Volume and Capacity
4th Grade
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Note: this lesson is intended to be part of the length and area lesson, and can be appended to it.

References:

- 2003-04 Columbus Public Schools Science SLC Guide

Benchmarks:

SLC 3: Students will compare the mass, dimensions, and volume of familiar objects in standard and non-standard units.

Objectives:

Students will compare relationships in units of metric measurements between metric measured objects and select the appropriate unit of measurement for the objects.

Materials:

- Rulers with cm and inches
- Measurement worksheets
- 1 cm x 1 cm x 1 cm blocks
- Overhead projector
- Transparency of worksheet (unable to locate)

Initial Demonstration:

Remind students that last time you discussed measuring and used rulers to figure out how long things were. Tell the students that today you are going to use a different method to measure things. Show them the 1 cm³ blocks and then pass them out [it is best if each students has 18 of them]. Have the students measure the cubes to determine their size.

Target Observations:

- The cubes are 1 cm x 1 cm by 1 cm.

Target Model:

- The cubes can be used to measure lengths and areas of other objects.
**Procedure:**

Pass out the worksheet. Have the students use the blocks to fill in the shapes drawn on page 2 of the worksheet. Instruct them to pay attention to how many blocks the sheet tells them to stack b/c now we are concerned about the space filled in 3 dimensions, not just one or two.

Go over the various lengths that the students measured. If they measured incorrectly, have them go back and try again. Add to this description of the measurement the term “cubed.” Tell them that the term cubed tells you that you describing volume as opposed to a length or an area. The students should be able to grasp this fairly quickly b/c the cube is indeed a cube. Make sure that each student includes the term “centimeters cubed” as part of their numerical answer.

Use the transparency on the overhead to do this. This makes it easy for you to show the students how to measure using the blocks and to correct incorrect measures as a whole rather than individually. You may need to remind them that they need to stack the cubes.

Show the students that instead of counting all the cubes, if the object is a regular polygon [e.g a square or a rectangle] they can measure the three dimensions [length, width, height] and multiply. Do this by asking any of the students if they found a “shortcut” [a student will usually volunteer this information to you before you even get this far].

**Target Observations:**

- A unit of volume/capacity is the cubic centimeter.

**Target Revised Model:**

- Some rectangular objects’ volumes can be calculated by multiplying the length, width and height in centimeters.

**Procedure:**

Show the students three graduated containers of water. 1) that is large [e.g. a 600 ml beaker] 2) middle sized [140 ml beaker] 3) a tall skinny one [graduated cylinder]. The beakers should have a water level that is visually in order from 3-2-1, the actual volume in the containers should be exactly the opposite. [i.e. the volume should be inverse to the apparent height].

Make sure that the graduations are in ml. Ask the students to vote on which has the most water. Then pour the water from each container into three exactly similar containers so that the students can see the results.
Discuss how when determining the volume of a liquid or capacity of a container, you must take both the height and width.

Tell them that the cube represents one ml. Show them how small a volume this is by putting it in a 2L bottle to give them a sense of the scale of this measurement.

**Target Observations:**

- A mL is another unit of volume. 1 mL = 1 cm$^3$.
- Appearances can be deceiving.

**Target Revised Model:**

- Some types of materials do not hold shapes [liquids] and cannot be measured with blocks.
- These need to be measured in beakers and graduated cylinders.

**Summary:**

Students have been introduced to the concept of volume and capacity. They have learned to measure regularly shaped objects with 1 cm$^3$ blocks, and that some irregular shapes might have to be measured with liquid. The students have learned about the units used to describe volume. They should feel comfortable making these kind of measurements on their own.