

The Length of my Foot

Summary

In this activity students will explore the concept of using units to measure length.

Main Core Tie

Mathematics Kindergarten

[Strand: MEASUREMENT AND DATA \(K.MD\) Standard K.MD.1](#)

Additional Core Ties

Mathematics Kindergarten

[Strand: MEASUREMENT AND DATA \(K.MD\) Standard K.MD.2](#)

Materials

- *How big is a Foot?*

Brightly colored box

Left shoe

Right shoe

Adult pair of scissors

Child-sized pair of scissors

Center 1: Heel to Toe

- ["Heel to Toe" recording sheet](#)

One shoe from "Shoe Store" dramatic play area

Regular-sized paperclips

Connecting cubes

Wooden blocks

Lima beans

Toothpicks

Center 2: Bull's-eye Bean Bag Toss

A bull's-eye target board

6 pairs of bean bags, each set of a different color

One of these nonstandard units of measurement:

connecting cubes

jumbo paper clips

straws cut in identical lengths

Center 3: Grab-bag Measurements

6 crayon boxes

6 pieces of chalk

6 blocks

6 markers

bead counter

12 beads

jumbo pipe cleaner

- [Grab Bag Measurements](#)

Center 4: Measuring Me!

Regular-sized paper clips

- [Measuring Me! recording sheet](#)

Paper for four classroom graphs with the following titles and pictures:

- "Our Wrist Size" (In paper clips)
- "Our Ankle Size" (In paper clips)
- "Our Head Size" (In paper clips)
- "Our Knee Size" (In paper clips)

Additional Resources

Books

- *Frog and Toad are Friends*
, by Arnold Lobel
- *How Big is a Foot?*
by Rolf Myller; ISBN 0-440-40495-9
- *Betcha!*
by Stuart J. Murphy; ISBN 0-06-446707-4

References

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Background for Teachers

The concept of using units to measure length will be explored in these activities. This measuring skill allows the students to compare the length of objects without placing them side by side. It also allows them to ponder these questions: How long? How short? How much longer? How much shorter? Because students' attention is drawn to the unit being used, the importance of labeling and recording the unit, as well as the number of units measured will be emphasized. Since non-standard units vary in size, children can be shown the importance of the size as well as the number of units in describing the length of an object. These activities will require the use of equal-length units. The most important concept to emphasize with the children is that more units are needed to measure a given quantity when the units are small than when they are large. Additionally, research has shown that activities that involve estimating the length of an object in two different sized units and then checking these estimates by measuring are highly recommended. Therefore, the following activities are designed to develop that skill.

Intended Learning Outcomes

5. Understand and use basic concepts and skills.
6. Communicate clearly in oral, artistic, written, and nonverbal form.

Instructional Procedures

Preparation

In advance, invite three parent helpers to come and assist you on the day this concept will be

introduced to the students. Plan to have the volunteers stay one hour.

In preparation for this concept to be introduced, share the book *Shoes, Shoes, Shoes* by Ann Morris. Set up a "Shoe Store" in the dramatic play area. Materials for the play area could include any of the following:

- Shoe racks with numbered labels for shoe size

- Shoe measurement tools

- Standard measuring tools: Measuring tape, yard sticks, rulers,

- Nonstandard measuring tools: connecting cubes, blocks, yarn, beans

- Triple beam balance for comparing weights of various shoes, or bathroom scales

- Shoe advertisements from retail stores

- Venn diagram made from hula hoops to sort shoes according to characteristics (color, laces vs. none, heels vs. no heels, etc.)

- Paper for sorting labels, price tags, shoes sizes, etc.

- "Heel to Toe" recording sheet for shoe measurements and estimations (See recording sheet)

- Cash register and play money

The week before this concept is to be introduced, send a note home to parents, inviting them to donate an old pair of shoes for our classroom "Shoe Store" or gather the shoes yourself. Explain to the students that the class will be having a Shoe Store in the dramatic play area and that we need shoes to sort according to style, size and color. We will measure and weigh the shoes, as well as pretend to be workers and shoppers in our store.

