Candies R Us

Summary

An activity creating boxes for candy helps students understand measuring volume and surface area.

Main Core Tie

Mathematics Grade 6

Strand: GEOMETRY (6.G) Standard 6.G.4

Group Size

Small Groups

Materials

- *Net 1*
- *Net 2*

Scissors
Tape
Two-cm graph paper
Multilink cubes

- *Candies R Us Box Designs*
- *Mixed-Up Pieces*

Additional Resources
Books
Navigating through Measurement in Grades 3-5, by NCTM; ISBN 0-87353-544-8
Math on Call, A Mathematics Handbook, by Great Source Education Group; ISBN 0-669-45770-1

Background for Teachers

In this activity, students will be working with nets to determine the surface area of various boxes. A net is a two-dimensional pattern that can be folded to make a three-dimensional model of a solid, and is an excellent visualization for surface area. Surface area represents the number of squares that cover the surface of a prism. The formula for surface area of a rectangular prism is: SA = 2(l x w) + 2(l x h) + 2(w x h). Students should already know how to find the area of two- dimensional figures and the volume of three-dimensional figures.

Intended Learning Outcomes

4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Instructional Procedures

Invitation to Learn
Give groups of students copies of *Net 1* and *Net 2*. Show them how to make the nets into boxes. Ask your students how the boxes are alike (volume is the same). Ask them how the boxes are different (different shapes). Ask them what the dimensions are for each box. Have them cut the tape and unfold the boxes. Have the students find the surface area for each net. Point out that although the boxes had the same volume, the surface area is not the same.
Instructional Procedures

Put students into pairs (or groups).
Tell students that the box company where they work just got a new contract from The Candies R Us Candy Company. Their new assignment is to design boxes with lids that will hold 12 of their chocolate candies.
Hold up a multilink cube and tell them that the chocolate candies have the same dimensions as the cube.
Explain to your class that the volume of the boxes are fixed at twelve, since that is how many chocolate candies the company wants in each box.
Tell students that their job is to review all of the possible rectangular boxes with a volume of twelve, and then prepare a presentation to the owners of Candies R Us. Their presentation needs to include a model of the box, and the reasons for choosing that box.
Ask students what they think the owners of the candy company would want in a box. Brainstorm ideas. (They might want a box that is easy to ship, convenient to stack and store, and profitable). Ask them: What would make a box profitable? (You might want to remind them about the Invitation to Learn, but do not tell them about the connection between surface area and the amount of material needed to make the box. Hopefully, if they don't think about it yet, they will discover it as they do the activity.)
Give each pair of students twelve multilink cubes and several sheets of two-cm graph paper.
Hand out the worksheet *Candies R Us Box Designs* .
Have students discover all of the possible boxes that would hold twelve chocolate candies (there are four possible choices).
Have them create a net for each of the boxes. Remind them that the paper should not overlap.
Have the students fill in the chart on the *Candies R Us Box Designs* worksheet. You may need to demonstrate the data for one box so they understand how to organize the information.
Ask students if they notice any patterns in the data on their charts (same volume, V = l x w x h, dimensions are all factors of twelve).
Have pairs decide which box they think is best, and discuss the reasons behind that choice.
Have the pairs make their presentation to the class. They need to show a model of the box that they would recommend and talk about the reasons that box would be the best option for the candy company.
Discuss the results of the activity. What do we call the measure of the number of multilink cubes that a box will hold? (Volume) What was the volume of the boxes you made for Candies R Us? (Twelve) Did the volume change from box to box? (No) What units do we use to measure volume? (Cubic units) Why? (Because volume is a three-dimensional measurement.) Was there a box that more pairs recommended? Why? (This should lead to a discussion on surface area.)
Explain to your students that the net they made for each box represents the surface area of the box, or the amount of material needed to cover the box. Ask them if they noticed a general rule for finding the surface area of any box (It is the sum of the areas of each face of the box.) What units do we use to measure surface area? (Square units) Why? (Because area is a two-dimensional measurement.) The volume stayed the same for each box, but what happened to the surface area? When might you want to find the surface area of something?
Come up with a formula for finding surface area of a right rectangular prism. SA = 2(l x w) + 2(l x h) + 2(w x h).
Have students draw a net in their journal and explain what it represents (the surface area of a rectangular prism). Have them write a summary of their findings from the activity. Have them explain how to find the surface area of a right rectangular prism.
Have students complete the assessment *Mixed-Up Pieces*.

Extensions

Curriculum Extensions/Adaptations/ Integration

Find the area of other right prisms by using the area of triangles, rectangles and parallelograms.
Create advertisements for boxes. Use poster board to cover the surface area and decorate the box.
Create boxes to hold 18 chocolate candies.
Write a letter to owners of Candies R Us outlining their recommendations and enclosing the net from their box of choice. Have the students discuss the box's surface area and volume and the reasons behind choosing that box. Tell students to make their letter convincing, so the owners will choose their box.

Family Connections

With a family member, find the surface area of a cereal box or other box from home.
Wrap a present from home without any overlap. Measure how much wrapping paper was needed to cover the surface area of the box.

Assessment Plan

Informal assessment includes observation and class discussions

- *Candies R Us Box Designs*
  Presentation -- model of box, reasons behind choice, discuss volume and surface area
- *Mixed-Up Pieces*

Bibliography

Research Basis

Reid, J. (1992). The effects of Cooperative Learning with Intergroup Competition on the Math Achievement of Seventh Grade Students. ERIC Source (ERIC # ED355106). Retrieved November 28, 2007, from www.eric.ed.gov.

This paper reports a study designed to determine the effect of cooperative learning strategies on mathematics achievement in seventh graders. Students were divided into two groups. One group participated in cooperative learning strategies, and the other group received individual/competitive instruction. Pre-tests indicated no differences existed in the groups prior to instruction, but that the cooperative learning groups performed significantly higher on the post- test. The paper concluded that cooperative learning strategies are more effective in promoting mathematics achievement.

Reineke, J.W. (1993). Making Connections: Talking and Learning in a Fourth-Grade Class. Elementary Subjects Center, Series No. 89. Eric Source (ERIC # ED365537). Retrieved December 10, 2007, from eric.ed.gov.

This report describes a fourth grade classroom where students' thinking was made public through discussions in which students presented and justified their interpretations of, and solutions to, the problems presented in class. Results suggested that the teacher and her students learned to talk about mathematics in ways that made their thinking visible and indicated that they know mathematics in fresh, inventive ways.

Authors

Utah LessonPlans