Assignment Discovery Online Curriculum

Lesson title:
Scavenger Hunt for Lengths

Grade level:
6-8

Subject area:
Mathematics

Duration:
Two class periods

Objectives:
Students will
1. understand how to measure and estimate lengths;
2. understand the difference between measuring and estimating; and
3. become more aware of linear measurements in the world and communicate better about the significance of these measurements.

Materials:

- Equipment for measuring length: rulers, yardsticks, tape measures, and trundle wheels
- Computers with Internet access (optional but very helpful)
- String (optional)
- Scissors (optional)
- Colored markers (optional)
- Reference material such as atlases and road maps
- Copies of Classroom Activity Sheet: Measurement Scavenger Hunt
- Copies of Take-Home Activity Sheet: Measurement Puzzles
- Answer Sheet for the Take-Home Activity Sheet: Measurement Puzzles (for the teacher only)

Procedures:

1. Begin the lesson by briefly reviewing measuring and estimating length. Direct students' attention to a long object in the classroom. Ask students to suggest different ways to estimate its length. Possible strategies include estimating the length of part of the object and using this to estimate the whole length, comparing the length with a length they know, and estimating the shortest and the longest possible lengths and using these to estimate the range of the length.

2. Have two students measure the object. What unit should they use to measure it? Why, for example, would you use feet, not inches, to measure the length of a chalkboard? If students need additional practice, have them select a few more objects to estimate and measure. Emphasize that estimates are approximate, not exact, measurements.

3. Group students into teams of four. Provide students with measuring tools, such as rulers, yardsticks, tape measures, and trundle wheels. Students may also make their own "yardsticks" by cutting a piece of string 1 yard long, marking feet in one color on the string, and marking inches in a second color over the length of 1 foot at one end of the string.

4. Distribute the Classroom Activity Sheet: Measurement Scavenger Hunt to each student. Have students work in teams to answer all the questions on the sheet. Each student, however, should fill in his or her own sheet. Students should try to finish the sheet during one class period. As you observe students measuring in class, encourage them to estimate to help them find appropriate objects.

5. At the beginning of the next class, go over the answers to the questions on the Classroom Activity Sheet. Discuss with the class when it is useful to estimate and when it is important to know the exact measurement. For example, if you were trying to determine whether a chair would fit through a doorway, an estimate would probably be sufficient. <u>But if you were cutting lumber for a house you were building, you would need to know exactly how long to cut the pieces.</u>

5. Distribute the Take-Home Activity Sheet: Measurement Puzzles for students to work on over a couple of days. If possible, devote a few minutes to a discussion of students' strategies and solutions once they have completed the sheet.

Questions:

1. Suppose there were no units for measuring length. Hypothesize how lengths might be described. Then discuss how measuring length would be different without inches. Finally, discuss why having a range of units for measuring length, such as inches and feet, to choose from in necessary

2. Would you measure a pencil in feet? A hallway in inches? Discuss whether these approaches make sense or whether using different units would be better.

3. Hypothesize about the possibility of developing a new standard unit for measuring length. Plan the unit. Explain whether the unit would be shorter than 1 inch, between 1 inch and 1 foot, between 1 foot and 1 yard, between 1 yard and 1 mile, or longer than 1 mile. Express the unit in terms of inches, feet, yards, or miles. Debate the advantages of the new unit.

4. Discuss some careers in which being able to measure or estimate length is essential. Some examples are jobs in architecture and construction, interior design, and medicine.

5. Suppose you were asked to design a room for young people in a neighborhood community center. You would need to tell the planners how big the room should be, whether a basketball hoop should be installed, whether the room should be divided into different sections, how many gallons of paint would be needed to paint the space, and how many sheets of flooring would be needed. How would you go about making these decisions? Would you use estimation, measuring, or both? What would your plan look like?

6. State whether you agree or disagree with each of the following, and defend your position.
   - An estimate is not a guess.
   - If you can measure, why estimate?
   - Linear measurements are not useful in everyday life.
   - Unless a measurement is exact, what good is it?

Evaluation:

Use the following three-point rubric to evaluate how well students measure, how well they estimate, and how well they describe the strategies they used to solve the problems.