As children arrive the following day, have them place the shoes they brought in the Shoe Store.

Invitation to Learn

Gather students in a large group for listening and discussing. Display a brightly colored shoe box.

Say: What two things do you think I have in this colorful box? Hmmmm....let me give you some clues...

They begin with the letter "s"

The sound at the beginning of this pair of items is "sh"

You can wear them

You can even measure things with them.

After students have had the opportunity to guess, take a right and left shoe from the shoe box, each of a dramatically different size, style, and color. Try to put both shoes on your feet. After much effort, stop and ask the children what the problem is.

Set the shoes aside and gather students in a large group setting appropriate for sharing the story, *How Big is a Foot?* by Rolf Myller. (The book concerns a king's decision to surprise his wife, the queen, on her birthday. The king plans to have a bed made for her. This gift was sure to be a great surprise, because beds had not yet been invented. This book is a terrific precursor for helping children understand that non-standard as well as standard units need to be equal in length.)

Instructional Procedures

Discuss the story *How Big is a Foot?* by Rolf Myller. Ask why the king needed to measure the length and width of the bed. Ask the students why the king's bed was different from the apprentice's bed. Ask students to identify what the king and the apprentice used to make the measurements for the bed.

Introduce the idea of a *unit*. A variety of units can be used to find the length (the measurement used to determine the distance between two points) of an object. Units can be connecting cubes, wooden cubes, unsharpened pencils, straws, toothpicks, paper clips, tongue depressors, beans, buttons, blocks, or even our feet! Help the students understand that the most important thing is that the units used to measure an object need to be the same size.

Ask: "What did the king use to measure the length of the queen's bed?"

"Why was this a problem?"

"What other things would have been better to use to measure the bed's length? Let's list some non-standard units you can think of."

Responses should indicate that there was a difference between the size of the king's foot and that of the apprentice's foot when the bed was being measured. Help guide the children's understanding to the concept that if the king had just used the same person's foot for all of the measurements, there wouldn't have been a problem. But because their feet were not the same size, the measurements were different. Measurement units need to be the same size.

Illustrate this concept to the students by telling them you want to measure the chalk tray. Tell them that you will be measuring it with a large pair of adult scissors. Have the students estimate how many scissor-lengths long it will be. Then measure it. Repeat the procedure using a child-sized pair of scissors. Help them to recognize the differences between the measurements, even though both measurements were made with scissors.

Explain to the students that they are about to visit four measurement centers. In each center, they will be measuring items with various kinds of units. Children should be reminded to remember the following:

Place the first unit at the end of the object.

Each unit must touch, must be placed end to end, and must be in a straight line.

Describe the length of the object to the nearest unit.

When measurements are not exact, students can use language such as *almost 3 toothpicks, between 6 and 7 paperclips, close to 5 beans, or about 10 straws.*

The children will now begin "Math Centers". Four centers activities will be placed at numbered tables in the classroom. The teacher will divide students into groups of four. Preferably, each group will only have six students. Group 1 will go to Table 1, Group 2 will visit Table 2 and so on. Invite the parent volunteers as they arrive to sit at one of the four centers. A brief description of what the volunteers will be teaching will be at their center. The centers will last approximately 10-12 minutes each. When a bell rings two times, children will clean up their materials, give recording sheets to the parent volunteer, and stand by their chair until the signal is given to move to the next center.

Center 1: Heel to Toe

Procedure: Invite children to choose a shoe from the class "Shoe Store". The children will place the shoe on a place mat in front of them at their table. The children will be directed to use an assortment of non-standard units to measure the shoe they have chosen. Prior to measuring, the students will be given a pencil and a ["Heel to Toe" recording sheet](#). The sheet will ask students to "guess" how many units (e.g. paperclips, blocks, toothpicks, etc.) will be needed to measure the shoe. They will record their guess and then they will make the actual measurement and record it. The parent volunteer will help children to realize that the smaller the non-standard unit, the more units it takes to measure the shoe.

