CONSTRUCTING TASK: FILL IT UP!

APPROXIMATE TIME: 2 Days

STANDARDS FOR MATHEMATICAL CONTENT

MCC.3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND KNOWLEDGE

According to Van de Walle (2006) "*volume* typically refers to the amount of space that an object takes up" whereas "*capacity* is generally used to refer to the amount that container will hold" (p. 265). To distinguish further between the two terms, consider how the two are measured. Volume is measured using linear measures for each dimension (ft, cm, in, m, etc) while capacity is measured using liquid measures (L, mL, qt, pt, g, etc). However, Van de Walle reminds educators, "having made these distinctions [between volume and capacity], they are not ones to worry about. The term *volume* can also be used to refer to the capacity of a container" (p. 266).

Van de Walle, J. A. & Lovin, L. H. (2006). *Teaching students-centered mathematics: Grades 3-5*. Boston: Pearson Education, Inc.

Students should have experience with basic capacity and conservation. Students will also need to be familiar with using liquid measuring tools (e.g. graduated cylinders).

ESSENTIAL QUESTIONS

- What is the tool best to use when measuring liquid volume?
- What connection can you make between the volumes and your everyday life?
- Does volume change when you change the measurement material? Why or why not?

MATERIALS

For each student:
- "Fill It Up" student recording sheet
- "Fill It Up, Measuring Stations" student recording sheet

For each group:
- a large pan or sheet of plastic (for spillage)
- a large graduated cylinder (1 liter)
- 2 different large containers (jar, bottle, bucket, pot, etc.)
- 1 bowl of water (may be colored for visual effect),
- 1 funnel

GROUPING

Small Group Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

In this task, students estimate and compare liquid volume. The unit of focus is the liter. Students will make connections to everyday items to build understanding of liquid volume and the liter.

Comments

Remember that the goal is for the students to develop a concept of liquid volume. According to Van de Walle (2006), "Children often confuse "holds more" with "taller" or "fatter," even though these may be misleading attributes. This is why a variety of container shapes not only adds interest but also can contribute to student understanding. (p.239)

Task Directions

Students will follow the directions below from the "Fill It Up" student recording sheet and the "Fill It Up Measuring Stations" recording sheet.

This task has four parts.

Part I:

Introduction, Discussion, Connections

The teacher will facilitate a conversation with the students about liquid volume. Discussion about the meaning of the concept and how it is measured should take place. The students and the teacher will make connections, cite examples, and clarify misconceptions. This would be a great opportunity to begin an anchor chart. The teacher should then show the class a container that measures one liter. Students should give examples of other containers that hold a liquid volume of about 1 liter to add to the anchor chart.

Part II

Exploring, Estimating, Comparing

In small groups, complete the mini activities below:

**Adapted from Teaching Student-Centered Mathematics, Van de Walle, Lovin, (2006)*

Capacity Sort

Provide a collection of labeled containers with one marked as the "target." The task is to sort the collection into those that hold more than, less than, or about the same as the "target" container. Provide a recording sheet on which each container is listed and a place to circle or write, "holds more," "holds less," and "holds about the same." List the choices twice for each container. The first choice is to record a guess made by observation. The second is to record what was found. (Beans, rice, liquid, or other fillers can be used to test estimates.)

Liquid Volume Line Up!

Given a series of five or six labeled containers of different sizes and shapes, order them from least capacity to most. Explain your thinking with your group members.

Notes for the teacher:

- Make sure that at least one of the containers measures 1 liter
- This can be quite a challenge, but let them "grapple" with it! Do not provide answers!
- Allow students to compare their findings with other groups.

Part III

Investigating, Estimating, Measuring

In small groups, students will explore, estimate, and measure liquid volume. Each group should have the following:

- a large plastic box or sheet of plastic (for spillage)
- a large graduated cylinder (1 liter)
- 2 different large containers (jar, bottle, bucket, pot, etc.)
- 1 bowl of water (may be colored for visual effect),
- 1 funnel

Using the funnel, have the students fill each of the containers until they believe that they have reached a liter. Once they have reached their estimate, allow them to pour the liquid from each container into the graduated cylinder. Ask the students to pay careful attention to what happens.

Part IV

Reflection

Once students have completed their work station task, ask students to complete the "Fill It Up" student recording sheet, and compare their estimations. Ask students to share their findings and to justify their findings by describing the process they followed.

FORMATIVE ASSESSMENT QUESTIONS

- What is an efficient way to measure liquid capacity?
- When estimating liquid capacity, what do you need to consider?
- How much is a liter?

- What other containers have you seen in your everyday life with a capacity of one liter?
- Does the shape of the container change the amount of liquid it can hold? Why or why not?

DIFFERENTIATION

Extension

- Ask students to compare the relationships between the containers and the amount of liquid they can hold. Several things may come to light in this discussion.
  - The amount of liquid used to fill two containers can be the same, even though the shape of the containers may be different.
  - Having a benchmark to look at helps to make more accurate measurements.

Intervention

- Have an adult work with a small group of students who need support using a graduated cylinder.
- Have students complete the task using only one container.

Name_____ Date _____

Fill It Up!

You will explore, estimate, and measure liquid volume. Your group should have the following:

- a large pan or sheet of plastic (for spillage)
- a large graduated cylinder (1 liter)
- 2 different large containers (jar, bottle, bucket, pot, etc.)
- 1 bowl of water (may be colored for visual effect),
- 1 funnel

Directions:

1. Look at your two containers. Estimate how much liquid it would take to fill each container to one liter.
2. Talk with your group members about how much liquid it would take to reach your goal of 1 liter.
3. Take turns filling each container until you believe that you have reached a liter. Use a funnel if you need to.
4. Once your group has reached their estimate, take turns pouring the liquid from the each container into the graduated cylinder.
5. Observe, discuss, and record what happens on the chart below. How close was your estimate?

Fill it Up! Recording Table		
Type of Container	**What happens when the liquid is poured into the graduated cylinder?**	**How close was your estimate to an actual liter?**

Questions For Reflection:

1. When estimating liquid capacity, what do you need to consider?
2. About how much liquid is there in a liter?
3. What other containers have you seen in your everyday life that have a capacity of one liter?
4. Does the shape of the container change the amount of liquid it can hold? Why or why not?