

LESSON 7

How Much Does It Hold?

Measurement (Volume)

Objectives . . . Students will be able to:

- ◆ Understand the attributes of volume.
- ◆ Develop the process of measuring and concepts related to units of volume.
- ◆ Make and use estimates of volume.
- ◆ Find things that are clearly bigger/smaller than a given volume.

NCTM Standards and NAEP Strand

Concepts learned and applied in Lesson 7 correlate to NCTM Standards 1, 2, 3, 4, and 10; and NAEP Strand 2 (Measurement).

Student Prerequisites and Key Words and Terms.

Present some simple examples of the type of problem to be explored—e.g., If I say a container holds a certain amount of liquid, is that the same as saying its *volume* is such and such? What is volume? How do we measure volume?

Materials List

Each Group

- Four see-through plastic containers for each group. The children will be predicting and measuring volume and may be more impressed with height than width, so choose two fairly tall and wide objects, but one low and broad (a good idea would be to make the latter hold the most volume, as in the video). Or you may in advance have your students ask their parents for some transparent plastic containers of different shapes and sizes.

Each Student

- A copy of BLMs 7-A and 7-B for the “You Try It at Home” activities.
- colored water

Student Prerequisites

- ◆ Proficiency with measuring cups.
- ◆ Understanding of conservation of volume.
- ◆ Ability to use strategies of estimation.
- ◆ Understand the relationships between gallon, quart, pint, and ounce.

Key Words and Terms

<i>volume</i>	<i>quart</i>
<i>ounce</i>	<i>pint</i>
<i>gallon</i>	

To Prepare Your Students

Introduce today’s video topic and ask questions designed to ascertain if the students are familiar with the

Video Overview

Beginning the investigation of volume, we see a boy pouring leftover soup into a storage container; a girl mixing frozen juice; a boy stuffing his books into a backpack. Knowing about volume is important!



Video Lesson

Milk for the Day

A grandfather and his grandson are having breakfast. The boy is pouring his first glass of milk of the day and grandfather asks, "How much milk do you think you drink in a day?" How can this boy find out how much milk he drinks each day?



YOUR CLASS MAY WANT TO TALK ABOUT THIS NOW

Use the following questions to help your students explore ways of determining volume:

1. How can you find out how much milk the boy drinks each day?
2. How many ounces are in a half gallon?
3. Can you make a number sentence to describe this situation?

Play



How Much Does It Hold?

Next, Rene Goeprich of Willard Elementary shows her class four containers and asks them to estimate how much water they think each will hold and rank them by volume.

**YOUR CLASS MAY WANT TO TRY THIS NOW**

You may now divide your class into groups and ask your students to predict which container will hold the most, which the least, and so forth. After they have worked out the problem, but before they present their solutions, play the video showing how other kids solved the problem.

Play

As the video continues, we see the predictions the video students came up with. The video then asks:

WERE THESE SOLUTIONS LIKE YOURS?

Note: Question is on-screen but there is no stop sign. Teachers should pause at this point and ask each group to present its solution. Encourage your class to think about all of the solutions and remind them that there are many possible solutions.

Play

Next, Rene has her groups test their predictions by using colored water to fill the containers and compare volumes.

**YOUR CLASS MAY WANT TO TRY THIS NOW**

The same groups may now test their prediction, filling the containers with colored water and measuring what each one holds. After they have worked out the problem, but before they present their solutions, play the video section showing how other kids solved the problem.

Play

The students are surprised to find out their predictions were wrong! What does this tell us about volume and the shape and size of containers? The video then asks:

WERE THESE SOLUTIONS LIKE YOURS?

Note: Question is on-screen but there is no stop sign. Teachers should pause at this point and ask each group to present its solution. Encourage your class to think about all of the solutions and remind them that there are many possible solutions.



Play

Next, two children are mixing Kool-Aid in different size glasses. They use the same amount of Kool-Aid—but will the two glasses taste the same?

Then, in the final segment, we see eight 8-oz. glasses of water as the narrator tells us that doctors recommend we drink this much water every day. The video shows 56 glasses of water. Would that be a week's worth of water? Would 56 glasses of water fill a bucket? A sink? The video suggests . . .

You Try It!

EXTENDED ACTIVITIES

These activities are designed to extend the mathematics learning introduced in this lesson.

Using the idea of the 56 glasses in the “You Try It” video segment, explore the following question: How many standard units fit into a given container of standard size?

