LESSON 9

What Size Do I Need?

Geometry and Measurement

Objectives . . . Students will be able to:

- *Identify and use units of measure for area and volume.*
- *Identify and use estimates of measure.*
- *Visualize spatial relationships.*

NCTM Standards and NAEP Strand

Concepts learned and applied in Lesson 9 correlate to NCTM Standards 1, 2, 3, 4, 5, 9, and 10; and NAEP Strand 3 (Geometry and Spatial Sense).

Materials List

Each Group

- colored construction paper—1 sheet each of 12"X20", 20"X20", and 20"X24"
- fifty 2X2 inch squares of colored construction paper
- rulers

Each Student

- A copy of BLMs 9-A and 9-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 we will be exploring—e.g., If I use a blanket to cover a bed, and the blanket is four feet long and four feet wide but the bed is six feet long and four feet wide, will the blanket cover the area? If I use a 1-cup measuring cup to fill a pint bottle, how many times will I have to fill the measuring cup?

Video Overview

As the video begins, we see a girl trying to fit her coat into her locker—but it doesn't fit; a girl has a large stack of clothes, but they won't all fit in her suitcase; a girl has built a new doghouse, but her dog can't squeeze through the door!

Student Prerequisites

- Familiarity with area.
- Ability to cover a region and determine the number of units needed to cover the region.
- Familiarity with volume.
- Ability to fill a container and determine the amount of material the container will hold.

Key Words and Terms

area	*volume*
covering	*filling*

Video Lesson

Boy Making Popcorn

In this segment, we see a boy making popcorn with a hot-air popper. But he puts in an entire bag of popcorn!

YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

Ask your students to predict what will happen. Will there be too much popcorn? Discuss what the boy should have done to avoid this problem.

As the boy continues, the popcorn spills over and he has far more than he can eat.

Brownie Party

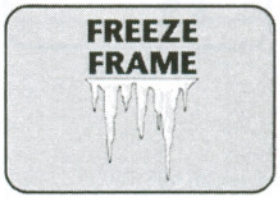
Next, Djuna Coe of Dewey School tells her class that they need to order brownies for 360 students for a school party. Each student will get a 2-inch by 2-inch square brownie. The bakery, however, has three sizes of pans in which brownies are baked. What combinations of pans can be used to get 360 brownies?

YOUR CLASS MAY WANT TO TRY THIS NOW

Divide your class into small groups and provide them with the materials. Using colored construction paper that represents the three different sizes of pans, colored 2X2 inch squares, and a ruler, ask the students to figure out which pans they would use to get 360 brownies. (They may also work with other materials, such as tiles.) Each group should come up with at least two solutions. 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

Kids Collecting Cans

After a game in a stadium, some children are collecting empty cans in a large cardboard box. The box fills quickly, but there are still more cans to collect.

YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

Ask your students what advice they would give to the children that would allow them to collect more cans.

Play

In the next segment, two kids want to make a checkerboard layout on a small round table using post-it notes. Will they fit?

In the final segment, Djuna Coe calls another bakery and asks if they have the size pans her students decided on for the brownies. But the only size they have is 18X20—her class needs to explore this new problem to figure out how they will cope with the new size. The video suggests . . .

YOU TRY IT!

Extended Activities

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

1. Have students make rectangular arrays with 24 square tiles (e.g., color tiles). Working in groups, students can investigate all the possible arrangements of 24 tiles that will make a rectangle. Then they can record their arrangements on 1-inch grid paper. They may also explore the same problem with 30 tiles.
2. Have students use interlocking cubes, sugar cubes, or 1-inch cubes to build a 3-dimensional structure. Limit the number of cubes to 50. After building their 3-D shapes, the students can view each other's structures and estimate the number of cubes used in each.
3. Give each student 27 interlocking cubes or sugar cubes or 1-inch cubes. Ask them to build the most compact and the most expanded structure possible with that number of cubes. Ask them to describe their observations.

Cross-curricular and Writing Activity

Make a class quilt out of paper squares. Have each student choose nine 2X2 inch squares cut from various colors of construction paper. Students can cut the 2X2 squares into triangles, rectangles, or smaller squares. Then each student should arrange their resulting pieces to form a design in the shape of a larger square measuring 6X6 inches. Decide as a class how to assemble all the large squares to form a quilt for display. Discuss the ways quilts were part of the lives of people (past and present) in the United States. Then ask the students to write a story about how quilts and quiltmaking are important.

You Try It At Home

Two handout masters, numbered 9-A and 9-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

These criteria provide a framework for scoring various aspects of the activity and should be shared with students at the beginning of the activity. It is hoped that you will feel free to alter them to meet your needs. Use some or all of them and/or create your own.

Advanced Response: The response includes at least two solutions to the problem. The sketches of the solutions are clear and complete, including labeling. The explanation of the solutions is concise and well organized with attention given to the most logical of the two answers (i.e., this pan would be very difficult to carry).

Proficient Response: The response includes one accurate solution to the problem. The sketch of the solution is clear and complete, including labeling. The explanation of the solution is concise and well organized.

Nearly Proficient Response: The response includes one solution to the problem. Either the sketch of the solution or the explanation of the solution are flawed in some minor way.

Minimal Response: The response includes one attempted solution to the problem. The sketch of the solution contains a major flaw and/or the explanation of the solution is incomplete, unclear, or inaccurate.

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 9 : Geometry and Spatial Sense.
Standard 10 : Measurement.
NAEP Strand 3 (Geometry and Spatial Sense).

Suggested Children's Literature

Rod Clement, *Counting on Frank*
Ann Grifalconi, *The Village of Round and Square Houses*
Anne Laurin, *Little Things*
Jane Jonas Srivastava, *Area*

You Try It At Home 1 and 2

Cover Up

How many boxes does it take to cover a table? Ask an adult at home or other care-giver to help you with the following project.

1. Find a box, for instance, a shoe box, a Jello box, a cereal box, etc.

2. Estimate how many of these boxes it will take to cover a table in your home.
   Write your estimate here: _____

3. Determine how many boxes are needed to cover the table.
   Write your answer here: _____

4. Explain how you got your answer in the space below. Use words and pictures.

Piece of Cake!

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

1. Find a rectangular baking pan at home. Imagine that you've baked a cake that fills it completely.

2. Measure its dimensions and write them here: _____ length and _____width

3. Determine how many 2x2 inch square pieces of cake could be cut from this pan.
   Write your answer here: _____

4. In the space below, tell how you know that this is the greatest number of pieces you could cut. Is there any cake left over?