

Problem Solvers Activity 19: How Much Does It Hold?

CHILDREN ARE LEARNING TO...¹

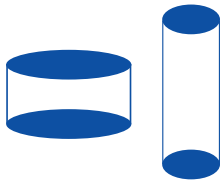
- Demonstrate awareness that objects can be compared by length, weight, or capacity, by noting gross differences, using words such as *bigger*, *longer*, *heavier*, or *taller*, or by placing objects side by side to compare length.
- Order three objects by size.

MATERIALS NEEDED:

4 clean, plastic containers with different capacities—for example:

- 8 oz./one-cup water or juice bottle
- 4 oz./half-cup water or juice bottle
- Margarine/butter container
- Spice jar
- Sour cream or yogurt container
- Baby food container

The containers should feature a variety of sizes, heights, and widths. It's also helpful if some containers are taller than others, as we want children to discuss whether height is a good way to measure.



4 spoons or scoops, different sizes

4 cups of different sizes

2 measuring cups (1/4 cup or 2-ounce capacity)

Plastic bin with lid (approximately 11x14x3"), or water table

Water

2 dot markers

4 pieces of paper

¹ California Department of Education (2008). Preschool Learning Foundations. Retrieved from <https://www.cde.ca.gov/sp/cd/re/documents/preschoolff.pdf>

PREPARATION:

- Pour water into plastic bin. Place the containers, measuring spoons and cups in the bin. Keep the $\frac{1}{4}$ -measures to the side. Have the dot marker and paper close by as you start the activity.
- Prepare copies of the parent handout for distribution.
- If you plan on implementing the optional book activity, refer to the preparation instructions in that section.

Background Information on Teaching Measurement, Volume and Capacity

Volume is the amount of 3D space an object takes up. If the object is empty, its volume is how much it can hold. When an empty object is filled with a liquid, volume is the capacity of the container. While these terms are helpful to teachers, young children are not yet ready to use or understand them. Children will use different, age-appropriate language to describe volume and capacity, as noted below.

Volume and capacity are complicated concepts for young children! Children take their first steps toward understanding these ideas when:

- From 2-3 years of age, children are able to recognize volume/capacity as an attribute, or feature, of an object—"This bucket holds a LOT of water!" "This cup only holds a little water." Part of this early learning includes developing a measurement vocabulary to describe what they see: full; empty; almost, nearly, mostly full (or empty); partly full (or empty); a little or a lot full (or empty).
- Starting at age 4 years, children can compare the volume, or capacity, of two containers. For example, you might see them discussing which cup holds *more* water.

Children begin to explore the capacity of containers (how much they hold) through everyday play. They use a variety of strategies to explore capacity—filling, dumping, and making direct comparisons. For example, they may line up two containers to see which is bigger. Typically children at this age assume that the taller container will hold more, as the attribute of height (and who/what is "bigger") is familiar and meaningful to them. The activity in this unit helps children *begin* to discover that height is not always indicative of the capacity of containers, though a full understanding of this concept won't emerge until they are school-age.

Children are also practicing *unit iteration* in this activity. Unit iteration is when children use a given unit (like a cup or spoon) repeatedly in order to find a measurement.

This activity engages children in a playful task that most toddlers enjoy: filling and dumping. By supporting and scaffolding their exploration, teachers can begin to introduce the concept of capacity as another interesting attribute children can discover in their play. It is important for teachers to remember that the **goal of this activity is not for children to master the concept of volume/capacity** or measurement, but to have meaningful opportunities to practice and explore these ideas.

Activity Instructions

ENGAGE

Gather a group of 4 children.

Take out the bin of water.

SAY: Problem Solvers, we have a something different to explore this week: Water! Let's take some time to explore our water bin. There are several kinds of cups, containers, and spoons for you to discover.

Encourage children to play/pour/fill as they wish for about 10 minutes so they have a chance to explore before moving to the structured part of the activity. As children engage in open-ended play, listen for children's use of measurement language (full/empty/more/less/too much/overflowing/heavy/light).

