Developing Measurement Concepts

Big Ideas
Measurement instruction should first focus on a conceptual approach. The first goal for students is to understand what it means to measure. Before anything can be measured meaningfully, it is necessary to understand the attributes to be measured (length, weight, and capacity). First graders who are learning about measurement need many hands-on experiences to build personal familiarity with the different units of measure being used. Students will be using non-standard units of measure (rice, cubes, hands, etc.) to develop personal benchmarks useful in estimation and comparison of measures.*

<table>
<thead>
<tr>
<th>An object can be measured by length, weight, and capacity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The attribute of the <strong>non-standard</strong> unit must match the attribute of what is being measured (i.e., Length is measured by equal units of length, weight is measured by equal units of weight, and capacity is measured by equal units of capacity).</td>
</tr>
<tr>
<td>Objects measured by length can be longer, shorter, or the same. Objects measured by weight can be heavier, lighter, or the same. Objects measured by capacity hold more, less, or the same.</td>
</tr>
<tr>
<td>The shorter, lighter, or smaller the unit, the more I need. The longer, heavier, or bigger the unit, the less I need.</td>
</tr>
</tbody>
</table>

Unit Preparation

Unit Set-Up:
- Prepare a “rice table”. To do this, get a plastic bin and fill with rice (sand, lentils, small beans, or popcorn kernels will work) along with containers of various sizes and shapes to fill (you may want to request containers from parents). One plastic bin is large enough for 2 students.

- Create an “object table” with things kids use in their everyday lives (either teacher created or kid created). As kids notice things about these objects, the teacher can add quotes to the objects to keep track of the “noticing”. This is also an opportunity to link vocabulary terms to concrete objects.

- Gather a variety of measurement tools, such as paper clips, links, tiles, cubes (for length), marbles, cubes, pan balance, scale (weight), and cotton balls, marshmallows, rice, or beans (for capacity).

*** In Kindergarten Trailblazers, the following lessons are available to build measurement concepts:
- As Tall as a ___? pgs 219-226
- Height Comparisons, pg. 259-260
- Length Comparisons, pg. 283 – 286
- If the Shoe Fits, pg. 287-288
- Teddy Bear Line-Up, pgs. 315-318
- Jumpers! pgs. 319-320
- Measuring Area, pgs. 347-348
- A Garden’s Area, pgs. 368-370
- Measuring Area with a Standard Unit, pgs. 371-378
- Exploring Capacity, pgs. 398-399
- Container Comparisons, pgs. 400-401
- Weighing In, pgs. 413-414
- Balancing Numbers, pgs. 415-417
Unit Introduction:
Administer Capacity Pre-Assessment to identify student learning targets (see pg. 39)

The tools for this activity use standard units of measurement (inches, ounces, minutes, etc) while the focus for first grade measurement is using non-standard units. The intent of this activity is to help students see that they use measurement in many areas of their lives, perhaps more than they realize. This activity is also designed to build excitement for the children before the conceptual unit begins.

Lesson 1: What can be measured?

Objective: To help students see how they use measurement in many different real-world contexts.

Materials: Gather several measurement tools, both those used at school and those used at home. Options might include tools that measure...

- Time: a calendar, watch, stop watch, kitchen timer, sand hour glass, etc
- Length: a ruler, yardstick, tape measure (contractor type and sewing type), etc.
- Weight: a bathroom scale, a food scale, a pan balance, etc.
- Capacity: measuring cups, measuring spoons, mixing bowls with measurements, pitcher with measurements, small measuring cups from medicine bottles like cough syrup, syringes with mL markings for medicine, etc.
- Money: coins, dollars, etc.
- Size: clothing tags with small, medium, large, shoes with the size marked, etc.

Crafting: Invite students to gather at the carpet. Ask them to think of what they know about measurement. Allow for think time. Invite students to share their responses. Height may be the common response. Record some student responses on a chart, “What does measuring tell us?”

