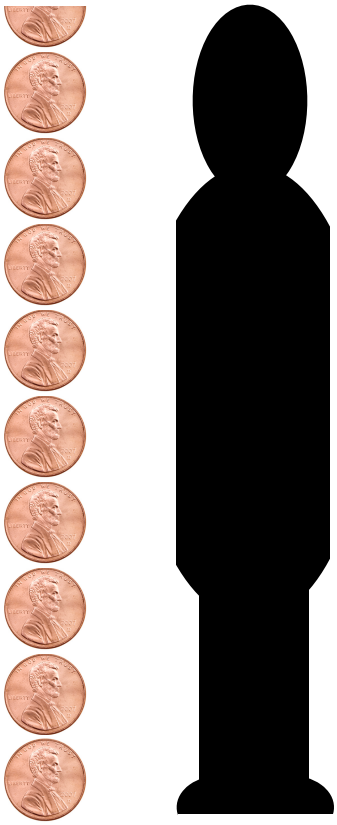

Measuring UP

An activity to explore units of distance

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Title of Lesson: Measuring Up

Grade level: 8th Grade

Subject(s): Laboratory skills

Summary: Students will use everyday objects as rulers to measure the sizes of things in the classroom. Students will find that it is easiest to measure objects that are the the same size as their ruler, will practice unit conversion, and will relate the sizes of objects in the classroom to the metric scale of distances.

Time Required: 40 minutes

Group Size: This activity was tested with 10 groups of 3-4 students, supervised in a 20:1 student/teacher ratio.

Materials:

- An assortment of objects in the classroom with different lengths. Examples: one meterstick, with units covered, a toothpick, a popsicle stick, a penny, a nail, a pencil, a piece of pvc pipe, one piece of oatmeal, a very long stick (give this to a responsible group well separated from the rest of the class)
- Student data sheet

Cost to implement: Free, if everyday objects from the classroom are used, or under $10 if additional objects of different lengths (screws, nails, dowels) are purchased at a hardware store.

Learning Goals:

- Understand why we need many different units for one quantity (distance)
- Learn to determine the best unit for the measurement to be taken
- Practice unit conversion
- Develop a more intuitive feel for metric distances.

Safety Issues: Any groups of students with using objects longer than a meterstick to make measurements should be cautioned to have care when navigating the object around the room to avoid hitting themselves, lights, the ceiling, windows, or other students. These groups should be trustworthy and well supervised.

Introduction (~10 minutes)

Before the start of this activity, it is useful to remind students that sometimes, when you are measuring things, you have to estimate.
Here, you can perform an example, like measuring the board with a marker or a piece of chalk. Probably it is not exactly '10 markers long' and you need to estimate an additional fraction. Have several students measure the same distance. Ask the class: whose measurement is right? Why might they be different?

Emphasize that when it comes to measurements there is no one **exactly** correct answer! People estimate different ways, and this is why scientists don't just measure something one time- they measure it many different times, and have different people measure it too!

Explain that this is why students are asked to list measurement ESTIMATES from 2 different people in their group.

Finally, it is important to tell students 'forget about meters, inches, centimeters'. This is not about pulling out your ruler to measure the object you are given, this is about making that object into your 'ruler', and relating it to other objects to describe the sizes of things around you.

Procedure for activity (~15 minutes)

Divide students into groups of 2-4.
Give each group a data sheet, and the unit they will use to take their measurements. Make sure that each group has space to conduct their measurements.

Student measurement time (10 minutes)

> Students will fill out the attached data sheet, measuring 5 classroom objects with their assigned unit.

Reporting (5 minutes)

> Have each group present
>
> - Their unit
> - The object that was EASIEST for them to measure
> - An idea of why it was easy to measure (or why another object was hard)
> - The object that was CLOSEST in size to the unit they had
> - The length of their desk in their given unit
>
> Record these in a table on the board

Closure (~15 minutes)

Ask students if they notice any patterns in the data in this table. Draw their attention toward the column with the object that is easiest to measure, and the object that is closest in size. Get the class to form a GENERAL conclusion about this data. (Depending on the objects used, the majority of groups might say that the object closest in size to their unit was their finger, and that it was easiest to measure, so try to steer students away from conclusions like "your finger is easiest to measure")
The goal is for students to realize that the object most similar in size to a unit will be the easiest to measure with that unit, whatever it might be (inches, kilometers, micrometers, etc.).

Ask students How would you determine how many oats long the classroom is? Have them **THINK** about this silently.

Ask students Compare your idea with your neighbor. (**PAIR**)

Ask students What ideas did you come up with? (**SHARE**)
Select 3-5 student responses to discuss.

Ask students to apply their solutions to another situation, and to develop statements about the relationships between other units.
For example, how many toothpicks long is a meterstick?

Ask students which of these units (or objects they measured) is most similar in size to a millimeter? A centimeter? 10 centimeters? A meter? 10 meters?
Have students record the answers in their notebook or a chart they can keep with them, or a chart to put up in the classroom to remind them how big metric distances are. (Help them out a bit with additional knowledge: for example, the thickness of a piece of paper may be *closest* in size to a millimeter, but a millimeter is actually about the same as the thickness of *ten* sheets of paper)

Examples:
10 sheets of paper are about a millimeter thick.
1 piece of oatmeal is about a centimeter long.
2 fingers are about 10 cm long.
2 desks put together are about a meter, front-to-back
A classroom is about 10 meters across.

References:

Wiggins, G. P., & McTighe, J. 2005, Understanding by design (Association for Supervision and Curriculum Development)

CA Science Standards addressed:
9b: "Evaluate the accuracy and reproducibility of data"
9e: "... develop quantitative statements about the relationships between variables

Student Data Sheet for Part 1

Group Members:

Name the 'unit' you were given to use for these measurements
(*Example: "a Screwdriver"*)

In the table below, record the length of these classroom objects using your measurement unit
(*Example: "this floor tile is about 1 and a half screwdrivers long"*)

Record measurements made by TWO DIFFERENT group members

	You measure:	**Another team member measures:**
OBJECT	LENGTH Unit:	LENGTH Unit:
The length of your desktop (front to back)		
The length of your finger		
The *thickness* of one page in your textbook		
The height of a lab partner		
The length of your classroom (side to side)		

Were there any of these objects you had difficulty measuring or could not measure with the unit you were given?

Did you develop any strategies to measure these difficult objects?