AREA AND VOLUME OF THINGS TO COME

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GRADES: 3 - 5

OVERVIEW

This lesson will provide students with an understanding of the difference between surface area and volume of rectangular prisms. It will also provide students with an understanding of how these mathematical concepts are used in our real world. The activities included provides for manipulation of materials and for the discovery of formulas used to calculate area and volume.

ETV SERIES

Math Talk #112: Scoping Out the Area

LEARNING OBJECTIVES

Students will be able to:

- *Calculate and record surface area and volume of rectangular prisms using standard and nonstandard measure.
- *Using the formula "length times width," find the area of rectangular prisms.
- *Calculate the volume by using the formula "length x width x height" of rectangular prisms.

MATERIALS

(per class)
Different size boxes(3 or 4 boxes)
A ruler for each student
5 yard sticks
(Per group of 4)
Data recording sheet
Grid sheets of 1 inch squares
Facsimile of manufacturer's pattern. (provided at end of lesson)
Cubical counting blocks (25 per group of 4)
Tissue box
Juice pack
Chalkboard eraser

VOCABULARY

Area--The number of square units needed to cover a region or figure.

Volume--The number of cubic units that fit inside a 3-dimensional figure.

Rectangle --A parallelogram (opposite sides are parallel) with four right angles.

Each pair of opposite angles are congruent.

Length --The measurement of distance between two endpoints.

Width--The measure of something from side to side.

Congruent--Same size, same shape.

PRE-VIEWING ACTIVITIES

Begin the lesson by introducing the surface area and volume of a rectangular prism. You are building background knowledge by distinguishing between the two. Place an outline of a rectangle on the overhead projector. Ask students, "What shape do you see on the overhead?" (Wait for their response-reach an agreement.) Scatter one inch squares around the rectangle. Ask students, "How many paper squares will it take to cover the inside of this shape?" (Answers will vary) Randomly call one child to come to the overhead projector to fill the rectangle with one inch squares. After child finishes, the teacher says, "Today you will learn how to find the area of rectangular shapes. The area or the number of square units needed to cover this figure on the overhead projector is_____, depending on the size rectangle you used." Tell the students that they can find the area of a shape by placing equal sized squares into the shape and counting the number of squares it takes to completely fill the shape. Ask the students "How many squares did it take to go across the top?" "How many squares did it take to go down the side?" "How many squares were used in all?" Have students work in cooperative groups of 4 continuing with this exercise with various sized rectangles, filling each with one inch squares, and recording on the data sheet how many squares were needed to go across the top, down the side, and the number of squares used in all. The purpose of this activity is to enable students to discover the formula for finding the area of a rectangle. (Length x Width) The teacher should continue with several examples until a majority of the students have discovered the formula.

After students have discovered how to find the area of a rectangle and other shapes (with practice) present to them a chart picturing a cubic unit, (1 unit by 1 unit by 1 unit) a cubic centimeter, (1cm by 1cm by 1 cm) and a cubic inch (1 in by 1 in by 1 in). Identify the pictures. Have students speculate on what is meant by volume. Tell the students that volume is the measure of what it takes to fill a 3-dimensional figure. Encourage students to suggest possible ways of measuring volume. Have students identify the dimensions. Encourage the students to take the prism model apart, layer by layer and count the cubes in each layer.

Students can continue to explore volume by working in cooperative groups of 4 to build rectangular prisms with cubes. Allow students to use small rectangular prisms, such as a tissue box, a juice pack, or a chalkboard eraser. Students estimate the number of cubes it would take to build each rectangular prism, then use cubes to build a prism approximately equal in size to the object. Record on the data sheet the dimensions of each prism and the total number of cubes used. Ask students, "What relationship do you see between the total number of cubes in a prism and the length, width and height?" Students should and will realize that the total number of cubes is the product of the length times width times height. Point out to the students that you can find the volume of a rectangular prism by counting cubes or by using the formula: Volume=LxWxH

FOCUS FOR VIEWING

To give learners a specific responsibility for viewing, say, "Now we're going to see a video that explains area and volume. As you watch, listen for other ways of looking at rectangles to find the total area."

VIEWING ACTIVITIES

Begin the video *Math Talk #112* with segment "Daddy Knows Different." **Pause** when "Daddy Knows Different" appears again on the screen, music sounds and "Daddy Knows Different" is spoken. Ask the students, "How did the son figure the area of his lawn since the lawn was so unusually shaped?" (He divided the unusual shaped lawn into three rectangles.) Ask the students "What formula did he use to find the area of each one of the three rectangles?"(He used the formula, LxW equals area.) Ask students, "What process was used to calculate the total area of the three rectangles?" (The process of addition was used to put all three rectangles together to get a total area of the lawn) **Resume** video. **Stop** video when video says, "I'm starting to understand this business." Ask students, "Does dividing a rectangle differently provide for a greater area?" (No)

Ask students, "Does the shape of the figure mean that the area is bigger or smaller?" (No)

Ask students, "How can you be sure that shapes have the same area?" (the only way to be sure that shapes have the same area is to measure.)

POST-VIEWING ACTIVITIES

(cooperative groups of 4)

Say, "Now that we have learned about area and volume, it is time for you to explore area and volume on your own as you will create a new and innovative package for a product that has not hit the market yet. I will provide for you a pattern you may use or you may design your own pattern. Use construction paper to make the actual box. Find the surface area and volume of the package. Design, draw and color the front panel for the new product."

ACTION PLAN

Have students write several manufacturers and inquire how they use area and volume in their packaging of goods.

EXTENSIONS

Literature

Have students read The Pueblo by Charlotte and David Yue. This book describes how the Pueblo builders of the American Southwest made walls 7 or 8 feet high and 12 to 20 inches thick.

Language Arts (Oral Presentation)

Have the students use an illustration of their own or a commercially prepared chart to explain the formula for finding the area and volume. Provide students the criteria for the presentation before hand.

Social Studies

Brainstorm real life careers and experiences that involve measurement on a daily basis. Invite speakers from those various careers to speak to the class for a discussion of how measurement is used. (especially area and volume) Have students use an Atlas or Almanac to find the area in square miles for the population of their city. They can then divide to find the number of people per unit area, (square mile)

Science

Have students compare. Which will hold more? Show or draw different containers. Have students decide which will hold more. Record their decisions. Experiment to find out if their quick guesses (hypothesis) were correct. Use the Scientific Method to experiment.