Say, “In order to get information about what we measure, we use tools…” One by one, show students the measurement tools. Think aloud as a model of how mathematicians may look at tools. For example, “Hmm…this is a ruler. I notice it has a straight edge and that it has numbers along the side that start with zero and go to 12 with these little lines along it.” Ask students to reflect on what you noticed about the tool to set them up for the next activity.

Composing: Pass out tools to students (1 for each partnership). Invite students to rally robin what THEY notice about the tool they are given.

Reflection: Add student thoughts to anchor chart: “What does measuring tell us?”

Homework: What can be measured? (see Lesson 1 Homework, page 36)

Extension: At a different class session, show children the kitchen timer and ask, “When do we measure time exactly and when do we estimate?” Say, “Do you get to play video games as long as you like, or does your mom or dad set a time limit?” Or, “When you have a glass of milk, do you measure it? How about when you take medicine?”
Essential Question 1: What attributes of an object can be measured?

Lesson 2 (1-2 sessions): Why do we measure?

Objective: Students will understand that objects can be measured by weight, length, and capacity.

Materials: Gather several familiar school or home objects such as: a plastic tub, a book, a toy, a box of crayons, a pencil cup, etc.

Set up measurement stations in the room: Each station is equipped with one tool for measuring. Feel free to use units available to you in your classroom. These are suggestions:

Station 1: length (such as links)
Station 2: length (such as tiles)
Station 3: capacity (such as popcorn)
Station 4: capacity (such as cotton balls)
Station 5: weight (such as a pan balance with beans for units)
Station 6: weight (such as a pan balance with pennies for units)

Crafting: Invite students to gather at the carpet. Show one item, such as a mug, to the students and think aloud, “I wonder how I might measure this. I remember the tools that we looked at yesterday (refer back to anchor chart). I notice that this mug holds water, it is heavy, it is kind of tall…”

Ask students: “How can I measure this?” Invite students to Rally Robin with a partner to think of all the attributes that can be measured. Ask for a few student responses and record on a chart. This is a good time to start measurement vocabulary development: attribute.

Demonstrate how the mug can be measured for length (use a non-standard unit like links or tiles), for weight (place the object in one side of a pan balance and balance with cubes or blocks), and for capacity (fill the object with tiles, cubes, beans, or rice).

Share expectations and demonstrate how to responsibly handle materials in measurement stations.

Composing: The purpose of this activity is to allow students opportunities to explore and “play” with different units of measurement. They may not be using these units “correctly” at this time, but allowing for exploration will help students construct measurement understandings necessary for later in the unit. Each student chooses an object from the object table or one brought from home. With object in hand, students rotate through measurement stations to measure their objects’ attributes.

Writing: Students respond to the prompt - This is what I know about measuring so far...

Homework: Why do we measure? (see Lesson 2 Homework, page 36)
Notes: Once students have had a chance to explore the many ways we can measure an object, add relevant vocabulary from the lesson to an anchor chart or word wall: weight, length, capacity.

Save the objects measured on the object table for future lessons in comparison.
Essential Question 2: Which unit do I use to measure?

Lesson 3: Choosing and Using Units to Measure

Objective: Length is measured by equal units of length; weight is measured by equal units of weight; capacity is measured by equal units of capacity.

Materials: Recording Sheets (Lesson 3, page 29). Set up measurement centers in the room.

1. Length: Students use non-standard tools to measure the length of an object
   a. Familiar objects such as unsharpened pencils, bookmarks, or name tags.
   b. Non-Standard units such as paper clips, links, or tiles

2. Weight: Students use non-standard tools to measure the weight of an object
   a. Familiar objects such as markers, sharp crayons, small toys
   b. Non-Standard units such as marbles, unifix cubes, or other small manipulatives
   c. Pan Balance

3. Capacity: Students use non-standard tools to measure the capacity of an object
   a. Familiar containers such as yogurt containers or milk cartons
   b. Non-Standard units such as dice or counters (something big enough for kids to count, but small enough to fill the container).