As children play, ask questions about what they are doing and discovering.

ASK: Problem Solvers, I have a something for us to think about together. What does **full** mean to you? Can someone show me "**full**"?

Encourage children to describe and demonstrate the concept of "full." Summarize their thoughts, like:

- Full is when water comes to the very top.
- Full is when there is no room for more water.
- Even though that container is *mostly* full, I see a tiny bit of the cup at the *very* top is still not full. Does "full" mean the cup is *overflowing*?
- Full is when the water comes to the very top of the cup but is not overflowing.

ASK: What if I have a cup of water that looks like this? [Take a cup and fill it about $\frac{3}{4}$ full with water.] Would you say it's full? [Wait for student responses. Then take another cup and fill it only about one-third full.] How about this cup? Is *it* full?

Encourage children to explain their thoughts about comparing these two cups. Summarize their thoughts, like:

- One cup is "fuller" than another—it has more.
- One cup is nearly full. That means the water is closer to the top.
- One cup is not full/isn't very full. That means that the water isn't close to the top.

ASK: Can you show me what "nearly full" or "almost full" looks like? [Encourage children to fill cups to demonstrate this concept.] Can you show me a cup that is not very full? What does that look like? [Again, encourage children to demonstrate.]

ASK: If a cup doesn't have ANY water in it, what do we call it? What's this? [Show an empty cup.] That's right—a cup with no water in it is empty. We know it can hold water—it has the **capacity** to hold water—but right now it's empty.

EXPAND

ASK: We have several different containers here. (Line up the 4 containers of different sizes.) If we wanted to find out which container held the MOST water, what could we do?

Encourage children to talk about what they would do and experiment with the water.

Facilitate a conversation where children share their ideas and observations. Summarize children's discoveries, using "I see" statements:

- I see you are lining the cups up next to one another to see which is tallest. You are wondering if the tallest container holds the most water.
- I see you are pouring water in the containers. I wonder if you are trying to see how much you can pour before the container is full?
- You filled both containers and now you are lifting them up. You're testing them to see which one is heavier. I wonder what that might tell us?

SAY: Let's try something. Let's choose two containers. Can you fill one of those containers to the very top? Next, we're going to pour it into *this* container. Let's see what happens. Who thinks it will overflow? Who thinks it won't reach the top? [Take children's predictions.] Let's see.

Select a child to pour the water from one container to the other. Observe aloud what happens: does it overflow, fill the container completely, or is there room at the top for more water?

ASK: So which container do you think holds more water?

Listen to children's responses and summarize their thoughts, using "I hear" statements:

- I hear you saying that if the water overflows, the first container holds more than second container. (You can model math language here and note that cup 1 *has* a greater capacity than cup 2.)
- I hear you saying that if the water doesn't reach the top, cup 2 can hold more/has a greater capacity than cup 1.
- So you are saying that if the water from first container reaches the top of second container, then the two containers hold the same amount, or have the same capacity.

Choose 2 containers for a comparison activity. Each container should hold at least 1 cup of water (8 ounces).

SAY: We have two containers here. Let's figure out which one has the greatest capacity.

Choose a container to start this activity. Have a $\frac{1}{4}$ -cup measure handy.

SAY: Let's use this measuring cup (2-ounce cup/ $\frac{1}{4}$ -cup measure) to discover the capacity of this container, or how much it holds. We're going to pour cups of water in the container until it's full. We'll see how many cups it takes to fill it all the way up. I'm going to need some Problem Solvers to help me!

Ask children to take turns pouring water. Observe together how many pours it takes to fill the container.

Represent on paper how many pours it takes to fill the container. For each cup they pour in, mark your paper using the dot marker. (If it is unequal number of cups, simply observe: We just needed a little bit more or We needed almost another whole cup.)

When the container is full, invite children help you count the dots on the paper as you point to each one. Say, "This container held ___ cups of water." Place the paper in front of the first container.

