Volumes of Play Dough Shapes

Summary

Students will create rectangular and triangular prisms with a given volume of play dough, discovering the properties and attributes of these solids (number of edges, faces, and vertices as well as the types of faces), reviewing Standard 3 objective 1. Then, by measuring and experimenting with various possible formulas, students will determine the volume of a right prism with either a rectangular or triangular base.

Materials

15oz. can of Play Doh (100 cm3) for each student or pair of students
1 plastic knife for each student
1 metric ruler for each student
1 Calculator for each student (optional)

Books:

- *Mummy Math: An Adventure in Geometry*
, by Cindy Neuschwander; ISBN: 1397808050 75052

Background for Teachers

When students calculate the volume of right rectangular prisms by multiplying length x width x height, they often fail to discover the universal formula of the volume of a right prism that is B (meaning area of the base) x H (meaning height of the prism). Teaching this formula instead, or in addition, prepares students to apply the volume of a right rectangular prism to the volume of a right triangular prism, which is also B x H. This lesson begins by reviewing the properties and attributes of right prisms and then allows students to measure and discover the universal formula for volume of right prisms.

Intended Learning Outcomes

Develop a positive learning attitude toward mathematics.
Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.
Reason logically, using inductive and deductive strategies and justify conclusions
Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.

Instructional Procedures

Invitation to Learn:

Give each student, or pair of students, one 5 oz. can of Play Doh equal to 100 cm3 and a plastic knife. (The 5 oz. can may contain slightly more than 100 cm 3. If you have time, you may wish to cut about ½ cm. from each cylinder of Play Doh, making it slightly less than 6 cm. tall.) Ask students each to each make a right rectangular prism, using all the play dough. Review exactly what a right rectangular prism is, recognizing that there are many possible dimensions that can fit the definition. Each prism must have two rectangular bases and sides that join at right angles. Discover that the side faces are also rectangles. Discover that there are 6 total faces, all rectangles. Discuss that the bases or side faces or both may also be squares, since squares are special rectangles. Review the vocabulary of solid figures (edges, vertices, faces) so students are conversant with these terms.

Ask students to now make a right triangular prism with all their play dough. Review the meaning of this term: A right triangular prism has two triangular bases with side faces that join at right

angles. There are three side faces, all rectangles. Determine the three types of triangular prisms: scalene, isosceles and equilateral. Determine the differences in side faces of these three varieties; scalene triangular prisms have three different sized rectangular faces, isosceles triangular prisms have two congruent rectangle faces, and equilateral triangle prisms have three congruent rectangle faces.

Instructional Procedures:

Review the definition of volume: the quantity of samesized units that can fill the space without gaps or overlaps. Announce that today we are measuring in cubic centimeters, a unit that is a cube that is one centimeter long, wide and high. Tell students that they each have 100 cubic centimeters of play dough, so they know that their shape has a volume of 100 cubic centimeters. Tell students that they are going to analyze their triangular prism shapes to find a formula that will give them a total of 100 cubic centimeters for the volume. Ask what they could measure to come up with this total volume. Lead them to the definitions of the base (area of the base of the prism, which in a triangle is ½ b x h) and height (of the prism). Give the group time for measuring and determining a formula. When groups have experimented, have them present their ideas on chart paper to the class. Direct the discussion to discover the formula for volume of a right triangular prism: B (area of the base) x H (height of the prism). Help them recognize the difference between h (height of the base) and H (height of the prism).

Have students all measure their prisms with metric rulers to see if they can come up with a number close to 100 cubic centimeters, proving this formula. (Note: At this point, you have to make an executive decision. Do you want students to use calculators to multiply more precisely if they are not fluent with multiplying decimals yet? Do you want them to round to whole centimeters, knowing that their answers will be approximations? Do you want them to multiply with decimals on paper, practicing their calculations but slowing down the lesson)?

Ask students if they think this formula will work for right prisms with bases that are not triangles. Have them reconstruct their right rectangular prisms, reviewing the formula. Have students measure the area of their bases and then multiply this amount by the height of their prisms. Their total should be close to 100, depending on how accurate their measurement and method of multiplication.

Discuss that this formula is why students measure the volume of a right rectangular prism as length x width x height, because length x width = the area of the base. Determine that this formula will work for all right prisms; students just need to know how to calculate the area of the base and the dimension of the height.

Lesson and Activity Time Schedule:

The Invitation to Learn may take approximately 30 minutes.
The activity may take approximately 60 minutes.
The total lesson and activity time is 90 minutes.

Extensions

Students may also calculate surface area of the shapes they construct.

Students may compare surface area with volume of a variety of right prisms, determining which shapes have a greater difference in surface area and volume and which are more similar.

Research shapes of containers of one type of item at the grocery store, like ice cream or cereal, recording the volumes of each. Determine if some shapes are misleading for their volume, or if some shapes are particularly efficient for storage or display.

Family Connections:

Students may continue this lesson at home by making play dough and constructing a shape to measure and calculate the volume. A letter to parents (pdf) including a play dough recipe is included at the end of this lesson.

Assessment Plan

Students may be given a different volume of play dough and asked to construct a right rectangular prism and a right triangular prism, measuring the area of the bases and the height of the prism and calculating the volume.

Traditional worksheet tests with pictures of prisms and the dimensions given that ask students to calculate volume are accurate assessment procedures after the concrete, manipulative activities have helped develop understanding.

Authors

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