Center 2: Bull's-eye Bean Bag Toss

Procedure: Lay the bull's-eye target board flat on the floor in an open area in the classroom or outside on the blacktop. Each child is given a matching colored pair of bean bags. The teacher will design a starting line, far enough away from the bull's-eye to present a challenge to the students. Students will take turns throwing their bags toward the bull's-eye target. After each player has thrown the bean bags, they will use the nonstandard unit of measurement to measure the distance of their nearest bag to the bull's-eye target. The student that has the closest beanbag goes first (or last) in the next round. The students may also want to measure the distance of the bag that is farthest from the bull's-eye. As students become more skillful in this activity, they can begin to record results of each toss and

compare their progress in landing on the target from one round to the next.

Center 3: Grab-bag Measurements

As children arrive at this center, the parent volunteer will give each child a jumbo-sized pipe cleaner. Wooden beads will be placed in a large container in the center of the table. Students will take 12 beads and slide them onto the pipe cleaner. Beads will be pushed tightly together on the pipe cleaner and students can bend the ends upward to hold the beads in place. This measuring device will be called a bead counter.

The parent volunteer will model for students how to measure with a bead counter. He/she will take an object and place the bead counter at the end of the object and will then count the beads from the beginning point to the ending point. If the object does not end exactly on a bead, the volunteer will describe the measurement to the nearest bead.

Procedure: Give each child or pair of students a sack with a variety of objects inside the bag. The teacher will have a cheat sheet with the bead counter measurements of each of the objects written on it. The teacher begins by looking in each of the bags and saying, "I spy an object that is 3 beads long . Each group of children will look through their bag, estimating which object it will be and then [recording](#) it. They will then make the measurement and record it.

If time remains in the center, the volunteer will then begin the game, "I Spy". He/she will say, "I spy something in the room that is black and 10 beads long. Can you find what it is?"(It's a chalkboard eraser.) The children will find the item in the classroom and measure it, using their bead counter The volunteer will repeat with many other items. Ideas for measuring could include a pencil, a pink eraser, a glue bottle, a small pair of scissors, a crayon box, a stapler, a tape dispenser, a piece of chalk, or the children's hands. "I Spy" gives the children an opportunity to use their new bead counters and to practice estimation skills while using a learning the measurement concept using units of measure.

Center 4: Measuring Me!

Under the title of each graph, the teacher will divide the paper into five columns, with a number in each column that may be the measurement for that particular body part.

Procedure: The students at this center will be divided into partners. They will work together to predict how many paper clips they will need to measure body parts, such as around the wrist, the ankle, the head, and the knee. They will predict how many paper clips they'll need for the measurement and then they will link the paper clips together and measure the specific body part of their partner. Each person records the results of their estimates and body measurement on the "[Measuring Me](#)" [recording sheet](#).

As the partners finish this activity, they will take the results on their recording sheet and graph their results on the corresponding body graph. Following the center time, the results can be discussed.

Extensions

Curriculum Extensions/Adaptations/ Integration

As young children perform measurements, it is easier for them when the objects they are measuring with are connected, like connecting cubes, paper clip chains, bead counters and so on. Iterating one unit over and over is much more difficult. This activity may help teach the concept of placing one single unit at the beginning of the object to be measured and iterating it end to end until they reach the end of the object to be measured.

Imprinted Snakes

Materials

- Play dough
- Paper clips (Jumbo and regular sized)
- Laminated place mat for each student

Procedure: Give each child a ball of play dough to work with. Instruct students to break off a piece of play dough and roll it into a snake.

Ask, "How many regular-sized paper clips long do you think your snake is? Make a guess. How could you find out using only 1 paper clip?" Allow children to brain storm ideas.

Suggest pressing the paper clip into the play dough to make imprints which go from one end of the snake to the other. Remind children that they must make the first imprint so that the end of the paper clip is at the end of the snake and that each imprint must touch the one before it.

You may wish to challenge the students to create a snake that is a specific length. "Roll a snake that you think might be 7 paper clips long. Make paper clip imprints to check your guess."

