## Insides and Outsides

## Summary

This activity will teach the basics of surface area and volume.
Materials
Invitation to Learn
Cubes

- Chart Paper

The Great Cover Up

- $X / Y$-axis Dry Erase Mats
- Key Graphing Cling

Pre-made rectangular prisms
Rectangular prism net patterns
Markers
Cubes

- The Great Cover Up (pdf) Graph paper
Cut it Out!
Graph paper
Cubes
Scissors
Tape
- Cut it Out (pdf)

Additional Resources
Books
Math Dictionary-The Easy, Simple, Fun Guide to Help Math Phobics Become Math Lovers, by Eula
Ewing Monroe; ISBN 978-1-59078-413-6

## Background for Teachers

In order for students to visualize and determine surface area and volume of three-dimensional shapes, it is important to manipulate actual objects. They must also have experience with the concepts of area, nets and rectangular prisms prior to the introduction of this standard and objective (Standard IV Objective 2). When talking about area, we are referring the measurement of a twodimensional shape. When talking about surface area, we are referring to the measurement of a threedimensional shape.
The surface area of a prism is the sum of the areas of all the faces, including the bases. The surface area is measured in square units. Although the students may not be familiar with this concept, they have actually experienced it as they've worked with nets. Surface area takes nets one step further by determining actual measurements. The purpose of this lesson is to help the students make this connection. The mathematical formula for surface area is:
$S A=2(I \cdot w)+2(I \cdot h)+2(w \cdot h)$
The actual formula for surface area involves using length, width and height, at this level. Having the students find the area of each face and then adding them together as square units to find the total will be less confusing for fifth graders.
The volume of a prism tells how many cubic units it takes to fill the prism. Volume is measured in cubic units. The mathematical formula for volume is:
$\mathrm{V}=\mathrm{I} \cdot \mathrm{w} \cdot \mathrm{h}$

## Extensions

- Prism Race (pdf)

Challenge students to find out how many different rectangular prisms they can make with a volume of 36 cubes. Encourage them to think of ways to make sure they have made all possible prisms.
Challenge students to make as many prisms as possible with the same surface area. Have them record the volumes of their solids and note any patterns.
Art: Draw three-dimensional rectangular prisms on isometric dot paper.
Design a net that can be folded into a rectangular prism that can hold 24 Multilink cubes.
Family Connections
Have students find at least five rectangular prisms from household items. Have them measure the length, height, and width of each item. Record the measurements in their math journals, and then find the volume and surface area of each of the items.

## Assessment Plan

Informal assessment includes class discussion, math journals and observation of group/partner work.

- The Great Cover Up
- Cut it Out
- Birthday Boxes


## Bibliography

Sowel, E.J. (1989). Effects of manipulative materials in mathematics instruction. Journal for research in mathematics education, 20 (4), 498-505.
This review of research sums up the result of sixty studies addressing the effectiveness of manipulatives on student learning and attitudes in mathematics teaching. Sowell concludes that the more concrete the manipulatives, and the longer the time spent using them, the better instructional outcomes.
Hinzman, K.P. (1997). Use of manipulatives in mathematics at the middle school level and their effects on students' grades and attitudes. ERIC Source (ERIC \# ED411150). Retrieved December 10, 2006, from http://www.eric.ed.gov
This paper reports on a study that examines mathematical scores when hands on manipulatives and group activities were used in the classroom. Results indicate that student performance was enhanced by the use of manipulative materials; and students' attitudes toward mathematics were significantly more positive than those in previous years when manipulatives were not used.

## Authors

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