

Problem Solvers Activity 18: Compared to What?

CHILDREN ARE LEARNING TO...¹

- Demonstrate awareness that objects can be compared by length, weight, or capacity, by observing significant 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:

Several spools of ribbon—all the same color. Make sure you have at least 12 feet of ribbon in total.

Scissors

8 pads of sticky notes (3x3 inches)

A child-safe item from the classroom that is 12-18 inches long (a book, a mat, a picture, stuffed animal, etc.)

Doll

Handout 1: Numbers

PREPARATION:

- Cut 12 lengths of ribbon. Use the following dimensions as a rough estimate. The lengths don't have to be perfect in order to run the activity.
 - 24 inches – cut 2 lengths
 - 18 inches – cut 2 lengths
 - 12 inches – cut 2 lengths
 - 8 inches – cut 2 lengths
 - 6 inches – cut 2 lengths
 - 2 inches – cut 2 lengths
- Spread the ribbons out (in no particular order) on the table where you will introduce the activity.
- Have the sticky notes and child-safe item handy for the **EXPAND** activity.
- Have the doll ready for the **EXPLORE** activity.
- Print two copies of **Handout 1** for children's reference. Laminate if you wish to make this resource sturdier.
- 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.

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

Background Information on Teaching Measurement and Length

Measurement is a complicated concept for young children! Children take their first steps toward understanding the concept of measuring length when:

- By age 3, they recognize length as an attribute, or feature, of an object. They may *not* be able to compare length yet.
- Starting at age 4 years, children can compare the lengths of objects to determine which is longer or whether they are same length. They may do so by lining the objects up next to one another. At this age, they also are beginning to use non-standard measurement tools (like sticky notes in this activity) to measure items.

There are several understandings that help children develop the skill of measurement over time. The first is the idea of *identical units*², which means that once you decide on a unit of measurement (like a sticky note), you must continue using that same unit throughout your measuring task.

Another concept children are practicing in this activity is *unit iteration*³. Unit iteration is when children use a given unit (like a sticky note) repeatedly in order to find a measurement. By laying multiple units from end to end (called *tiling*), children can determine the length of an object by counting the number of units—in this case, sticky notes—that they use.

Children are also practicing the concept of “covering.”⁴ This means that when measuring, there cannot be any space that is not “covered” by a measurement unit. Finally, children are also discovering the idea of “remainders”⁵—leftover space that must be described in some way. In this activity, children may find that it takes 3 sticky notes plus “a little bit” of another sticky note to measure a ribbon. This is age-appropriate language that, over time as they enter school, will form the foundation for understanding fractions.

As children practice unit iteration, they will be developing **very early** experience with *transitive reasoning*⁶, which is a concept based on comparison. For example, if three ribbons (A, B and C) have different lengths and A is longer than B, and B is longer than C, then we can also say that A is the longest of them all. Understanding this idea is quite challenging for young children and is a concept that develops over time.

It is important for teachers to remember that the **goal of this activity is not for children to master** the concept of measurement, but to have meaningful opportunities to practice and explore this concept.

² Bush, H. (2009). Assessing children’s understanding of length measurement: A focus on three key concepts. *Australian Primary Mathematics Classroom*, 14(4), 29-32.

³ Ibid.

⁴ EdTech Leaders Online. (2007). *The importance of units and iteration in measurement*. Retrieved from: http://courses.edtechleaders.org/documents/elemmeasure/Reading_Units.pdf

⁵ Ibid.

⁶ Bush, H. (2009). Assessing children’s understanding of length measurement: A focus on three key concepts. *Australian Primary Mathematics Classroom*, 14(4), 29-32.

Activity Instructions

ENGAGE

Gather a group of 4 children.

Show children the ribbons. Encourage children to explore/touch/sort the ribbons as they wish.

As they do so, listen for children's use of measurement language (long, short, big/bigger, short/shorter, wide, narrow).

ASK: What do we have here? What can you tell me about these? What do you notice about them? What is the same about them? What is different about them?

Facilitate a conversation where children share their observations. You may hear children making discoveries like the ones below. Take time to summarize what you hear, such as:

- The ribbons are different lengths. Some are long, some are short.
- We can put them in order by how long (or how short) they are.
- We can see which ones are longer or shorter by...[insert the strategies children suggest].

If children are not exploring length during this free play, you might prompt them by asking a question like: *I see some long ribbons and some short ribbons. Do you see any long ribbons? Can you find a short ribbon?*

After children have had an opportunity to explore these materials:

Place 2 ribbons (of different lengths) about 6 inches apart. Place one horizontally on the table and one vertically.

ASK: Problem Solvers, let's look at these two ribbons. What can you tell me about them?

Listen for children to describe their length, and to compare them (big/bigger or long/longer).

