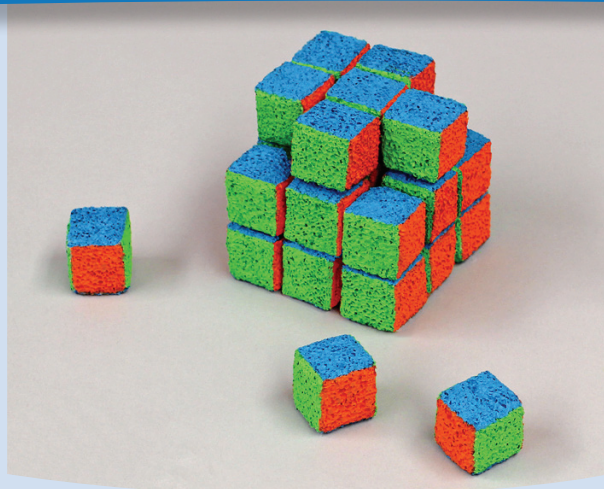


Hands-On Volume

MATERIALS

FOR STUDENT:
(one per group of three students unless otherwise noted)

- FloraCraft® Make It: Fun® Foam, twenty-seven 1" cubes (approx.) cut from large Foam Block (see FOR TEACHER)
- Pencil
- Cardboard, 4" x 8" (to help stack cubes)
- Paintbrushes, three, medium 1/2" wide chisel
- Paper plates, three large and three small
- Paper towels, three
- Ziploc bag
- Paint apron per student



FOR TEACHER:

- FloraCraft® Make It: Fun® Foam Block, 15/16" x 11 15/16 x 17 15/16" (approx. 12" x 18" x 1" thick) (can get 216 cubes per block, which is enough for eight groups of three students)
- Acrylic paint: Sour Apple (green), Turquoise Blue, and Bright Orange (and any additional paint color choices you want to offer)
- Serrated knife
- Pencil
- Ruler
- Permanent black marker
- Cutting mat or stack of newspapers
- Old newspapers or plastic tablecloth (optional)
- Plastic-lined garbage can
- Paper towels
- Squeeze bottle of water
- Bucket of water
- Wet wipes
- Drying area

TEACHER PREPARATION

Note: Read through all instructions first and check out the TIPS! Plan the timing of the three sessions. You may be tempted to skip having the students compress the edges of the foam blocks, but the reason for doing so, is to strengthen them for use. It is also recommended that you paint one, yourself, since that might affect how you prepare.

[1] Use a ruler and pencil to measure and make small marks as ruler guides for 1" wide strips on the foam block. Be very accurate. (Pencil will show on foam if you go over the mark a couple of times. However it's not necessary to draw the entire line – just measure and mark in a couple of places as a guide for placing the ruler.) Then, on a cutting mat or stack of newspapers, use a serrated knife against the edge of the ruler to cut the foam block, with several passes of the knife for each cut. Cut very accurately. Then, cut strips into twenty-seven 1" cubes for each group.

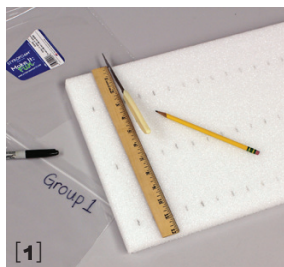
Also use permanent marker to write each group name on a plastic bag.

[2] Count out twenty-seven foam cubes per group's bag. Test compressing the foam so that you can explain to students (as well as leave one example, for them to see, in each plastic bag). Place the foam cube edge on the table and press down, rocking it back and forth a little. Then rotate the cube to

the next edge, pressing it down and gently rocking. Continue rotating until all four edges have been compressed. Turn the cube a quarter turn and compress those four edges, as well. Last, turn the cube again and compress the last four edges (for a total of twelve edges.) Make the cube edges slightly rounded but don't press so hard that their flat surfaces become rounded and then won't set flat on the table.

[3] Select three colors of acrylic paint (and additional options for students to choose, if desired).

[4] Cut one 4" x 8" piece of cardboard per group and set aside to use after the project is finished. Before students arrive, place in each group's work area, the bag of foam cubes and pencil along with three of each: Large plates, small plates, paper towels and brushes. Wait until after they have compressed the foam cubes to pour out the paint.