Crafting: “Yesterday we got to explore our measurement stations and learn about how objects can be measured. Let’s see what we know about measurement so far (read from students’ responses from previous lesson). Today, you will be rotating again, but you will be writing down the measurements you observe.” Model how to fill out the measurement record sheet, completing the chart for at least one object for each table.

Composing: Students rotate through each measurement station. As students explore the measurement stations, they respond on the recording sheet: Draw a picture of the object you measured and how you measured it (see Lesson 3, page 29)

Reflection: Ask students what object they measured and what unit they used. Ask why they chose a particular unit. Ask if other students measured the same object, or used the same unit to measure a different object. Invite students to compare results. Were they the same? Why or why not?

Assessment: As students measure, observe student measuring approximations. Allow students to explore their misconceptions – if they are not lining up the objects accurately to measure length, just make note of it at this time.
Lesson 4: Linking Up (See Trailblazers, Grade 1, Unit 6, Lesson 1)

Objective: Length is measured by equal units of length.

Reflection: What did you learn about measuring length today?

Lesson 5: Measuring our World - Weight

Objective: Weight is measured by equal units of weight.

Materials: Pan balances, objects to weigh, non-standard units (cubes), recording sheet (Lesson 5, pg 30)

Crafting: Ask students, “What did you notice about the pan balance when we used it the other day?” Students share with a partner. Ask, “What was tricky about the pan balance?” Allow time for student response. Think aloud: “Today we are going to use this tool to weigh objects accurately. I want to be sure that I can get good information, so I’m going to ask myself questions about whether the balance is working and if my results make sense.” Ask students, “How did you decide when it was balanced?” Invite student responses.

Show students how to balance a pan balance accurately. Some teachers add paper clips or modeling clay to the top bar to balance. Now that students have explored and built background knowledge about using a pan balance to measure weight, they will accurately use the tool.

Composing: Students weigh objects using a pan balance and record weights on the recording sheet.

Assessment: Note students’ accuracy with measuring weight and question students to help clear up misconceptions.

Reflection: What did you learn about measuring weight today?
Essential Question 3: How do I use measurement to compare objects?

Lesson 6: Drop by Drop (adapted from http://illuminations.nctm.org/LessonDetail.aspx?ID=L127)

Objective: Students engage in activities that promote understanding of how to measure volume using standard units.

Materials: Prepare approximately one quart of water for each pair or small group of students. For demonstration purposes, use a quart of water, a couple of empty containers, and a “cup” for measuring.
- Book: Drip, Drop, by Sarah Meeks
- One quart of water for each pair of children
- Measuring “cup” – can be a yogurt container or other non-standard unit of measurement
- Various Containers - each group should have one container (containers should be different sizes/none larger than a quart)

Crafting: Gather students so they can see the book and hear the story, Drip, Drop, by Sarah Weeks. This story portrays a mouse that keeps getting leaks in his roof during a rainstorm and chooses to catch the water with different kitchen containers (i.e. a pan or cup). After reading the story, explain that each pair of students will pretend that it has rained in the classroom and will measure how many cups and tablespoons different containers can hold using the “rain” that fell.

Model for the students how to measure the number of “cups” of water a container can hold by moving one cup from the full container to the empty container. Explain that you are measuring the capacity of the different containers. Have the group count aloud each cup of water you move from the quart you have prepared to the empty containers. When each container is full, discuss that the capacity of the container was __ cups. Repeat the demonstration using different containers or different measuring devices and units.

Composing: Ask students to predict how many cups it will take to fill their container and then record their prediction. Working with their teams, students count how many “cups” it takes to fill the container. Students can record on scratch paper or a post it note like this:

Prediction____________ Actual Amount ______________

Reflection: Each student pair or team brings their measurement and empty up to the carpet area to share. As a class, sort the capacity of the containers from smallest to largest capacity. Reflect on surprises about the relationship between the size / shape of the container and its capacity.
Lesson 7: Capacity Sort (See Activity 8.13 in Student-Centered Mathematics, page 238)

Objective: Use non-standard units to compare objects according to their capacities or weight (PE 1.4.D).

