LESSON 5

How Long? How Far?

Measurement

Objectives . . . Students will be able to:

- *Identify and use tools for measuring length.*
- *Identify and use standard and nonstandard units of measurement.*

NCTM Standards and NAEP Strand

Concepts learned and applied in Lesson 5 correlate to NCTM Standards 1, 2, 3, 4, and 10; and NAEP Strand 2 (Measurement).

Materials List

Each Group

- tape measure, yardstick, or meter stick
- various nonstandard measurement materials, such as books, erasers, pencils, etc.
- paper on which to sketch plans for steps
- kindergarten child, or height measurement of a kindergarten child
- *Optional*: Legos, Tinker Toys, Lincoln Logs, etc.

Each Student

- A copy of BLMs 5-A and 5-B for the "You Try It at Home" activities.

To Prepare Your Students

Introduce today's video topic and ask questions designed to ascertain if the students are familiar with the Student Prerequisites and Key Words and Terms. Present some simple examples of the type of problem to be explored—e.g., What would you use to measure your height? How would you find the length of this classroom? Could you use other things for measuring besides yardsticks, tape measures, or rulers? . . .

Video Overview

In the opening montage, we see a mother and her son comparing their stride length; a girl doing the long jump; a girl trying on a jacket and finding it is too small. We need to know how to measure things in everyday life!

Student Prerequisites

- Concept of length.
- Experience with length measurement of standard units.
- Experience with length measurement of nonstandard units.

Key Words and Terms

length *height*

standard measures: meter, centimeters, inches, feet, yard, etc.

nonstandard measure

Video Lesson

Backyard Swing

Two children want to make a swing and suspend it from a swing set in their back yard. What do you think they will have to know in order to find out how much rope to buy?

STOP **YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW**

Use the following questions to help your class respond to this problem.

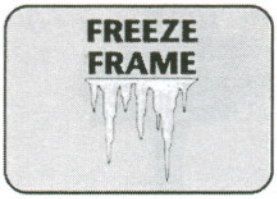
1. Why is the girl using the rake? How can this help determine the amount of rope needed? Is this a standard or nonstandard measurement tool?
2. What kind of calculations are involved in this method? Why do the children need to multiply by two (or add twice)?
3. How would you solve the problem without a tape measure?
4. What other measuring tools might you use?

After they have worked out the problem, but before they present their solutions, play the video showing how other kids solved the problem.

Play

Watch the ways the children on the video solve the problem. The video then asks:

IS THIS SOLUTION LIKE YOURS?



Note: Question is on-screen but there is no stop sign. Teachers should pause at this point and ask each group to present its solution. Encourage your class to think about all the solutions and remind them that there are many possible solutions.

Play

The Drinking Fountain

John Eller of Baker Demonstration School tells his class that their classroom will be used next year by kindergarten students—but the drinking fountain is too tall for them! He asks his class to design steps that will allow kindergarten children to use the drinking fountain.

YOUR CLASS MAY WANT TO TRY THIS NOW

Form your students into small groups and introduce the problem to them. You may need to use an imaginary fountain, so make a mark on a wall to show them the height of the fountain and another mark to show the height of a typical kindergarten student.

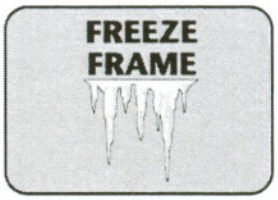
Give them the materials available for the investigation—tape measure, yard or meter sticks, nonstandard measurement materials such as pencils, erasers, books, etc., and pencil and paper for making a drawing of their solutions. If they are available, you may wish to let them use Legos, Lincoln Logs, Tinker Toys, etc., to make a model of the steps they will propose making.

If possible, have the groups, accompanied by an adult, research existing steps around the school by measuring the height and depth of different stairs. Then have them design steps and draw plans that include their measurements.

After they have worked out the problem, but before they present their solutions, play the video showing how other kids solved the problem.

Play

Watch the ways the children on the video solve the problem. The video then asks:



WERE THESE SOLUTIONS LIKE YOURS?

Note: Question is on-screen but there is no stop sign. Teachers should pause at this point and ask each group to present its solution. Encourage your class to think about all the solutions and remind them that there are many possible solutions.

Play

Arbor Day Tree

A class wishes to plant a tree in the school yard for Arbor Day. How will they find out how far from the building to plant the tree?

YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

Use the following questions to help your class respond to this problem.

