

Topics: Spatial Skills,
Volume, Measurement

Materials List

- ✓ Building blocks, centimeter cubes, or other uniform building materials (150 pieces, minimum)

This activity can be used to teach:

- Measure volume and solve problems involving volume (Common Core Math Standards: Grade 5, Measurement & Data, 3-5; Geometry, Grade 6, 2; Grade 7, .6; Grade 8, 9)
- Ratios and proportions (Common Core Math Standards: Grade 7, Ratios and Proportional Relationships, 2)
- Science & Engineering Practices (Next Generation Science Standards: Grades 4-8)

Building it Bigger

What Happens When Dimensions are Doubled?



Explore how scale affects volume in this hands-on, pyramid building activity.

To Do and Notice

1. Use centimeter cubes to build a pyramid with a square base 3 blocks long, a second layer 2 cubes by 2 cubes, and a top layer with 1 cube (total cubes = 14).
2. Count the number of cubes used to build the pyramid.
3. Estimate the number of cubes needed to build a pyramid exactly the same shape, but twice as big (twice the base length, twice the height).
4. Build the pyramid with twice the dimensions and count the cubes used. Compare the actual to the estimate. Be sure to recreate the shape **exactly**! Did the larger pyramid require more building material that anticipated?
5. Optional Extensions:
 - Do other shapes illustrate the same volume relationship when their sizes are doubled?
 - What if the dimensions were tripled?

The Content Behind the Activity

Volume is the measurement of the amount of space taken up by an object. The metric unit for measuring volume is the liter, defined by the space taken up by a 10 cm cube. There are 1000 milliliters (ml) in every liter (l). 1 milliliter can also be expressed as 1 cubic centimeter (cm^3 or cc).

We live in 3-dimensional space. When measuring or building in 3-dimensions, people need to remember the magic word “cubed”. Many students will assume that if an object’s dimensions are doubled, the new shape will require twice the building material. Some students confuse volume with area and believe the new shape will require 4 times the material (the multiplier squared.) The test results, however, surprise most students: a pyramid twice as large will require 8 times the material (i.e. – the multiplier cubed, $2 \times 2 \times 2 = 8$). (Note: If students do not build **exactly** the same shape, the number of required cubes will be different.) Making an even larger pyramid yields even more surprising results:

Original Pyramid (# of cubes)	Multiplier (A shape “X” times larger)	Do the math	Number of Required Cubes
14	2	$2 \times 2 \times 2$	$8 \times 14 = \mathbf{112}$
14	3	$3 \times 3 \times 3$	$27 \times 14 = \mathbf{378}$
14	8	$8 \times 8 \times 8$	$512 \times 14 = \mathbf{7,168}$

Taking it Further

For other activities relating to volume, see the RAFT Idea Sheets *The Long and the Short of It*, *Chewed Food*, and *Taking Up Space*.

Web Resources (Visit www.raft.net/raft-idea?isid=15 for more resources!)

- Teacher designed math courses from NJCTL – <https://njctl.org/courses/math>