Materials: For each student group of 4
- a large tub of filler (rice, beans, small cubes...)
- a target container (labeled as TARGET),
- 5-6 comparison containers labeled A,B,C, etc.
  - It is advantageous to have containers that are tall and skinny, and some that are short and wide. The containers selected should challenge students’ concept of capacity.
- Recording Sheets (Lesson 7, pg. 31-32)

Crafting: Invite students to gathering space. Remind students that so far, you have practiced accurately measuring length and weight. Say, “Today, we will work some more with measuring capacity.” Show two containers to the students (one filled - the target; one empty). Ask, “Do you think this (empty) container holds more, less, or about the same as this (filled) container?” “Why do you think so?” Provide think time, then invite students to share their prediction and reasoning with a partner.

Think aloud about capacity comparisons: “If I pour the rice from this (target) container into this (smaller) container, I notice that some rice spills out. I’m wondering what that means…” Invite students to turn and talk to a neighbor.

Say, “If I have this right, you’re saying that it means that the container is SMALLER/HOLDS LESS than the target container. Interesting...” Ask students what it means if you pour the contents of the target container into a different container and it doesn’t fill up (the comparison container holds more). Model capacity comparisons with a few more containers and continue to invite student thinking, paraphrasing what students are saying to model the language of capacity.

Show students the worksheet they will use (pg. 31-32) and model how to use it to keep track of the capacity comparisons. Set expectations for how many containers to compare (the worksheet has space for up to 6 trials).

Emphasize that the children should predict the capacity first before testing it. Review rules for handling materials. Note that students can compare containers in any order and everyone should be working at all times. Ask students to try their best to keep their findings private so everyone can enjoy the discovery process. However, don’t worry if the knowledge is shared. The children are beginning to explore and test their thinking about containers and capacity.

Composing: Dismiss students to work in groups of 4. Each group should have a large tub of filler (rice, beans, small cubes...), a target container (labeled as TARGET), and 5-6 comparison containers labeled A,B,C, etc. Monitor groups as they work; assist as needed to clarify directions. Listen for and record student dialogue as they work through the comparisons.
Some guiding questions useful for students who seem stalled in their work:

- What are you trying to find out?
- What is your guess? (more, less, about the same)
- How can you find out?
- What does it mean if the filler spills over, doesn’t fill up the container, or almost exactly fills the container?

Reflection: After sufficient time for students to test several containers, invite them back to the gathering space. Ask, “Did you find out anything surprising?” Is taller always more? Is shorter always less? Record some observations on chart paper as an artifact of the learning. Collect students’ worksheets.

Writing: Now what do we know about measuring capacity?

Homework: Students continue capacity explorations with objects at home (see Lesson 7 Homework, pg. 37)
Lesson 8: Capacity Line Up (See Activity 8.14 in Student-Centered Mathematics, page 239)

How can we determine which containers hold more than, less than, or about the same as a target container? How can we order containers based on their capacity?

Objective: Use non-standard units to compare objects according to their capacities or weights (PE 1.4.D)

Materials: Enough sets of small containers for students to work in pairs. Each set of containers should be the same so students can reflect as a class on the results. Containers should mostly be different than the ones used in Capacity Sort. Large tubs of filler (rice, beans, etc). Recording Sheets (Lesson 8, pg. 33)

Crafting: Invite students to the gathering space. Begin the lesson by referring to the chart from the Capacity Sort lesson. Ask 1 or 2 students to retell what they learned in that lesson.

Tell students that today their focus is to determine the order of containers - from which container has the least capacity to the one which has the most capacity. Show students a collection of 5-6 containers and ask them to think-pair-share how they might go about determining the order. Ask one or two students to share out with the group. However, do not emphasize using one particular strategy. One of the main teaching goals for this lesson is for students to discover their own method for determining capacity. Show students the worksheet (see pg. 33) they will use during the lesson to record their findings.