1. Why do the children need to determine how far from the building to plant the tree?
2. What information will they need to obtain?
3. Where can this information be found?

After we view the solution to the tree-planting problem, the video continues with a sequence showing two girls throwing paper airplanes. They measure how far the planes went by using their shoe lengths. What's the problem here? The video suggests . . .

YOU TRY IT!

EXTENDED ACTIVITIES

These activities are designed to extend the mathematics learning introduced in this lesson.

1. In pairs, practice pacing: place a piece of masking tape on the floor. Take two normal paces, then stop. Use a measuring tape to measure the distance of the two steps. Record this distance on paper. Using steps that are as consistent as possible with the original, together (one child as a recorder using tally marks and one as the pacer) walk from the classroom to the gym, music room, art room, cafeteria, or place of your choice. Determine how many total paces were walked and calculate the distance. Approximately how far do you think you walk in hallways on an average day? In a week?
2. A bad storm blew down a big part of a farmer's fence. Now he has decided to replace all of it. He paced out the distance to get a rough idea of how much barb wire and how many fenceposts he must buy. His farm is a rectangle and he paced off 120 strides along one side and 100 paces along the other. He averages three feet per stride. How much wire should he buy? If he puts in a fencepost every four yards, how many posts must he buy?

Cross-curricular and Writing Activity

Write a story about the space shuttle. You are the pilot and must catch up to a satellite in orbit that is in trouble. You know your shuttle travels at 274 miles per minute. NASA has told you that it will take you two and a half hours to catch the satellite. How many minutes is that? How far will you have to travel?

You Try It At Home

Two handout masters, numbered 5-A and 5-B, are provided in a booklet accompanying the Teacher's Guide; reproduce as many of these as you need. Reduced examples are also provided at the end of this lesson. These activities are designed to extend and reinforce concepts taught in the lesson, and to enable parents or other caregivers to become more involved with students' mathematics learning.

Assessment and Criteria for Scoring

The following four proficiency categories may be used to evaluate student performance in response to Lesson 5. You may use these evaluation categories to assess student classroom performance and extended activity performance.

Advanced Response: The response shows evidence of selecting an appropriate method producing accurate results for devising the fountain steps, and the results are presented clearly and concisely both verbally and graphically (using models, pictures, or drawings).

Proficient Response: The response shows evidence of selecting an appropriate method producing accurate results for devising the fountain steps, and the results are verbally presented in a clear and organized way.

Nearly Proficient Response: The response shows evidence of selecting an appropriate model for devising the fountain steps, but the results are flawed because of some inaccurate applications of the method or the results are not communicated clearly.

Minimal Response: The response shows evidence of attempts to select a method for devising the fountain steps, but the application of the method does not produce any explainable results and/or the explanation is not understandable.

References and Resources

National Council of Teachers of Mathematics (1989) Curriculum and Evaluation Standards for School Mathematics. Reston, VA: The Council.
Standard 1 : Mathematics as Problem Solving.
Standard 2 : Mathematics as Communication.
Standard 3 : Mathematics as Reasoning.
Standard 4 : Mathematical Connections.
Standard 10 : Measurement.
NAEP Strand 2 (Measurement).

Suggested Children's Literature

Rolf Myllar, *How Big Is a Foot*
Marisabina Russo, *The Line Up Book*
Lio Lionni, *Inch By Inch*
Shel Silverstein, *One Inch Tall*; poem found in *Where the Sidewalk Ends*
How Many, How Much; *How to Make a Swing With No Rope or Board or Nails*; poems found in *A Light in the Attic*

You Try It At Home 1 and 2

High, Higher, Highest: Your Height

1. Ask a parent or care-giver your height at birth. Write it here: _____

2. With your parents (or another adult) measure your current height in inches. Write it here: _____ (12 inches = 1 foot)

3. How many inches have you grown since birth? _____

4. What was your average growth per year? _____ How do you know?

Designing Floor Plans

Ask an adult at home or other care-giver to help you with this project.

1. Choose a room in your home and measure each wall. On a piece of unlined paper or grid paper, draw an overhead map of the room, including the wall measurements. You now have a smaller version of the room's perimeter.

2. Measure the furniture in the room. On your map, add the furniture outlines in a different color pen or pencil.

3. Attach your map to this page.

4. Measuring and drawing is a time-consuming process which architects and other designers use daily. How is math used in making a floor plan of a room in your home?