Observe to see if children change the position of the ribbons so they are both horizontal or both vertical, in order to better compare them.

ASK: What can we do to figure out which one is longer?

Often children suggest lining the ribbons on top of one another so they can be compared. Validate that this is a good strategy and encourage them to try this approach.

Listen for children's responses/ideas and re-state their discoveries:

- In order to compare the length, I see that you lined them up at the same place.
- Then you looked to see which ribbon went the farthest.
- I heard you say that the ribbon that goes farther is the longest ribbon.
- That means *this one* is longer than this one.
- *This one* is shorter than this one.
- Encourage prediction: What would happen if we moved this ribbon over a little bit? Can we still compare them? Why not? (Because they are not starting from the same place.)

For children 3.5 years and up: Add a third piece of ribbon to the set of 2.

ASK: We have a set of two ribbons—one is longer and one is shorter. Now here is a third piece of ribbon. Where should we put this ribbon?

Listen as children talk through this question, compare the ribbons, and decide where to put the new one. **Summarize** children's thinking about how they came to choose a position for the third ribbon. **Describe** the ribbons as long, longer, and longest.

SAY: Let's put all the ribbons back together. [Lay all 12 ribbons on the table once again.] Now, let's play a different game. Let's sort these ribbons into two sets. Let's make one set of LONG ribbons and one set of SHORT ribbons. What can we do to figure this out, Problem Solvers?

Listen to how children think this through. Children may have an easier time sorting the ribbons that are quite clearly long/short. **Observe closely** to see how children determine where to place ribbons that are "in the middle." Are they lining the ribbons up next to one another to assess length? How do they decide on a "cut-off point" for long and short? **Note:** *There is no right answer* to this task—it is designed to spark children's thinking about measurement.

EXPAND

SAY: Let's take a look at this ribbon. [Select a ribbon about 12-18 inches long.] We know this ribbon is pretty long. But I want to know how long it is. I have a tool to help us figure that out.

Take out the sticky notes.

SAY: I'm going to use these sticky note squares as a tool to help me figure out how long the ribbon is. I will put the first square at the edge of the ribbon, right here. [Model how to begin measuring from the edge of the ribbon. Place a sticky note directly under the ribbon so children can see both note and ribbon at the same time.]

SAY: Our ribbon is longer than one square. Let me put down another square. [Lay a second sticky note.] What about now? Do we need another square?

Choose a child to place the next sticky note and continue until they reach the end of the ribbon. If the final sticky note extends beyond the ribbon, that's okay!

SAY: Let's see how many squares long our ribbon is. [Count together with children and summarize: Our ribbon is ____ squares long.]

If the final sticky note is longer than the ribbon, you can state: *The ribbon is 3 squares plus a little bit of another square long.*

"COVERING" THE RIBBON

In this part of the activity, children are practicing the concept of "covering." Covering means that when measuring, there cannot be any space that is not "covered" by a measurement unit (in this case, the sticky note).

You may need to help children place the sticky notes next to one another without overlapping or having space between them.

SAY: Let's try it again. This time, let's measure something in our classroom.

Take out the selected child-safe classroom item. Give each child a pad of sticky notes. Choose a child to begin and have them start by placing the first sticky note at the edge of the item. Continue giving each child a turn to add to the line until you have reached the end of the item. Then take turns counting each sticky note in the line until the group has discovered how many sticky notes long it is. Write the numeral on a sticky note and place on top of the item.

Place children in pairs and give each pair a pad of sticky notes. Ask them to find something to measure in the room and bring it back to the table. For younger children (30-36 months), it is best to have items pre-selected and continue to run this activity as a small group.

When pairs return to the table, ask them to use the sticky notes to measure the items. Observe how they approach this task and provide support if needed.

When they are done measuring, ask them to count the sticky notes with you. Label a sticky note with the numeral the describes how long the item is. Let children place the label on the item.

If children wish, they can try to write the numeral themselves. Offer **Handout 1** as a reference for children if they wish to write their own label.

Invite each set of partners to show their item and say how long it is.

SAY: This item is ___ squares long (point to your original item). This item is ___ squares long (point to the first group's item). And this item is ___ squares long (point to the second group's item). What can we do to figure out which is the *longest*? How do we know? What makes you think that?

[For children under 42 months, compare only two items.]

ASK: Which is the *shortest*? What can we do to figure that out?

SAY: Let's put these things in order. What should go first as the *longest*? What should go next? What item is the shortest? How do we know?

Listen to how children think through this task. Provide support as needed—offering suggestions like lining items next to one another or lining up the sticky notes next to one another to see which is longer.

Use terms like long/longer/longest and longer/shorter as children work on this task.

IT HAS A BIGGER NUMBER

Some children (approaching age four) may observe that an item is longer because it has the most sticky notes or a "bigger number." What a great observation!