Composing: Dismiss students to work with a partner at one of the stations. Explain they can work together on determining the order of the containers but each student is responsible for filling out the worksheet.

Monitor students as they work; assist as needed to clarify directions. Listen for and record student dialogue as they work through ordering the containers.

Ask guiding questions of students who seem stalled in their work:
- What are you trying to find out?
- What is your guess as to the order of the containers?
- How can you find out?
- Does filling each container to the top tell you what you need to know?
- Can you determine the container with the least, or most, capacity? Can that help you determine the relative capacity of the remaining containers?

Reflection: After sufficient time to determine the order of the containers, invite students back to the gathering space. Ask student pairs to share their discovery with another pair of students. Did they get the same results? Why or why not?

Ask for some students to share out their findings with the whole group. Record their responses on chart paper.

Discuss what students learned from today’s lesson. Ask them when they use capacity in their own lives (how much medicine to take; how much milk to drink; how much water or oil to add to a recipe; what container to put left-overs in, etc).
Ask when it is important to be exact in measuring capacity (recipes, medicine, buying milk, juice, gasoline, etc) and when it is okay to estimate (drinking milk, having a bowl of soup, some water for washing the car or dog or watering plants, finding a container for Legos or other small toys).

Lesson 9 (optional lab): Rolling Along with Links (See Trailblazers, Grade 1, Unit 6, Lesson 2)

Objective: Measuring, comparing, and ordering lengths.
Children build a cube train and compare its length to the length of other objects in the room.

**Key Content**
- Describing length relationships using comparison language: longer than, shorter than, or close to.

**ACTIVITY**

**Longer, Shorter, or Close To?**

**Materials**
For the Student

Note Home Blackline Masters (English/Spanish), Pages 285–286
train of 6 connecting cubes

**Developing the Activity**

Begin the activity by posing questions like the following to the children:

- Is the chalkboard longer than, shorter than, or close to this book? The wall?
- Is a pencil longer than, shorter than, or close to the length of this book? This crayon?
- Is a ______ longer than, shorter than, or close to the length of a ______?

Have children sit in a circle. Give pairs of children a cube train that is six cubes long. Ask them to find one thing that is longer than, one thing that is shorter than, and one thing that is close to the length of the cube train. When they bring the objects back to the circle, give each child an opportunity to use his or her own language to describe how much the difference is by using the vocabulary of “a lot,” or “a little bit,” taller or shorter, or “close to.”

**Homework:** Students compare objects to the 6 cube train (see Lesson 10 Homework, pg. 38)
Lesson 11: Balancing Numbers (See kindergarten Trailblazers Month 9, Lesson 4)

Reproducible: See Lesson 11: Balancing Numbers, pg. 34

Balancing Numbers

In this activity, the balance is used to model a variety of problem-solving situations involving addition and subtraction. The task, which is introduced as a whole-class activity, can be placed in the math center.

Key Content
- Developing the concept of mass and its measurement.
- Working with a balance.
- Solving problems involving addition and subtraction.

ACTIVITY

Using a Balance

Materials
- For the Student
  - Making Both Sides Balance Blackline Master, Page 417
  - Two-pan balance, for the class
  - 12 small wooden blocks or connecting cubes, for the class
  - Number cube (large, if available)

- For the Teacher
  - Observational Assessment Record (Teacher Implementation Guide, Assessment section)
  - Chart paper
  - Marker
  - Just a Little Bit, by Ann Tompert, optional

Before the Activity

Make sure the balance is correctly zeroed, as described in Lesson 3, before beginning the activity.

