Calculating Capacity with Cups & Quarts

Summary

The students will be able to describe part whole relationships and determine simple equivalences with measurement in capacity.

Materials

5 cereal bowls
Empty milk or juice carton from school lunchroom
5 gallon Ziploc bags of cereal, rice, miniature marshmallows
5 cup containers
5 quart containers
5 gallon containers
5 large plastic bins for catching measuring items (1 for each group)

- *Measuring Cups Capacity Experiment* (pdf)
  5 gallon Ziploc bags and 5 quart Ziploc bags -- to divide up dry cereal, etc. for groups -- students will estimate and measure into containers
  1 cup dry measure per group
  1 quart empty container per group
  1 gallon container per group
  1 large (approximately 12" x 18") rectangular Sterlite or Rubbermaid bin per group
  Journal
  Copy *Measurement Problem Solving Cards* (pdf) into cardstock, laminate and cut out. Make one set for each small group or pair of 2 students.
- *Measurement Problem Solving Answer Sheet* (pdf)
  for each student.
- *Measurement Problem Solving Answer Key* (pdf)
  for teacher.
- *Problem Solving Equivalences* (pdf)

Books:

- *Pastry School in Paris: an Adventure in Capacity*
  , by Cindy Neuschwander; ISBN-13: 9780805083149
- *Capacity*
  (Math Counts), by Henry Pluckrose; ISBN 13: 9780516454511.
- *Hershey's Weights and Measures,*
  by Jerry Pallotta; ISBN: 0-439-388775.
- *Room for Ripley*
  , by Stuart J. Murphy; ISBN-13: 9780064467247.
- *Lulu's Lemonade*
  , by Barbara deRubertis; ISBN-13: 9781575650937.
- *Let's Be Kids and Measure Liquids!*
  , by Kelly Doudna; ISBN-13: 9781599286105.

Background for Teachers

Measurement is difficult for students to understand unless they are given hands on experiences measuring using measurement tools. Teachers need to create the chance for students to measure and make equivalences.

This lesson will give students opportunities to measure using cups and quarts (pounds and ounces as an extension). Although the gallon is not part of 3rd grade core, most students know what a gallon of milk is. Therefore, using a gallon can be another real life reference point students can use as they experiment how much a container can hold. Within the customary system, the common units for measuring capacity are fluid ounces, cups, pints, quarts, and gallons.

For teacher reference, capacity is how "much" can fit into something, (e.g., The capacity of a container may be 2 cups of rice or 500 ml of water.) Capacity for third graders includes cups and quarts. Volume is the amount of 'space' that is taken up (whether or not there is something in it or it is solid), expressed in cubic cm (or m or km).

The weight of liquid measurements can be included in the second part of the lesson after students have experimented with capacity. Most students have seen a soda pop can or bottle. Use what they know to measure the capacity of the liquid inside the container. Then give students the chance to weigh the ounces, cups, and/or quarts of known quantities of cereal, and drinks. Next, have students do problem solving by making equivalences of what they have found.

Prior to the lesson, have students bring containers from home such as juice, cereal, milk, soda pop, etc. This will give students real world connections to what they already have and use in their homes.

One way to teach capacity is with an Enduring Understanding and Essential Questions. After each question are the suggestions lessons that or ideas that should be covered.

Enduring Understanding:

There are appropriate tools and units to estimate and measure capacity.

Essential Questions:

How do we measure liquids and solids?

KWL -- Brainstorming:

i. Weight (pounds, ounces, grams)

ii. Capacity (cups, quarts) (not in the core: pints, gallons, kilos)

What kind of tools are used to measure foods & drinks (customary and metric)? (Use of body benchmarks such as a fist for ½ or 1 cup.

Problem solving -- 4 cups = 1 quart

How do we measure capacity and with what tools?

Problem solving -- compare capacity

Determine simple equivalences:

6 c = 11/2 quarts or 1 quart and 2 cups

4 c = 1 quart

What are ways to measure weight?

Pounds, ounces (capacity and weight), grams

Problem solving by comparing objects by their weight (light verses heavy -- for lb. and oz.)

How would your life be different without standard types of measurement for capacity?

