

# Capacity Challenge

## Summary

Small group activities help students understand and estimate the measurement of volume.

## Group Size

Small Groups

## Materials

### Marshmallow Mouth

- Mini-marshmallows

- 5 Bottles of different sizes

- 5 cups of rice

- *Pigs in the Pantry; Fun with Math and Cooking*

- Math Journals

### Crazy Cups

- Quart milk cartons

- Containers

  - Cup

  - Pint

  - Quart

  - Gallon

- Rice

- Measurement containers

- Measurement "cups"

- [\*Crazy Cups\*](#)

### Additional Resources

#### Books

*Pigs in the Pantry; Fun with Math and Cooking*, by Amy Axelrod; ISBN 0-689-80665-5

## Background for Teachers

Volume and capacity are the measurements used to describe the inside of a container. The definition of volume is the measurement of space occupied by anything. The definition of capacity is the amount a container holds. An object such as a rock or a brick has volume but no capacity. People began measuring volume, as they did with mass and weight, using natural objects like eggshells. The problem was that eggshells could differ in size. It became necessary for people to develop a standard unit of measurement.

The Babylonians were the first to develop a standard unit for measuring capacity. They used a hollow cube with specific linear measurements filled with water. This gave them the first unit of capacity. Today, a cube filled with water is still used as a standard unit of capacity.

## Intended Learning Outcomes

1. Demonstrate a positive learning attitude.
2. Develop social skills and ethical responsibility.

## Instructional Procedures

### Invitation to Learn

Have the students correct silly sentences. They can record their corrections in their Math Journals.

For example:

John is very thin. He weighs 60 inches.

Sarah poured juice for each student. She gave each child a quart.

Susan walked a long way. She walked 10 centimeters.

The bug crawled across the desk. It went about 6 miles.

#### Instructional Procedures

##### Marshmallow Mouth

Read *Pigs in the Pantry* to the class. Discuss what happened that made it so difficult for the pigs' recipe to turn out correctly. Discuss how important it is to use accurate measurement when asked to do so.

Have several containers at the front of the room that vary in capacity. Try to use bottles that are short and fat, long and slender, as well as bottles that are familiar to the students.

Work as a class to order the bottles by capacity. Be sure that the labels are removed so that the students cannot see the capacity listed on the label.

Once the bottles have been put in order, fill the bottle that is predicted to hold the largest amount to the top with rice. Use a black marker line to show the full capacity

Use the rice from the largest bottle to fill the next largest bottle. Talk with the students to determine if this container is filled to capacity. Repeat with the remaining bottles. Be sure to always use rice from the first/largest bottle. The main point for the students is that if the rice from one container overflows when poured into a new container, the first container has a larger capacity. If the rice does not come to the rim or top of the container then the first container has a smaller capacity.

Rearrange the bottles, if necessary, in the correct order from largest to smallest. It is important that the order does change from the original order so that the students understand that looks can be deceiving.

Relate to the students that they have just determined the capacity of the bottles. Use the correct terms throughout the lesson so that the students become familiar with their meanings.

Group the students into pairs. Have each student estimate how many mini-marshmallows it will take to fill their own mouth to capacity. Students will keep their teeth clenched and fill their mouths between their teeth and cheeks to avoid any possible choking hazards. Students will record this observation in their Math Journals. Partners should also estimate each other's mouth capacity by looking into their partners open mouth. Record this observation as well.

When all estimates are done, pass out a generous handful of mini-marshmallows to each team. Tell them that their mouths are filled when their lips can still close over the marshmallows. There is no eating until all of the work is done. Have students begin filling their mouths with the marshmallows. One student fills his/her mouth while their partner counts and records the data.

Make a large chart that shows each child's name and the capacity of marshmallows his/her mouth can contain. Compare largest to smallest, equal to, not equal to, etc.

#### Instructional Procedures

##### Crazy Cups

Place the following containers at the front of the room. Have the containers labeled: 1 gallon, 1 quart, 1 pint, 1 cup.

Discuss where they have seen these objects before.

Review the need for a standard from of measurement.

Using the rice, show several examples of the relationships between the different containers.

Have the students break into small groups. Each group should have 5 containers that can be filled with rice using a 1 cup measure.

Have them estimate how many cups they would find in each container. Record it on the Crazy Cups blackline.

Using rice, have students measure the correct amount into each container. Record their findings on their Crazy Cups blackline.

## Extensions

### Curriculum Extensions/Adaptations/ Integration

Have students bring in containers that they think hold 1 cup. Break into teams and explore.

By pairing up, students who do not understand or have other special needs can still participate and have a successful learning experience.

### Family Connections

Have students choose 4 bottles or containers at home and have them determine the capacity of these bottles from greatest to least. Have them record data and return it to school.

Have students help cook something for dinner with their parents. Request that the recipe calls for measurement using cups. Have the student report to the class about their experience.

Compare written estimates in children's Math Journals for reasonable estimates and measurements.

## Assessment Plan

Use the class graph as a discussion/assessment tool. Review what capacity means.

Discuss how various containers may have capacities larger or smaller than expected.

Show students a 1 cup container. Have students list 5 other containers that would have less than 1 cup capacity. Record estimates in their Math Journal.

## Bibliography

### Research Basis

Rommel-Esham, K., (October, 2007). How Much Popcorn Will Our Classroom Hold? *Science and Children* 45(2) 22-26.

How much popcorn will our classroom hold? This intriguing question sparked a terrific integrated science and math exploration conducted with fifth and sixth-grade students. In the process of finding the classroom's volume, students developed science-process skills (e.g., developing a plan, measurement, collecting and interpreting data, prediction, inference, communication, and using number relationships) and applied mathematical processes (determining an estimate, using benchmarks, measuring, mapping, etc.) in a meaningful way-getting an authentic glimpse of how these two subjects are inextricably linked.

Downey, J.A., Cobbs, G.A., (January 2007). "I Actually Learned A Lot from This": A Field Assignment to Prepare Future Preservice Math Teachers for Culturally Diverse Classrooms. *School Science and Mathematics* 107(1) 391-403.

Teacher education programs are cognizant of the need to prepare preservice teachers (PTs) to work effectively with children from diverse cultural backgrounds. Well-constructed field experiences can help PTs develop awareness and gain understanding of important cultural considerations related to effective teaching and learning (Sleeter, 2001). This paper describes a unique field assignment created for an Elementary Math Methods course in which 61 PTs were trained to conduct a semi-structured interview with a student whose cultural background was different than their own. PTs transcribed their own interviews and completed a guided reflection on their experiences. Reflections were submitted and analyzed for emerging themes. Analyses suggest that the structured interview component of this field assignment provided PTs with increased insight into mathematics instruction and the learning needs of diverse students. It also discusses the value and limitations of this instructional innovation and propose avenues by which to continue to help PTs grow toward becoming culturally relevant pedagogies (Irvine, 2003).

Authors

[Utah LessonPlans](#)