> Three points: accurate measurements, sound judgment, and good understanding of linear relationships; reasonable estimates; communication of decisions about measuring or estimating length
>
> Two points: mostly accurate measurements, some judgment, and some understanding of linear relationships; somewhat reasonable estimates; some communication of decisions about measuring or estimating length
>
> One point: some accurate measurements and a basic understanding of linear relationships; a few reasonable estimates; communication of a few aspects of measuring or estimating length

Extensions:

How Many Do You Think?
Pose the challenge of estimating how many pennies lined up end to end it would take to make 1 yard. Then ask a few students to arrange a row of pennies along a yardstick. Continue estimating with other objects and lengths, such as the following:

- About how many pencils placed side by side would it take to make 1 foot?
- About how many paper clips placed end to end would it take to equal 1 foot?

Now have students try to solve the following problems, which require calculating, measuring, and/or estimating.

- About how many cars lined up bumper to bumper would it take to stretch for 1 mile?
- About how many desks like the ones in your classroom stacked on top of each other would it take to reach 10 miles high?

Guide students in creating similar problems for their classmates.

Estimation Contest
Set up an estimation contest. Post a question about a length that you know but that students can only estimate. Examples: What is the height of the flagpole in front of the school? What is the length of the rope hanging from the ceiling of the gym? What is the height of the basketball hoop? Provide a shoebox for students to submit their estimates, and ask them to include their names. At the end of the contest, tell students the actual length and honor the students with the first-, second-, and third-closest estimates.

Secret Destination
Have students work in groups of two or three to choose a starting place and a secret destination. Possibilities include the door of the classroom, a certain tree in the schoolyard, a mark on the gym floor, and a gate in the schoolyard. Ask each group to make a map from the starting point to the destination that shows measurements, including inches, feet, and yards. Arrange for groups to trade maps to see whether the other groups can find their way to the secret destinations.

One Step at a Time
Have students work in pairs to measure their stride, or the distance from the heel of one foot to the heel of the other foot after taking one step. Have each student answer the questions below.

1. Measure the total distance of 10 of your strides, trying to make each stride about the same length. Now divide this distance by 10.
2. Why does this procedure give a more accurate length of your average stride than just measuring the length of one stride?
3. Explain how you can use the length of your stride to measure a distance.

Suggested Reading:

Yearbooks in Science, 1930-1939
Nathan Aaseng. Twenty First Century Books, 1995
Covering important scientific events of the 1930s, this book includes the development of new ways to measure distance using sound and light waves, and the inventions that followed: radar, electron microscopes, and radio telescopes.

For Good Measure: The Most Complete Guide to Weights and Measures and Their Metric Equivalents
William D. Johnstone. NTC Publishing, 1998
If you want to know how to measure anything anywhere in the world, here's your book! Learn how length, surface, volume, weight, electricity, metrics, and "diverse units" like pressure, energy, and speed are measured here in the United States and in other countries. There's even a chapter on measurement in music and verse! The entries contain small paragraphs with the history of the particular measurement. A wealth of information is contained in this relatively modest paperback and is extremely well indexed.

Vocabulary:

approximate
Definition: Fairly close to the actual but not quite accurate.
Context: Ben's mom estimated that his **approximate** height was 5 feet.

distance
Definition: The space between two points.
Context: The **distance** between New Orleans and Chicago is 927 miles.

estimate
Definition: To make a rough or approximate calculation.
Context: The designer **estimated** that the room had 10-foot ceilings.

exact
Definition: Accurate, precise.
Context: The architect used a tape measure to obtain an **exact** measurement.

foot (plural: feet)
Definition: A unit of length equal to 12 inches.
Context: Originally, a **foot** was the length of the king's foot, but now it is a standard unit of length equal to 12 inches, or one-third of a yard.

length
Definition: The distance from one end to the other of the longest side of an object.
Context: The **length** of a hockey field is 100 yards, and its width is 60 yards.

linear
Definition: Relating to, consisting of, or resembling a line.
Context: The **linear** measurement of an object is its length.

Academic standards:

Grade level:
6-8
Subject area:
Mathematics
Standard:
Understands and applies basic and advanced properties of the concepts of measurement.
Benchmarks:
Solves problems involving units of measurement and converts answers to a larger or smaller unit within the same system (i.e., standard or metric).

Grade level:
6-8
Subject area:
Mathematics
Standard:
Understands and applies basic and advanced properties of the concepts of measurement.
Benchmarks:
Selects and uses appropriate units and tools, depending on the degree of accuracy required, to find measurements for real-world problems.

Grade level:
6-8
Subject area:
Mathematics
Standard:
Understands and applies basic and advanced properties of the concepts of measurement.
Benchmarks:
Selects and uses appropriate estimation techniques (e.g., overestimate, underestimate, and range of estimates) to solve real-world problems.