Lesson Preparation:

These activities will be done in small groups. There are member roles and responsibilities given as a reference for teachers. Students need journals to record their findings. At each table place the following items (students can bring something from home they can measure.):

Gallon bags of cereal, rice, miniature marshmallows, bowl, cup, quart, large plastic bin, gallon Ziploc bag, and a quart Ziploc bag.

Copy Problem Solving cards onto cardstock, laminate and cut out. Make one set for each small group.

Intended Learning Outcomes

Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.

Communicate mathematical ideas and arguments and coherently to peers, teachers, and others using the precise language and notation of mathematics.
Connect mathematical ideas within mathematics to other disciplines, and to everyday experiences.

Instructional Procedures

Invitation to Learn:
Show a bowl that could be used for breakfast cereal. Also show the small milk or juice box from the lunchroom.
Ask students, "Do you know how much cereal would fit into the bowl?" or "How much milk would you put in the cereal?" or "How much juice or milk fits in the small "boxes" in the lunchroom?" Today we will use standard measurements of cup, quart, and gallon to measure common foods and drinks such as cereal and milk, juice, or water.
Instructional Procedures:
Teacher Instructions:

- Show capacity containers for gallon, ½ gallon, quart, pint, cup, etc.
- Show containers for a box of cereal, bag of cereal, rice, miniature marshmallows, quart and gallon Ziploc bags, etc.
- Tell students today they will be exploring measurement in small groups of four to six.
- Students will have jobs and take turns making measurements, checking measurements, and writing information in the table of the recording sheet. A job sheet will help keep students on task (*Cooperative Group Member Roles* (pdf)).
- Using the *Measuring Cups Capacity Experiment* form, ask students if they can identify the how much each container holds.
- Next ask, " how many cups of cereal will fit into the cereal bowl?"
- Ask students what size containers they buy at the store and what liquid is normally contained in these containers. Students are going to use the *Measuring Cups Capacity Experiment* form to write the amounts of each type of item. Students will first predict how much each container will hold. Next, students will measure the item and write their findings in the recording sheet.
- Students should write in their journals common equivalences they find.

Lesson and Activity Time Schedule:

- Each lesson is 55 minutes. (intro 10 min., investigations 45 min.)
- Each activity is 30 minutes. (activity problem solving 30 min.)
- Total lesson and activity time is 90 minutes.

Activity Connected to Lesson:
Extend the activity: Ask students how many cups of juice they believe they can pour from a gallon of juice. Have students explain their reasoning. Pour the apple juice into cups to see how many cups are in one gallon. (Let the students drink the apple juice.) Show students how to create an array to show cups, quarts, and gallon.

- Hand out copies of *Measurement Problem Solving Cards* and *Measurement Problem Solving Answer Sheets.*
- Give students the measurement tools needed to solve the problem cards, and let students work in small groups to find the answers.
- When completed, pass out *Problem Solving Equivalences* form.
- Students should experiment with different equivalences and create their own measurement problems. For example: 4 cups + 3 quarts equal 1 gallon.
- Have students come up with as many different equivalences as they can using *Problem Solving Equivalences*.

Extensions

The weight of liquid measurements can be included in the second part of the lesson after students have experimented with capacity. Most students have seen a soda pop can or bottle. Use what they know to measure the capacity of the liquid inside the container. Then give students the chance to weigh the ounces, cups, and/or quarts of known quantities of cereal, and drinks. Next, have students do problem solving by making equivalences of what they have found. Extensions for students would to include the vocabulary "pint" and "gallon.'

Integrating the weight of liquids and the conversions for each is another way to extend the lesson. This lesson is especially good for students with special needs because of its "hands-on" nature and experimentation.

To extend the lesson, explain to students that 1 cup = 8 ounces and 16 ounces = 1 pound. Have students turn their measurements into liquid ounces.

- *Problem Solving Equivalences*

Family Connections:

For home integration, have students make estimations and find measures of different items at home. Students should include the standard measurement they used to measure the food or liquid.

Include parents in helping students create their own conversions to measurements they make up.

- *Problem Solving Equivalences*

would be a fun and engaging activity for parents to do with their child.

Assessment Plan

Making observations and asking questions during the experiments are great formative assessments.

The measurement activity sheets are also a good measure of what the students are learning.

- *Measurement Problem Solving Cards w/Measurement Problem Solving Answer Sheet*
- *Problem Solving Equivalences*

Authors

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