.

- **Explore Other Types of Measurement:** temperature, volume, and mass/weight. *How to Teach Measurements in Elementary School Science* by Neal J. Holmes and Joseph J. Snoble is a great resource for this area (www.nsta.org).
- **Measuring Plants:** Have your students record the plant's growth every week on a calendar. Then, write math statements about the plant's growth over the entire month.

Week ____ had the most growth

Week ____ had the least growth

It grew more on week _____ than any other week of the month. (Week 3, for example)

_____ cm during week 1

+ _____ cm during week 2

+ _____ cm during week 3

+ _____ cm during week 4

_____ Total month's growth



NAME: _____

Measure Up Student Activity Sheet 1

The object I will measure is _____.

Here's a drawing of what I measured.

A large, empty rectangular box intended for the student to draw the object they are measuring.

I am using _____ to measure the length of my object. This is my measurement unit.

Here's a drawing of my measurement unit.

A large, empty rectangular box intended for the student to draw their measurement unit.

Estimate

I estimate (guess) that what I am going to measure is _____ units long.

Actual

My object is _____ units long.

Write a math statement that explains the difference between the estimated and actual length of what you measured.

Example: I used a glove to measure a rug. I guessed that the rug is 15 gloves long. The rug is actually 18 gloves long. My guess was less than the actual amount.



Measure Up Student Activity Sheet 2

Practice measuring with a ruler

The object I will measure is a _____.

It was this long: _____

How tall is that plant?

Estimate

I estimate (guess)
that the plant is
_____ tall.



Actual

I measured and found
that it is actually
_____ tall.

In the space below, write a math statement that explains the difference between your estimate and the actual height.