Scaffolding Task: Measuring Pets

(Approximately 1-2 Days)

STANDARDS FOR MATHEMATICAL CONTENT

MCC2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

MCC2.MD.2 Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measure measurements relate to the size of the unit chosen.

MCC2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters.

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

*****Mathematical Practices 1 and 6 should be evident in EVERY lesson. *****

BACKGROUND KNOWLEDGE

It is important to recognize this is the first time students are using standard units of measure; therefore the first few tasks address non-standard and standard units of measure. We are building the understanding that measurement is a consistent distance or duration. **It is highly recommended that you follow these tasks in the order presented, so that students recognize the need for a consistent unit of measure and the importance of using standard units of measure.**

(Information quoted from Van de Walle and Lovin, Teaching Student-Centered Mathematics: Grades K-3, pages 226)

"For most attributes that are measured in elementary schools, it is possible to have physical models of the units of measure. Time and temperature are exceptions. Unit models can be found for both informal units and standard units. For length, for example, drinking straws (informal) or tagboard strips 1 foot long (standard) might be used as units.

The most easily understood use of unit models is actually to use as many copies of the unit as are needed to fill or match the attribute measured. The length of the room could be measured with giant footprints by placing tagboard copies of the footprint end to end, completely "covering" the length of the room. It is somewhat more difficult to use a single copy of a unit in an iteration process. For the footprint example, one footprint could be placed down and then moved to take the space of the second footprint, and so on. However, not only is this more difficult for younger children, but it also obscures the meaning of measurement- to see how many units will fill the length."

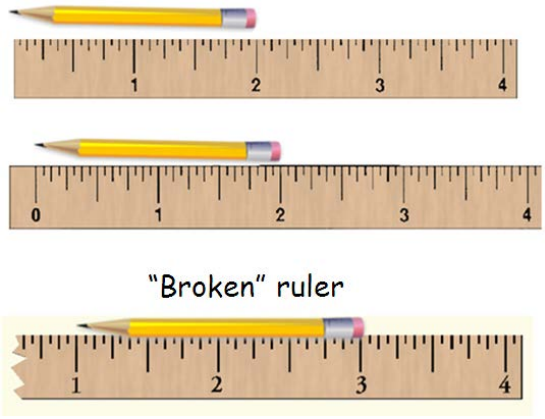
This standard associated with this task calls for students to measure the length of objects in both customary (inches and feet) and metric (centimeters and meters). Students should have ample experiences choosing objects, identifying the appropriate tool and unit, and then measuring the object. The teacher should allow students to determine which tools and units to use.
Foundational understandings to help with measure concepts:

- Understand that larger units can be subdivided into equivalent units (partition).
- Understand that the same unit can be repeated to determine the measure (iteration).
- Understand the relationship between the size of a unit and the number of units needed (compensatory principle).
- Understand the measuring of two-dimensional space (area) using non-standard units.

When some students see standard rulers with numbers on the markings, they believe that the numbers *are counting the marks instead of the units or spaces between the marks*. Have students use informal or standard length units to make their own rulers by marking each whole unit with a number in the middle. They will see that the ruler is a representation of a row of units and focus on the spaces.

Some students might think that they can only measure lengths with a ruler starting at the left edge. Provide situations where the ruler does not start at zero. For example, a ruler is broken and the first inch number that can be seen is 2. If a pencil is measured and it is 9 inches on this ruler, the students must subtract 2 inches from the 9 inches to adjust for where the measurement started.

Students are first introduced to standard linear measurement in second grade; therefore they will need many experiences to learn how to use the ruler correctly. It is important to show students how to accurately use the ruler when it begins at 0, as well as when it begins at the end of the ruler. It is important to expose students to both types and give them practice with both types of rulers. Research tells us that students see rulers with hash marks as counting numbers instead of the units (or spaces) between the marks. This is what will be helpful as they are exposed to experiences like the "broken" ruler. It is important for students to develop an understanding of length (measure) even when the starting point varies. Students should begin to understand that a ruler is a representation of a consistent row of units.



ESSENTIAL QUESTIONS

- Why is it important for us to know how to measure different objects using different tools of measurement?
- Why is it important for us to know how to measure different units of measurement?