1. Using a standard-sized dixie cup (4 oz., 6 oz., or 8 oz.), have students pour sand, rice or water into pint, quart, half gallon, and gallon containers (milk cartons, juice bottles, measuring cups) and count the number of cups it takes to fill them.
2. At another time you might also want to explore metric measurement of volume in the same way.

Cross-curricular Activity

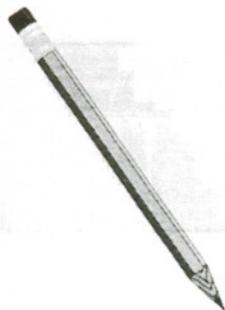
Have students bring a variety of empty, clean containers, such as cereal boxes, juice containers, or plastic containers to class. Provide rice, beans, macaroni, popcorn or another dry material. Ask students to record their estimates of how many of a standard measure (e.g. dixie cups, measuring cups, pint measures) fit into each non-standard container. Have students calculate the exact volume of each container. (This might be a good opportunity to discuss multiplication as repeated addition.)

How much does each volume weigh? Provide scales and have them choose two materials and measure an equal amount of each. Use the scales to determine the weight of each dry material and compare. (This might be a good opportunity to explore the concept of density.)

Writing Activity

Write a detective story about volume: A thief has left behind a locked container full of precious gems. It is one of four sealed containers, each of a different size, in a room. Someone has filled the other three with materials still in the room. There are various boxes lying around and a scale. How can you find out what is in each container without opening it?

Write your detective story in a way that solves the problem and describes the process you used.



You Try It At Home

Two handout masters, numbered 7-A and 7-B, are provided in a booklet accompanying the Teacher's Guide; reproduce as many of these as you need. Reduced examples are also provided at the end of this lesson. These activities are designed to extend and reinforce concepts taught in the lesson, and to enable parents or other caregivers to become more involved with students' mathematics learning.

Assessment and Criteria for Scoring

The following four proficiency categories may be used to evaluate student performance in response to Lesson 7. You may use these evaluation categories to assess student classroom performance and extended activity performance. These criteria for scoring can be used when students are checking their predictions for which container will hold the most volume.

Advanced Response: The response shows evidence of selecting an appropriate method producing accurate results for checking and comparing the size of each container, and the results are presented clearly, completely, and are well-organized, both verbally and graphically (using pictures or words).

Proficient Response: The response shows evidence of selecting an appropriate method producing accurate results for checking and comparing the size of each container, and the results are verbally presented in a clear and organized way.

Nearly Proficient Response: The response shows evidence of selecting an effective method for checking and comparing the size of each container, but the results are flawed, because of some inaccurate applications of the method, or the results are not communicated clearly.

Minimal Response: The response shows evidence of attempts to select a method for checking and comparing the size of each container, but the application of the method does not produce any explainable results and/or the explanation is not understandable.

References and Resources

National Council of Teachers of Mathematics (1989) Curriculum and Evaluation Standards for School Mathematics. Reston, VA: The Council.

Standard 1 : Mathematics as Problem Solving.

Standard 2 : Mathematics as Communication.

Standard 3 : Mathematics as Reasoning.

Standard 4 : Mathematical Connections.

Standard 10 : Measurement.

NAEP Strand 2 (Measurement).

Suggested Children's Literature:

Pamela Allen, *Mr. Archimedes' Bath*

Steven Kellogg, *The Mysterious Tadpole*

Tomie de Paola, *Pancakes for Breakfast*

Henry Pluckrose, *Capacity*

Jane Jonas Srivastava, *Spaces, Shapes, and Sizes*



You Try It At Home 1 and 2

Water, Water Everywhere . . .

Estimate how many glasses it takes to fill up a pail. A sink? A plastic basin? A zip-lock bag? Ask an adult at home or another care-giver to help you with the following project.

Find a glass. Estimate how many glasses of water will fill the containers below. Record your estimate, then use your glass to find out the actual measurement. Measure as many containers as you can.

Pack It Up

How much can your closet hold? Ask an adult at home or another care-giver to help you with the following project.

Use a six-pack of some item. For example, you may be able to find a six-pack of soda, juice, yogurt, etc. Estimate the number of your kind of six-pack you would need to fill up your closet (or your bathroom, or your bedroom, etc.).

Use the space below to record your estimate. Then describe how you imagined you could actually use the six-pack to fill this space. Use words and pictures to explain your solution.