Choose a second container.

SAY: Let's try it again with this container.

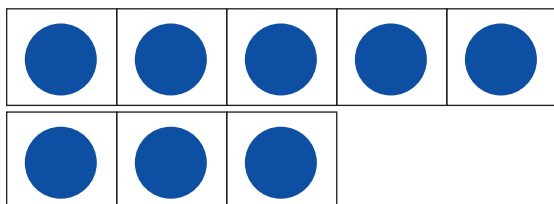
Repeat the activity with the second container. Once again, mark the number of cups poured with dots and have children count the total with you.

ASK: What can we do to figure out which container holds MORE water?

Facilitate a conversation where children share their ideas and strategies. Take time to summarize what you hear, such as:

- Looking at the containers to see how big they are.
- Picking the containers up to see which is heaviest.
- Comparing the dots to see which container held the most cups of water.

Encourage children to place one line of dots on top of the other so children can see which line is longer.



SAY: These dots show us how many cups each of our containers could hold. Which line is longer? The longer line tells us that *this* container held the MOST water and had the greatest capacity.

IT'S NOT ABOUT THE RIGHT ANSWER

The goal of this activity is **not** for children to get the right answer. Instead, the goal is give them meaningful opportunities to **think about** concepts like full and empty, and **practice** skills like unit iteration and comparisons. young children need to know.

EXPLORE

Repeat the group activity as outlined above with two different containers for children aged 30 to 42 months.

Try the *How Much Does It Hold?* activity outlined below as a partner activity—for children aged 42 to 48 months.

SAY: Now, you and your partner will each get a new container and a cup. Your job is to discover how many cups of water your container holds.

Give each pair of children a container, a cup (1/4 cup or 2 ounce capacity), a dot marker, and a piece of paper.

SAY: We already have measured these two containers that are full of water. We learned that this one holds more water. This container holds less water. Now let's figure out how much water your containers hold. Which partner would like to help with marking dots? Who would like to do the pouring?

Give the dot marker and the paper to the child keeping track of pours. As their partner pours in cups of water to their container, prompt them to make a dot on the page.

Observe children to ensure they are pouring and marking accurately. If they get ahead of one another, say: Let's pause to give [Child Name] time to catch up.

Use terms like *empty, nearly/almost full, full, and overflowing* as children engage in this task.

Observe children's conversations during this activity—they may begin to naturally make comparisons, predictions, and observations. Listen for measurement terms and summarize children's discoveries.

Watch to see how much children are filling the container they are using to pour—this might be place you can explore unit iteration: *Are you filling the measuring cup up all the way each time?*

Facilitate a conversation where children share their observations about their containers. Probe using questions like:

- What did you learn about your new container?
- When you started, did you think your container would hold a lot or a little water? What made you think that?
- Show me how many cups of water you poured in. Let's count together to see what your container's capacity is.
- *Encourage the two groups of children to compare the capacity of the containers they just measured.* Let's look at the dots you made to measure the capacity of your containers. What do you see? What can we do to find out which container held the MOST water? Which container held less?
- Here are the containers we measured together. This container held the least water. This container held the most water. Where does your new container belong in the line? [Give each set of partners a chance to place their containers in the line according to its capacity.]

With the children's help, place the containers in order from least capacity to greatest capacity.

REFLECT

To close the activity, bring the children back together. Use reflective questions - like those below - to prompt children's thinking about these activities. Listen for the capacity language they may use as they respond to these discussion questions.

- What did you discover about how much our containers could hold?
- What did you enjoy about discovering capacity today?
- What do you think is tricky about discovering the capacity of our containers?
- What strategies did you use to help you with today's activity?

Individualizing the Activity

MAKE IT MORE CHALLENGING:

- Use containers with greater capacity (which will lead to more counting of pours).
- Compare 3 or 4 containers in the **EXPAND** activity.
- Give partners a second container to measure in the **EXPLORE** activity.