Validate that the more squares it takes to measure an item—the larger the number—the longer the item is.

EXPLORE

Run the How Tall Am I activity below as a small group activity for children aged 2.5 to 3 years. Measure the height of 2–3 children as time allows. Let children take turns placing sticky notes as they measure their peer and count the squares together as a group.

Try the How Tall Am I? activity as partners—for children aged 3 and up.

SAY: Now, you and your partner will have a chance to see how tall you are. How will we do it?

Take out the doll and place it on its back on a table. Demonstrate the activity with the sticky notes.

SAY: If you lie down on your back like my doll friend here, your partner can place the sticky notes in a line to see how many it takes to measure tall you are. Where should I start with the first sticky note?

Listen for children's suggestions. Establish a shared understanding of placing the first sticky note either at the head or heel of their partner.

Continue placing sticky notes in front of the doll until you have reached its full length.

SAY: I put the squares next to the doll. I didn't touch my friend here, did I? No, I put the squares right next to my friend. When I'm done, my friend can get up very carefully and help me count the squares.

COMMON COUNTING ERRORS

Here are some common errors you may observe:

- Skipping a number in the counting sequence (1, 2, 4, 5)
- Repeating a number in the counting sequence (1, 2, 3, 3, 4, 5)
- Using the incorrect sequence (1, 2, 4, 3, 5)
- Counting the same object more than once
- Skipping an object when counting

It's no big deal if children make these errors! When they are done, simply suggest that the two of you try again, together. Model the correct counting sequence while pointing to each item as you count.

Move the doll into a standing position.

SAY: Let's count to see how many squares tall my friend is. [With the children, count the sticky notes.]

SAY: My friend is ____ squares tall! Now it's your turn! With your partner, choose who will go first. That person will lie down on their backs while the other partner measures them with these squares. Then you'll switch.

Distribute more sticky notes to the pairs of children, if needed.

Let partners begin measuring. After each child has been measured with the sticky notes, use masking tape to tape the sticky notes together in a line.

Observe as children count the sticky notes to ensure they are counting accurately. Children may be more than 10 sticky notes tall so will likely need support counting up to, and beyond, ten.

Give each child the opportunity to write their name on the top sticky note of "their" line. If they wish, they can try writing the numeral to indicate how many squares tall they are, or you can write this for them. **Handout 1** can be used as a reference for writing numerals.

Observe children's conversations during this activity—as they will probably begin to naturally make comparisons and observations. Listen for measurement terms and summarize their discoveries.

Conclude the activity when both children in each pair have had an opportunity to measure and be measured. If you wish, hang the sticky note measurements up in the classroom and/or allow children to take them home.

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 measurement language they may use as they respond to these discussion questions.

- What did you discover today about measuring?
- How is measuring helpful?
- What do you think we can learn from measuring things?
- What did you enjoy about measuring today?
- What do you think is tricky about measuring? What strategies did you use to help you with the tricky parts?

Individualizing the Activity

MAKE IT MORE CHALLENGING:

- In the **EXPAND** activity where partners find an item in the classroom to measure, challenge them to then find *another* item that is either **shorter** or **longer** than their original selection. Or ask them to find something in the classroom that is the same/**equal** in length to their original item.
- In the **EXPAND** activity, after you have measured one item with the sticky notes, select another item and ask children to predict how many squares long they think it will be. Place it next to the original item to promote children's ability to compare and predict.

MAKE IT LESS CHALLENGING:

- Use shorter items for the **EXPAND** activity. Pre-select items from the classroom for measuring that are less than 6 sticky notes long.
- In the **EXPAND activity**, instead of comparing the length of 3 objects, compare the length of only 2 objects.
- Rather than measuring peers in the **EXPLORE** activity, measure stuffed animals or dolls in the classroom.

MAKING CONNECTIONS ACROSS THE DAY:

- Place the sticky notes and ribbons in a basket and add it to the Manipulatives area or another Center to encourage math play. Include a copy of **Handout 1** and writing utensils to invite children to write down the lengths of objects they measure.
- Use measurement activities to solve daily classroom dilemmas. For example, perhaps you want to know how much craft paper you need to unroll in order to cover a table in the classroom. Ask children how you can measure the table to find out how long it is. (Encourage children to measure using the index cards or sticky notes and use them again to measure the craft paper before you cut it.)
- Model different types of measuring tools—for example, on the playground, children can measure how wide the sidewalk is by lining up fall leaves and counting them. Or children can take off their shoes and measure how far it is from the snack table to the sink by counting their shoes in a line.
- Look for natural opportunities to use measurement language across the day: *long/longer/longest, short/shorter/shortest, close/far, narrow/thin/wide, tall/short, big/small, heavy/light, full/empty, hot/warm/cool/cold.*

Song: *Big Steps, Little Steps*

The lyrics to the song are below. Make this a fun physical activity by asking children to join in as you model the movements below:

1. Model big, long steps on the big beats of the chant and encourage children to take long, slower steps like you.
2. Model small, short steps on the little beats of the chant and encourage children to take short, quicker steps.
3. Model big, stomping steps like a dinosaur.
4. Then model quick tip-toe steps around the room like a mouse.

