How Much Does it Hold?

Strand: Measurement and Geometry

Topic: Measuring and comparing volume using nonstandard units

Primary SOL: 1.10 The student will use nonstandard units to measure and compare length, weight and volume.

Related SOL: 1.2b, 1.4a, 1.4b

Materials

- Chart paper with table predrawn (sample attached)
- Tall and skinny container
- Short and fat container
- Cubes (approximately ¾" – can be wooden or plastic connecting cubes)
- Ping pong balls (or marbles)
- Small plastic cup
- Large tub of water (or rice or sand)
- Various sized containers to be used at stations
- Marbles, ping pong balls, cubes, pom-poms, etc., to use as units of volume
- Various small cups that can be used as units of volume

Vocabulary

container, equal, equivalent, fill, greater, less, more, unit, volume

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Introduce the lesson by showing students a tall and skinny container and a short and fat container. Also show them the cubes that will be used as a unit of volume.
2. Give each student the opportunity to predict which container will hold the most cubes. Indicate the students' predictions with tally marks on a chart showing the outlines of the two containers. Explain that when you are thinking about how much a container holds, you are thinking about its *volume*.
3. Measure the volume of the tall and skinny container by filling it with the cubes. Count the cubes with the students. On the chart that you have prepared ahead of time, write the number of cubes. Measure the volume of the short and fat container with the cubes and write the number of cubes on the chart. Ask students, "*Who can use a sentence to tell me which holds more or less?*" Guide students to respond, "*The tall and skinny container holds less than the short and fat container or the volume of the tall and skinny container is less than the volume of the short and fat container*." Ask students to reflect on their predictions. "*Was anyone surprised about which container had the greatest volume?" "Why did you think that container would hold the most?"*
4. Explain to students that the *unit* that was used to find the volume of each container was a cube. Suggest a different *unit* (such as marbles or ping pong balls, depending on the size of your containers) that could be used. Have students predict how many of this new

unit it would take to fill each container. As students make their predictions, notice whether students realize that whichever container held more cubes will also hold more of the new unit. Measure the volumes using the new units and write the number of new units it takes to fill each container. Compare the volumes of the containers. Help students realize that whichever container held more the first time holds more the second time—the volume is still greater even with a different unit. Then compare how the measures or number of units changed. Ask students to explain why you used more or less of one unit than another. (If you used ¾-inch connecting cubes and standard ping pong balls, it will take fewer ping pong balls. Ask students to explain why it takes fewer ping pong balls.)

5. Then introduce another type of unit: a smaller container. Show students a small cup and ask: *How might we use the small cup to find the volume of the tall and skinny container and the short and fat container?* Hopefully, students will suggest filling it with water and dumping it into the larger container again and again, counting the number of containers it takes. If not, guide them to this idea. Using the small cup filled with water (or rice, or sand), find the volume of each container. Point out that it is important to fill the cup completely before you dump it into the container you are measuring. Write the number of cups that it takes to fill each container. Ask: *"Which container has the greater volume?" "Is that what we found when we used the cubes and the ping pong balls?" "What was the unit that we used this time?"* (Students will sometimes want to call the water, rice, or sand the unit instead of the cup. Remind students that the unit is what we were counting.) Compare the volume measures with the various units. "*Why did it take fewer cups than cubes to fill the tall skinny container?"*
6. Set up stations around the classroom. Label each station with a number or letter. At each station place two containers for which students must find the volume. Label each container "A" and "B". At some stations, provide cubes, marbles, ping pong balls, or pom-poms, etc. for students to use as units of volume. At other stations, provide small cups and a container of water, rice, or sand. Group students. (Group size will depend on the number of stations you set up.) Students can use the attached recording sheet as they rotate to each station, working with their group to measure and compare the containers. It is not necessary that students visit all stations; however, they should have experience with both types of units.
7. As students work at stations, interact and observe for the following: *Are students making any predictions about which container has the greater volume or how many units each container will hold? Are students measuring volume accurately? Can students explain the unit they are using and how the size of the unit affects the measure? Are students able to use the measures to compare the volume?*
8. At the end of the lesson, bring students back together for a class discussion. Have students share their results. Discuss why the measures of volume may be slightly different.

Assessment

- **Questions**

  - Could a tall, skinny container hold as many cubes as a small, fat container? Why, or why not?"
  - Think about a time you have gone to the grocery store with your family. Why do different things come packaged in different sized containers? Can you give an example of something that comes in a large container? In a small container?
  - How can you find the volume of a container?
  - Can you find the volume of a line? Why or why not?

- **Journal/writing prompts**
  - You know a shoe store that sells baby, children's, and adult shoes. Would you use the same size box for every pair of shoes you sell? Why or why not?
  - Jeremy filled a bowl with 10 big marshmallows. How many small marshmallows do you think will fit in the bowl? Use pictures or words to show what you are thinking.

- **Other Assessments**
  - Observe students as they work at stations.
  - Show students a small cup and a large cup. Ask them to find the volume of a bowl using each cup as a unit of volume.

Extensions and Connections (for all students)

- Place different-sized containers and dried beans in the mathematics center for students to experiment with to see whether two containers hold equivalent amounts or whether one container holds *more than* or *less than* the other. They may do this by pouring beans from one to another. *(Note: This needs to be modeled by the teacher before students work on their own.)* Students should record their results in their mathematics journals.
- Estimation jars provide a good opportunity for students to think about volume. Use jars that are the same size to help students compare the volumes of various materials (e.g., large and small marshmallows), and discuss the students' observations and estimations.

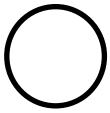
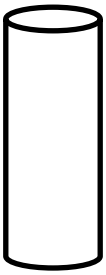
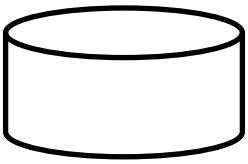
Strategies for Differentiation

- When using an estimation jar, pour a "benchmark" amount of rice (i.e., one scoop) into a bag and display it next to the larger container of rice to help support the students' development of estimation skills.
- Provide a sentence frame, such as, "The (container one) holds (more than/less than/the same as) the (container two)."
- Provide a chart with pictorial representations of the concepts of more than, less than, equal to, and the same as.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Sample Recording Chart

Volume – How much does it hold?

	How many <u>cubes</u>? 	How many <u>ping pong balls</u>? 	How many <u>cups</u>? 
			
			

The _____ has a greater volume.

The _____ has a smaller volume.

Measuring Volume Recording Sheet

Station _____:

Unit of Measure: _____

Container A: _____

Container B: _____

The volume of container A is _____ than the volume of container B.

Station _____:

Unit of Measure: _____

Container A: _____

Container B: _____

The volume of container A is _____ than the volume of container B.