MAKE IT LESS CHALLENGING:

- Use a larger cup as your measuring cup (so it takes fewer cups to fill the container).
- Measure the capacity of smaller containers (which will lead to less counting).
- Avoid counting pours (or have the teacher be responsible for keeping track) and simply observe concepts of full/empty/nearly full/nearly empty as children explore the capacity of containers.

MAKING CONNECTIONS ACROSS THE DAY:

- On the playground, provide children with a variety of containers to use at a water play table or sandbox to promote exploration around capacity. You can change out water for sand, beads, seeds, or other sensory materials.
- Point out capacity during everyday routines. For example, you might point out that the pitcher of water at snack-time was able to fill 4 cups before it became empty.
- Notice the capacity of containers in the classroom: The book basket is almost *empty*. Where did all the books go? Or: The climbing structure can only fit 3 children and then it's *full*.
- Look for natural opportunities to use measurement language across the day: *full, empty, partly full, almost full, overflowing*.

Song: *Filling Cups*

The lyrics to the song are below. Teachers can play the song while children engage in free play with water and cups, or perform the activities outlined in the lyrics below as children play and imitate.

Filling, filling, filling cups
Watch me pour!
Filling, filling, filling cups
Which one has more?

If space allows, let children pour water into their own cups.

First, I'll pour some for you
Then some for me.
When I pour from here to there,
It's full, you see!

*Pour half a cup of water into one cup
Pour half a cup into another cup of the same size.
Pour the water from one cup. Into the other.*

Filling, filling, filling cups
Watch me pour!
Filling, filling, filling cups
Which one has more?

If space allows, let children pour water into their own cups.

This one is empty
Let's fill it up.
Pour it up to here, it's al-
most a full cup.

*Show an empty cup.
Pour water to a nearly full level.*

Filling, filling, filling cups
Watch me pour!
Filling, filling, filling cups
Which one has more?

If space allows, let children pour water into their own cups.

This one is nearly full
Let's fill it up.
Oops! I poured too much in my
Overflowing cup!

*Show a cup that is nearly full.
Keep pouring until it overflows.*

Filling, filling, filling cups
Watch me pour!
Filling, filling, filling cups
Which one has more?
This one's almost empty, how
much does it need?
When we pour from other cups
It's full indeed!

*If space allows, let children pour water into their own cups.
Show an almost empty cup.
Fill up that cup using other cups with a little water in each.*

Filling, filling, filling cups
Watch me pour!
Filling, filling, filling cups
Which one has more?

If space allows, let children pour water into their own cups.

Making Literacy Connections

Share the following book with children as an opportunity to deepen their understanding of capacity. The literacy extension activity below suggests another play-based experience to build spatial awareness.

Suggested Book: *A Beach for Albert* by Eleanor May

AS YOU READ:

This story explores the idea of capacity—how much water will fill Albert the mouse’s swimming pool, and what is the most efficient way to fill it up? Without using any formal measurement language like liters or gallons, this book helps children begin to understand the idea that capacity is an attribute that can be measured.

As you read:

- Make sure that children understand that a “spigot” is another word for an “outdoor water faucet.” Perhaps you can show them where your program has a spigot outside.
- Show children the cover illustration and ask: Have you ever gone to the beach? What do you like to do at the beach?
- The mice decide to make their own place to swim by filling the large bowl with water. Pause and show children the illustration of the bowl after Albert has poured one bucket of water in it. Ask: Do you think the bowl is nearly full? Or nearly empty? Do you think Albert will be able to fill the bowl quickly or slowly? Listen to children’s explanations and predictions before moving on.
- The story shows that sometimes containers can be tricky: One container may *look* bigger than another but actually be the same size. (Perhaps you can show children an example of this in real life.)
- Ask: Why is Albert getting tired? What do you think he can do to fill up the bowl?
- Ask: Hmmm, the cup holds more water than the pail. This makes Albert happy! But the cup is also heavier. What do you think makes it heavier? (It’s holding more water.)
- When Albert accidentally spills water all over Wanda, ask how Wanda feels. How is Albert feeling?
- All of Wanda’s and Albert’s friends save the day. The bowl is filled quickly with everyone’s help. Ask: If you were able to swim with Wanda and Albert, what would you like to do in the water?