Developing the Activity

If possible, introduce the lesson by reading Just a Little Bit, by Ann Tompert. Then, gather the children in a central area, with the balance, blocks, and number cube visible to all. Choose a child to roll the number cube and place that number of blocks on one side of the balance. Have another child roll the number cube. Ask the class to predict whether that number of cubes will be heavier, lighter, or the same as the cubes already on the balance, and how they know. Have the second child place the blocks on the balance. Ask children how to make both sides balance. Expect them to suggest adding cubes to one side or taking cubes away from one side. Ask, "How many cubes do we need to add to (or subtract from) one side of the balance to make both sides balance?" You can record these solutions as number sentences. After doing this activity several times as a whole group, it can become a center activity.

Assessment

Put 3 red cubes and 4 blue cubes on one side of the balance. Ask a child to tell how many cubes must be put on the other side to make both sides balance.

The Making Both Sides Balance Blackline Master is provided as a possible assessment. Children should have access to the two-pan balance and cubes to solve the problems, if necessary. Record your observations on the Observational Assessment Record in the Assessment section of the Teacher Implementation Guide.

Extension

If your classroom equipment includes a see-saw, it can be used as a large balance to compare the weights of heavier objects.
Lesson 12: Measurement “I Spy”

Objective: An object can be described by comparing its attributes of measurement to benchmark items.

Materials: Misc. objects from the classroom and object table, each hidden in a brown paper sack.

Crafting: Teacher chooses an object, such as a pencil. Without showing students the pencil, describe its measurement attributes. Ex: “I have an object that is longer than this paper clip. But it is shorter than this ruler. It is about as long as my hand. What do you think it is?” Students continue to ask comparison questions to hone in on what the teacher “spies”. Expand to comparing weight and capacity.

Composing: Pass out a brown paper bag concealing an object to each pair of students. Students play measurement “I Spy” with partners.

Reflection: Now what do we know about measurement?

Homework: Lesson 13 Homework: Measurement “I Spy”, pg 38
Essential Question 4: How does the size of a unit affect the number of units needed?
Lesson 13 (1-2 sessions): Changing Units (length)
(See Activity 8.6 in Student-Centered Mathematics, page 231)

Objective: Students will understand how larger units will result in a smaller measure and vice versa.

Materials:
- Non-standard measuring units for length: tiles, paper clips of 2 sizes, links, toothpicks, cotton swabs. Put 2 different types of units at each table.
- Objects that can be measured by length (books, desk top, full-size pencil, white board eraser). Each table should have the same objects to measure if possible.
- Chart paper (sample below for class reflection after students work independently) and student recording sheets (Lesson 13, 15, 16, page 35).

<table>
<thead>
<tr>
<th>Object</th>
<th>1st Unit:</th>
<th>2nd Unit:</th>
<th>3rd Unit:</th>
<th>4th Unit:</th>
<th>5th Unit:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book</td>
<td>Tiles</td>
<td>Cotton Swab</td>
<td>Toothpick</td>
<td>Links</td>
<td>Small Paper Clips</td>
</tr>
<tr>
<td>White board eraser</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

What patterns do you see in this chart? What do you notice about the size of the unit and the number needed to measure?

Crafting: Invite students to gather at the carpet. Show them 2 units (for example, small paper clip for shorter unit and toothpick for longer unit) of measurement and ask, “Which unit needs more to measure the length of the book? Why?” Ask for student predictions and explanations.

Measure the length of the book using the smaller unit and record on the student sheet. Ask students to predict the measure of the book using the second unit. Have students share predictions with a partner and tell why they predict that number. Record the predicted number before measuring. Then, make the actual measurement to verify predictions. Record.

Composing: Now you and a partner will measure objects and use 2 different units to measure the same object. At the tables, you will find 2 types of units and lots of objects to measure.

Reflection: When students are done, they can reconvene on the carpet to share out. Ask pairs to share what they found out and how they predicted whether an object would need more, fewer or the same amount of units to measure. Record the data on a chart (see sample above) as they share.

The predictions and explanations will be the most powerful part of the activity. Ask students if they see any patterns: bigger unit takes fewer, smaller unit takes more...
Lesson 14: Using Unusual Units (see Trailblazers, grade 1, Unit 6, Lesson 4)

Objective: Objects measured by length are longer, shorter, or the same.