Big steps, long steps
Moving right along steps
Stretch out your legs and go go go!
2x

Small steps, short steps
Tiny, tippy-toe steps
Very quick and fast we go go go go!
2x

Heavy Stomping
Feet are clomping
Like a big old dinosaur.
2x

Lightly dancing
Feet are prancing
Like a little mouse all over the floor!
2x

Making Literacy Connections

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

Suggested Book: *You Are (Not) Small* by Anna Kang

AS YOU READ:

This story is a great illustration of *comparisons* when measuring. To determine if someone is big or tall, you must compare them with someone else. This is a key concept for young children as they begin to explore the complexities of measurement.

As you read:

- Be prepared to read in a very dramatic way as these creatures debate who is big and who is small!
- Show children the cover and read the title. Ask: What do they think this book will be about? Do they think *they* are “not small”? Are *they* small or big? How do they know?
- On page one, the orange furry creature says, “You are small.” Pause and ask children, “Do you think that’s correct? Is the purple creature small? How do you know?”
- Ask the same question on page two: “Is the orange creature big? How do you know?”
- As the story unfolds, encourage children to join in and yell “Small!” and “Big!” when you get to these two-page spreads.
- Let the children yell “BOOM!” on the following page as the very big creature steps into the story. Explain that when the words are very big on the page with an exclamation mark (!) it means readers should say those words very loudly. As you look at the picture on this page, make sure children understand that the creature is so big we can only see his feet!
- Point out the parachutes carrying the very small pink creatures. Ask children: “What do you see here? Are they big or small? Are they bigger than the purple creatures? Or are they smaller?”
- At the end of the story, the creatures realize that it’s possible to be *big and small*. Ask children if they are big compared to someone in their family or someone they know. Are they small compared to someone they know?

BIGGER IS BETTER?

For toddlers and preschoolers, size (especially big/bigger!) is often mixed up with winning or being the best. Through repeated measurement explorations and play activities, children will eventually learn that “bigger” is a relative term. The book selected for this activity demonstrates this idea in a very child-friendly way.

(Brownell, J. O., Chen, J-Q., & Ginot, L. (2014). *Big ideas of early mathematics: What teachers of young children need to know*. Pearson.)

BUILD ON THE BOOK:

Materials: A collection of 10-20 items from the classroom of different sizes

Choose an item and ask children to see if they can find something on the table that makes your chosen item look *small*. Then ask them to choose another item from the table that makes your chosen item look *big*.

Give children a chance to select an item and then give peers an opportunity to select other items that, in comparison, are either big or small. As children play, observe how they make comparisons—by lining objects up, looking at them visually, or by using another strategy.

Handout 1: Numbers

1

2

3

4

5

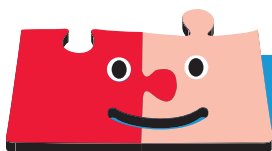
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7

8

9

10



Just for Families

Measuring Fun

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

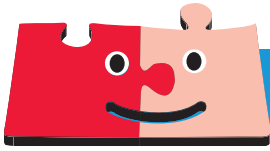
- **Big**
- **Small**
- **Long**
- **Short**
- **Same**
- **Equal**



To help your child think about big and small, line up one shoe from each member of your household. Which is big? Which is small? Together with your child, can you put the shoes in order—starting from the small shoe?

To help your child think about long and short, take out 5-6 spoons or another child-safe item. Help your child use this item to measure around the house. Line up spoons and count to see how many spoons long the table is, or how wide the door is, or how tall their teddy bear is.

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



Solo para familias

Medir la diversión

Esta semana, estamos aprendiendo sobre medidas usando palabras como:

- Grande
- Pequeño
- Largo
- Corto
- Igual



Para ayudar a su hijo a pensar en lo grande y lo pequeño, alinee un zapato de cada miembro de su hogar. ¿Cuál es más grande? ¿Cuál es más pequeño? Junto con su hijo, puede poner los zapatos en orden, empezando por el zapato más pequeño.

Para ayudar a su hijo a pensar en largo y corto, saque 5 o 6 cucharas u otro artículo seguro para niños. Ayude a su hijo a usar este artículo para medir en la casa. Alinee las cucharas y cuente para ver cuántas cucharas tiene de largo la mesa, qué ancho tiene la puerta o qué alto es su osito de peluche.

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