MATH

GRADE LEVEL
FOURTH – FIFTH

COMPLETION TIME

- 45 minute session
 - 30 minute session
 - 30 minute session
- (2 hours minimum drying time after each session)



OBJECTIVES

Students learn:

- The definition of volume
- How to calculate the volume of three dimensional items
- Understand how volume relates to addition and multiplication

STANDARDS

- Geometric measurement: Understand concepts of volume
- Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume

LESSON INTRODUCTION

- After going over the lesson on volume, explain to students that sometimes it's easier to understand if they have actual cubes to stack, add, and multiply. Let them know that they will be able to work in groups of three to create a set of twenty-seven cubes. Ask them to form groups and have the group collectively choose the three colors they'd like to paint their cubes.



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INSTRUCTIONS

[1] Ask the students to get into groups of three and to divide their foam cubes, into nine per student to put onto each of their large paper plates. Have them find the one compressed foam cube sample that you did for them as a sample. Demonstrate and have students compress the edges of their foam cubes (as described in TEACHER PREPARATION, Step 2).

[2] Have students put on their aprons and roll up their sleeves, letting them know that this paint will not wash out of clothes. Ask them to use the pencil to put their group name on each of their plates. Then have them discuss and decide on the three colors they would like to paint all of their cubes. You can squeeze those colors onto their three small plates.

[3] Explain that each student should select one color to paint on their nine foam cubes during this session. In the second session, they can paint their cubes a second color and in the third session, they can paint the third color.

Demonstrate how to pinch a foam cube in one hand while painting one side. Show how to neatly run a bead of paint from the side of the brush, along the edge, not the end of the brush, which tends to look wispy and doesn't allow for a neat line. Since the edges are slightly rounded, ask them to find the middle of the edge, knowing that the other colors will be meeting their color.

Then, rotate the foam cube to paint the opposite side and set it down onto the large plate.

Have students paint their first color on their nine cubes.

[4] As students paint, squeeze more paint onto their plates and distribute wet wipes as needed. When they are finished, collect the brushes and put them into the bucket of water (until after class when they can be washed out). Have them put both their large plate of foam cubes and small plate of paint into the drying area to use at the next session.

SESSION TWO

[5] Repeat session one, with students painting two opposite sides in a different color on each of their nine cubes. Then clean up, saving the paint plates.

SESSION THREE

[6] Repeat previous painting sessions, with students painting the last two opposite sides in the third color on each of their nine cubes

[7] When dry, show students how to use the foam cubes, by stacking them with the same color up and on the sides on all cubes. Distribute a cardboard piece to each group and have students fold it in half. Then, show them how to use it to straighten the stack of foam cubes by pulling it against the back and one side of the stack. Students can start calculating volume by multiplying length x width x depth of various size stacks. Store the cubes in the plastic bags.



MODIFICATIONS

To simplify project:

- With small groups of students, spray paint the foam cubes in the three colors (out doors on newspapers).
- Pre-compress foam cubes so that they are ready to go.
- Wrap two four-paneled paper strips around each cube and glue.

To expand project:

- Have students combine cubes to build larger structures and calculate the volume.
- Before painting, diagonally cut foam cubes to create half blocks that can be used to calculate irregular sides. (Use toothpick halves to join them into the shapes.)

For multiple ages:

- Younger and older students can work side-by-side, making their own cubes, and use them to solve math problems on different levels. (Younger students can do addition and subtraction, while the older students work with multiplication and volume.)
- Younger students can paint the first color and older students can paint the second and third colors, that can "clean up" the edges, as needed.

ADDITIONAL IDEAS

- Use the colors of the cubes to assign different values depending on the color that is showing on top.
- Store them in clear acrylic boxes so that the colors show.
- Attach stickers to them to assign values or sizes to use in calculating.
- Connect with toothpicks to create colorful, abstract sculptures.



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TIPS

- When cutting foam, keep the blade perpendicular to the table so that the foam edges are straight. Score lightly first and then press more firmly to cut deeper, with several passes of the knife.
- When cutting foam strips into 1" cubes, be accurate in measuring. Then, carefully hold down the foam (on both sides of the cut) as you saw back and forth, with the serrated knife. If you just press down, the foam can snap apart, instead of making a clean break.
- Prepare the painting area, covering tables if needed. Allow for plenty of space for each student. Have large plastic-lined garbage can ready.
- If the acrylic paint seems too thick, walk around with a squeeze bottle (not a squirt bottle) of water and put a few drops of water on each student's puddle of paint. Or, if you know it in advance, add a little water to the paint in the container and shake well, to thin the paint to the consistency of cream. This will go down into the pores of the foam more easily.
- Have paper towels ready to distribute to any messy fingers.



REFERENCES

Perimeter, Area, And Volume by David Adler
The Great Pyramid Of Giza by Janey Levy
Famous Bridges Of The World by Yolonda Maxwell
The Sacred Geometry Of The Great Pyramid by Ernest F. Pecci