Lesson 15: Changing Units (weight)

Objective: Students will understand how larger units will result in a smaller measure and vice versa.

Materials:
- Non-standard measuring units for weight and pan balances: beans, small cubes, pennies, etc.
  Put 2 different types of units at each table
- Objects that can be measured by weight (books, full-size pencil, boxes of crayons). Each table should have the same objects to measure if possible.
- Chart paper (sample below for class reflection after students work independently) and student recording sheets (Lesson 13, 15, 16, page 35).

<table>
<thead>
<tr>
<th>Object</th>
<th>1st Unit: Lima Beans</th>
<th>2nd Unit: Pennies</th>
<th>3rd Unit: Unifix Cubes</th>
<th>4th Unit: Marbles</th>
<th>5th Unit: Wooden Cubes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box of crayons</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

What patterns do you see in this chart? What do you notice about the size of the unit and the number needed to measure?

Crafting: Follow the same procedure as Lesson 13, but extend to measuring weight with different units.

Composing: Student pairs or groups of 4 weigh objects using the pan balance and different units of measurement. Pose questions such as:
- How did you make your prediction for the second unit?
- Was your prediction confirmed? Why or why not?
- Why do you think it takes fewer pennies to weigh that object than beans? Tell me more...

Reflection: When students are done, they can reconvene on the carpet to share out. Ask pairs to share what they found out and how they predicted whether a unit would take more, fewer or the same amount of units. Record the data on a chart (see sample above) as they share.

The predictions and explanations will be the most powerful part of the activity. Ask students if they see any patterns: bigger unit takes fewer, smaller unit takes more...
Lesson 16: Changing Units (capacity)

Objective: Students will understand how larger units will result in a smaller measure and vice versa.

Materials:
- Non-standard measuring units for capacity: beans, unifix cubes, cotton balls, etc. Put 2 different sized units at each table
- Objects that can be measured by capacity (cups, containers, boxes, etc.) Each table should have the same objects to measure if possible.
- Chart paper (sample below for class reflection after students work independently) and student recording sheets (Lesson 13, 15, 16, page 35).

<table>
<thead>
<tr>
<th>Object</th>
<th>1st Unit: Snap cubes</th>
<th>2nd Unit: Cotton balls</th>
<th>3rd Unit: Marbles</th>
<th>4th Unit: Small cup of Rice</th>
<th>5th Unit: Tiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue bowl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empty cookie box</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

What patterns do you see in this chart? What do you notice about the size of the unit and the number needed to measure?

Crafting: Follow the same procedure as Lessons 13 and 15, but extend to measuring capacity with different units. *Note: Students can count cubes or cotton balls to determine how many units are needed to fill a container. When using rice or beans, though, you will need to set a standard unit. For example, students count how many small Dixie cups of rice are needed to fill the container. The comparison then is the number of cups needed to fill the container.*

Composing: Student pairs or groups of 4 measure the capacity of objects by filling with different sized units. Pose questions such as:
- How did you make your prediction for the second unit?
- Was your prediction confirmed? Why or why not?
- Why do you think it takes fewer ____ to fill that object than ____? Tell me more...

Reflection: When students are done, they can reconvene on the carpet to share out. Ask pairs to share what they found out and how they predicted whether a unit would take more, fewer or the same amount of units. Record the data as they share.

The predictions and explanations will be the most powerful part of the activity. Ask students if they see any patterns: bigger unit takes fewer, smaller unit takes more...)
Unit Closure:

- **Administer Capacity Post-Assessment**
- **Capacity Celebration** – Students can use measuring cups to follow a recipe for “capacity trail mix”
- **Capacity Anthology** – Students can compose stories related to capacity (see list of mentor texts) and publish them in a class book
- **Measurement Math Problems** – Students can compose problem solving tasks related to measurement and solve one another’s problems.
- **Other ideas?**