MATERIALS

- *Measuring Penny* by Loreen Leedy or similar book
- Colored construction paper
- Scissors
- Glue
- Rulers
- Nonstandard units of measurement found in the classroom

GROUPING

Partners

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I
Gather students together and discuss the different sizes of dogs and other pets of the students. Ask the students to compare the sizes of different breeds (Jack Russell versus Greyhound). *Are all dog noses/tails/ears the same length? How would you compare the dogs' sizes/lengths? Which dogs do you think have the longest/shortest noses/tails/ears? Will the dog with the longest tail have the longest nose?* It is important to include discussions about the difference in length and height.

Tell the students the book, *Measuring Penny*, is about a girl who wants to measure her dog Penny and compare it to other dogs in the park. Read the book aloud to the students. *Please note*

that the book discusses elapsed time and other concepts not appropriate for this task. The nose, tail, ears, paw prints, height, and how far dogs can jump are all measurements taken in the book.

After reading the book, ask the students to give examples of other nonstandard units that could be used to measure the dogs (based on items found in the classroom). Students are expected to say things like erasers, pencils, paper clips, etc. Another example would be measuring a dog's height by the number of hands tall, like what is done when measuring horses. Assign students a partner or let them choose a partner. Distribute the student task sheet of rectangles and squares, scissors, rulers, and glue to the students. Instruct the students to work with their partners to cut out 10 to 15 rectangles, some of which may be squares! *The various sizes will be beneficial when the students begin comparing the sizes/lengths of their dog's measurements with the measurements. This way the class can still discuss which body part is the longest/shortest/widest/thinnest.* Use the cut-out shapes to create a "measure dog." The students should name their new pet. Remind the students to include a body, nose, tail, legs, and ears. Be sure that the squares and rectangles touch and then glue the "measure dog" to a solid sheet of construction paper.

Part II
Once each student has created their "measure dog", have them choose nonstandard units found at their desks and in the classroom to measure their dog's height and the lengths of its body parts. These nonstandard units could include paperclips, crayons, erasers, etc. Have the students record these measurements on a chart.

Have some students share their dog's nonstandard measurements. Choose a specific body part, like the tail, and ask several students for their lengths. Record these on the board. The nonstandard units should vary. Ask the students about comparing these measurements. *Is it easy to compare paperclips to erasers? How do you know which length is longer when they are measured with different materials? Can two pencils actually be longer than ten paper clips?* Ask the students if there is a better way to measure lengths if they want to compare them. The students should suggest that they all need to use the same unit, a standard unit—i.e. an inch. (The students may suggest other units like centimeters and feet.)

Ask the students to use their ruler to re-measure their "measure dog" lengths to the nearest inch. Have them record these measurements on the same sheet of paper as their nonstandard measurements. Ask the students to share their new results with their neighbor. Record the standard unit measurements of the same students' lengths next to the nonstandard measurements on the board. Ask the students about comparing the standard unit measurements. *Is it easier to compare the lengths now that they are all in inches? Now can you tell me which is longer/shorter? When all the measurements were in a standard unit, did any of the lengths surprise you? Were there any lengths that you thought would have been shorter/longer?* Ask similar comparison questions for other body parts.

Part III
Review length and measurement and why standard units are important for comparison. Have students share their explanations. Students should mention that it is hard to compare lengths when they use different standards of measurement. Some expected students responses are: we need to use the same units of measure so we can know how long everyone's dog is; we need to use the same units of measure (standard units) so we can compare. Students can demonstrate what they know by accurately giving a measurement with a nonstandard unit and also measure their dogs with rulers (standard units) correctly. Possible student suggested examples: it is difficult to compare 10 erasers and 3 pencils. Instead it is much easier to tell that 10 inches is bigger than 9 inches.

FORMATIVE ASSESSMENT QUESTIONS

- How would you compare the dogs' sizes/lengths?
- Do you think all the dogs will have the same noses/tails/ears?
- Is it easy to compare paperclips to erasers?
- How do you know which length is longer when they are measured with different materials?
- Can two pencils actually be longer than ten paper clips?
- Is it easier to compare the lengths now that they are all in inches?
- When all the measurements were in a standard unit, did you discover anything?
- Were there any lengths that you thought would have been shorter/longer? Why?