Credit:
Lyn Cowan, freelance mathematics writer and editor, Toronto, Canada.

DiscoverySchool.com
http://www.discoveryschool.com

Classroom Activity Sheet: **Scavenger Hunt for Lengths**

Name: _____

Measurement Scavenger Hunt

Part 1: Classroom Search
Use the clues to find an object and estimate its length. Then measure its exact length.

Clue	Object	Estimate	Exact Measurement
Something more than 5 feet long			
Something between 10 and 15 feet long			
Something between 1 and 2 feet long			
A book that is twice as long as it is thick			
Something that's twice as tall as it is wide			
Two things with a difference in length of approximately 2 feet	1. 2.	1. 2.	1. 2.
Two things for which the length of one is double the length of the other	1. 2.	1. 2.	1. 2.

Part 2: Map Search

Using an atlas, a road map, or the Internet, find examples of each of the following:

1. Two cities about 60 miles apart: _____ and _____

2. The length of an island that is part of your country: _____

3. The distance between Mexico City and your community: _____

4. The distance between two cities on opposite sides of the Atlantic Ocean: _____

Take-Home Activity Sheet: **Scavenger Hunt for Lengths**

Name: _____

Measurement Puzzles

1. A pole that is 20 feet long is cut into equal pieces with four cuts. How long is each piece? Explain

2. A tennis net 38 feet wide is folded in half three times. How many inches wide is the folded net?

3. Complete each statement.
   a. One yard is to 4 feet as 18 miles are to _____ miles.
   b. A quarter of a yard is to half an inch as 1 yard is to _____ inches.
   c. Four inches are to 1 foot as 2 feet are to _____ yards.

4. Fill in the next three lengths in each pattern. You may use any unit of length.
   a. 6 inches, 1 foot, 2 feet, _____, _____, _____
   b. 8 yards, 20 feet, 192 inches, _____, _____, _____

5. A football field that is 100 yards long has cones equally spaced along one entire side. The cones are 10 yards apart. How many cones are used? Explain.

6. Suppose you travel 80 miles east one day and 20 miles west the next day, and then you continue traveling 80 miles east one day and 20 miles west the next day for six more days. How far will you be from where you started? What direction will you be from where you started?

7. Suppose you cut a string that is 1 yard long into two parts so that one part is one-fifth the length of the other part. How long is each part?

8. I'm a standard unit of length. I'm not an inch or 96 eighths of an inch, but I am less than a thousandth of a mile. What am I?

9. a) Write your own riddle and the solution for your riddle.

b) Try your riddle on a few people. What do you notice about their solutions?

Name: _____

Solutions: Measurement Puzzles

1. A pole that is 20 feet long is cut into equal pieces with four cuts. How long is each piece? Explain. *The pole is cut into five equal pieces with four cuts. The length of each piece is 20 feet divided by five, or 4 feet.*

2. A tennis net 38 feet wide is folded in half three times. How many inches wide is the folded net? *57 inches.*

3. Complete each statement.
   a. One yard is to 4 feet as 18 miles are to *24 miles*.
   b. A quarter of a yard is to half an inch as 1 yard is to *2 inches*.
   c. Four inches are to 1 foot as 2 feet are to *6 yards*.

4. Fill in the next three lengths in each pattern. You may use any unit of length.
   a. 6 inches, 1 foot, 2 feet, *4 feet, 8 feet, 16 feet (Units of length may vary.)*
   b. 8 yards, 20 feet, 192 inches, *12 feet, 8 feet, 4 feet (Units of length may vary.)*

5. A football field that is 100 yards long has cones equally spaced along one entire side. The cones are 10 yards apart. How many cones are used? Explain. *There is a cone at each end with 9 more cones dividing the 100 yards into 10-yard lengths, so 11 cones are used.*

6. Suppose you travel 80 miles east one day and 20 miles west the next day, and then you continue traveling 80 miles east one day and 20 miles west the next day for six more days. How far will you be from where you started? What direction will you be from where you started? *You will be 240 miles east of where you started.*

7. Suppose you cut a string that is 1 yard long into two parts so that one part is one-fifth the length of the other part. How long is each part? *One part is 6 inches long. The other part is 2 feet 6 inches long. (Units of length may vary.)*

8. I'm a standard unit of length. I'm not an inch or 96 eighths of an inch, but I am less than a thousandth of a mile. What am I? *You are a yard.*