BUILD ON THE BOOK

Materials: A plastic container or plastic bowl; a teaspoon for each child, a tablespoon for each child, a small (4 oz cup) for each child, water in a plastic pitcher, animal figures

Show children the container and tell them it’s Albert’s pool! But the pool is empty, and the children need to fill it. Ask them to predict which tool will fill the pool the fastest. Which tool will fill the pool most slowly?

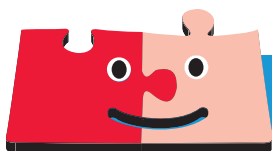
Distribute the teaspoons to start. Give each child the chance to scoop and pour a teaspoon of water into the pool. Prompt child observations: Is it nearly full? Or nearly empty? Explore children’s predictions: Do we need a lot MORE teaspoons of water? Or just a few more teaspoons to fill it up?

Move on to the tablespoons. Facilitate a similar conversation.

Continue with each child pouring a 4 ounce-cup of water into the bowl. Continue the conversation about capacity. Discuss which spoon or container would help them fill up Albert’s pool up quickest.

Allow children to explore by filling the bowl in whatever way they wish.

Conclude the discussion by reflecting on their discoveries: What tool helped us fill the bowl quickly? Why do you think it worked so well? (The cup—because it had the greatest capacity or could hold the most water.) What tool held the least water? (The teaspoons, because they had the least/smallest capacity.) Provide the animal figurines to “swim” in Albert’s pool and close with free play.



Filling and Dumping

This week, we're learning about measurement using words like:

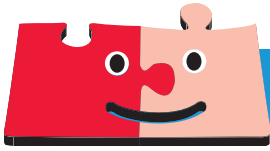
- **Full**
- **Empty**
- **Almost Full**
- **Almost Empty**



Help your child learn about the capacity of containers—or how much containers can hold.

- Play fill-and-dump games at bath-time. Give your child safe, plastic containers to fill, pour, and dump while in the tub.
- As they play, talk about full and empty. Which containers hold the most and the least water?
- Let your child help you prepare meals. Even though children don't understand the concept of measuring cups yet, you can model how to use these tools as you work together.
- Notice full/empty during daily routines:
 - Does your child want a full cup of water, or just a little bit?
 - Is their tummy "full" after they eat?
 - Is the box of cereal empty? Or almost empty?
 - Is there room to put their t-shirt away in the drawer, or is it full?

Using measurement words during playtime and everyday routines helps your child develop a strong math vocabulary!



Solo para familias

Llenar y vaciar

Esta semana, estamos aprendiendo sobre medidas usando palabras como:

- **Lleno**
- **Vacío**
- **Casi lleno**
- **Casi vacío**



Ayude a su hijo a aprender sobre la capacidad de los recipientes, o cuánto pueden contener los recipientes.

- Juegue juegos de llenar y vaciar a la hora de bañarse. Dele a su hijo recipientes de plástico seguros para llenarlos, deje que llene y vacíe mientras él está en la bañera.
- Mientras juegan, hablen sobre lleno y vacío. ¿Qué recipientes contienen más y menos agua?
- Deje que su niño le ayude a preparar las comidas. Aunque los niños aún no entienden el concepto de tazas de medir, puede modelar cómo usar estas herramientas de medidas mientras trabajan juntos.
- Observe lleno y vacío durante las rutinas diarias:
 - ¿Su hijo quiere una taza llena de agua, o solo media taza?
 - ¿Está su barriga “llena” después de comer?
 - ¿Está vacía la caja de cereales?
 - ¿Hay espacio para guardar la camiseta en el cajón o está lleno?

¡Usar palabras de medida durante la hora del juego y las rutinas diarias ayuda a su hijo a desarrollar un vocabulario matemático sólido!