DIFFERENTIATION

Extension

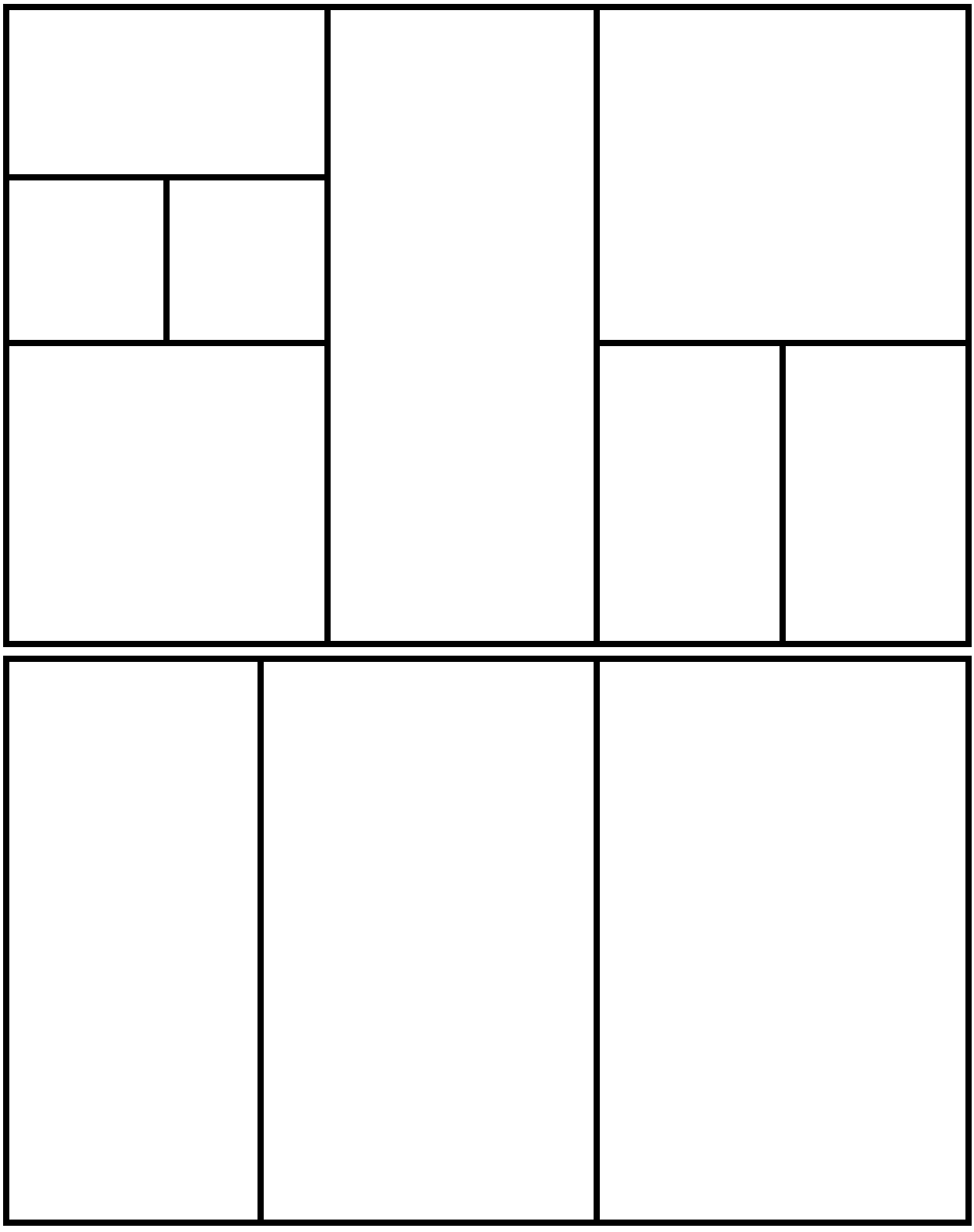
- Working in pairs, use different size dog bones and let students measure with those as the two different non-standard units and compare measurements. Have students construct viable arguments to support why their unit of measurement was the best choice critique the reasoning of others.

Intervention

- This lesson is very hands on and tactile. Allowing time for struggling students to make connections with the mathematics of the lesson is crucial. Involve these students in the discussion as much as possible, paying close attention to them as they work through the activity.
- See also activities 8.1, 8.2, 8.3 in *Teaching Student Centered Mathematics* by John A. Van de Walle.

Measuring Pets

Name _____



Measuring Pets

Name: _____

Body Part	Nonstandard Unit: _____ Measure	Inches Measure