If children work as partners, they could challenge their partner to make a snake a specific length and then check each other's snakes by imprinting with paper clips.

Variation: Have the students use the jumbo paper clips and compare the lengths they found with the regular sized clips.

Growing Gardens

Kindergarten students love the aspects of the planting process and many measurement concepts can be taught using a classroom garden. Gardens in all their colors, shapes, and sizes offer mathematical connections to many books. Books that are terrific resources to invite students to engage in this kind of classroom project are the following:

Anna's Garden Songs, by Mary Q. Steele

Apples and Pumpkins, by Anne Rockwell

Growing Vegetable Soup, by Lois Ehlert

How a Seed Grows, by Helene Jordan; ISBN 0-06-445107-0

My Hand Rake, by Jonanne Barkan

Pierrot's ABC Garden, by Anita Lobel

Planting a Rainbow, by Lois Ehlert

Solomon's Secret, by Savior Pirotta

The Sunflower Garden, by Janice May Urdy

The teacher could have each of the students plant three sunflower seeds a thumbnail in depth in a clear, plastic cup. Use potting soil that has been moistened for the planting. Place a piece of plastic wrap over the top of the cup and secure with a rubber band. Set in the sunlight for 5 or more days. The seeds will begin to sprout and the children can watch as the white roots work themselves down through the soil. Soon, a tiny green sprout (or more) will pop up through the soil.

Invite children to use a popsicle stick to measure the growth of their sprout. Remind them to place popsicle stick gently on the surface of the soil and mark the ending point of the sprout on their popsicle stick. They may continue to make these measurements until the plant is ready to take home.

You may also use two varieties of bean counters for these measurements. Lay a 12" piece of clear packaging tape on a table with the sticky side up. Lay ten large, dry lima beans end to end in the middle of the tape. Write the numerals 1-10 on the beans with a fine tip marker. Fold the bottom of the tape up and the top of the tape down to seal in the beans. Trim off the ends. Make another bean counter using smaller beans, such as pole beans or bush beans. Invite children to perform their measurements using this form of non-standard measurement.

Family Connections

In class, read the story "The Lost Button" in *Frog and Toad Are Friends* (Lobel 1970). Send a tongue depressor home with students as well as a class newsletter, inviting parents to help their child collect used buttons. Instruct parents to help their child find 10 buttons of the same size and glue the buttons onto the tongue depressor. Students may use this new "button ruler" to measure household items. In the newsletter, invite students to find two things that are shorter and two things that are longer than

their foot.

Assessment Plan

Circulate among the students to ensure that they are measuring with units correctly. Check to see that they are placing the units end to end without leaving spaces or overlapping units. Check to see that units are placed in a straight line. Observe whether children are using appropriate units for appropriate distances or objects. For example, are they trying to measure the length of the room with toothpicks, or the length of a crayon with a straw? If necessary, lead a discussion on which units are suitable for measuring long and short objects or distances. As children measure they will have measurements that are not exact. Model such language as almost, between, close to, or about. Avoid formal language such as inches, meter, units, and non-standard, etc.

Ask key questions to students as you make anecdotal records:

How many units long do you think this is?

Is it shorter or longer than you thought it would be?

Would it be better to use popsicle sticks or paper clips to measure this? Why?

Measure this item with paper clips. How long is it?

Measure it with straws. How long is it?

Bibliography

Research Basis

Hiebert, J. (1984). Why do some children have trouble learning measurement concepts? *Arithmetic Teacher*, 31 (7), 19-24 .

In this study, researchers found that even though children do not yet conserve or reason transitively on standard Piagetian tasks, they still benefit from concrete measuring activities. It was also determined that children in both control and experimental groups experienced some common difficulties and showed some basic misconceptions.

Clements, D.H., (1999). Teaching Length Measurement: Research Challenges. *School Science and Mathematics*, 99,(1), 5-11.

Researchers have found that standard units need to be utilized simultaneously with non-standard units as young children are learning measurement skills. Teaching young children to measure with only non-standard units does not necessarily lead to competence in measuring skills.

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