



Where is the Foot that Fits?

Mathematics

Measurement

It was all in the shoe for Cinderella; having the right measurement, size and foot for the perfect fit into the glass slipper.

National Standards: Mathematics > Measurement

NM-MEA.PK-2.1, NM-MEA.3-5.1 (Grades K-3) Understand measurable attributes of objects and the units, systems, and processes of measurement

- recognize the attributes of length, volume, weight, area, and time
- understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute
- compare and order objects according to these attributes
- understand how to measure using nonstandard and standard units
- understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems
- select an appropriate unit and tool for the attribute being measured.
- carry out simple unit conversions, such as from centimeters to meters, within a system of measurement
- understand that measurements are approximations and how differences in units affect precision

NM-MEA.PK-2.2, NM-MEA.3-5.2 (Grades K-3) Apply appropriate techniques, tools, and formulas to determine measurements.

- measure with multiple copies of units of the same size, such as paper clips laid end to end.
- use repetition of a single unit to measure something larger than the unit, for instance, measuring the length of a room with a single meterstick;
- use tools to measure develop common referents for measures to make comparisons and estimates
- select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles
- select and use benchmarks to estimate measurements

Kentucky: Mathematics Standard

2. Students shall develop their abilities to apply core concepts and principles from mathematics, the sciences, the arts, the humanities, social studies, practical living studies, and vocational studies to what they will encounter throughout their lives.

Measurement (2.8, 2.10, 2.12) (Grades K-3)

2.8 Students understand various mathematical procedures and use them appropriately and accurately.

2.10 Students understand measurement concepts and use measurements appropriately and accurately.

MA-E-2.2.5 Use nonstandard and standard units to measure weight, length, perimeter, area (figures that can be divided into rectangular shapes), and angles

MA-E-2.2.7 Choose appropriate tools (e.g., protractors, meter sticks, rulers) for specific measurement tasks

MA-E-2.2.8 Identify measurable attributes of an object and make an estimate using appropriate units of measurement

MA-E-2.2.9 Use measurements to describe and compare attributes of objects

Ohio: Mathematics > Measurement

- Estimate and measure to a required degree of accuracy and precision.
- Select and use appropriate units, tools and technologies.

Benchmark(s) Grades K-2

- A. Explain the need for standard units of measure.
- B. Select appropriate units for length, weight, volume, and time.
- C. Develop common referents for units of measure for length, weight, volume and time to make comparisons and estimates.
- D. Apply measurement techniques to measure length, weight and volume.
- E. Recognize that using different units of measurement will yield different numbers for the same measurement.

Benchmark(s) Grade 3

- C. Develop common referents for units of measure for length, weight, volume and time to make comparisons and estimates.
- D. Identify appropriate tools and apply counting techniques for measuring...simple irregular two-dimensional shapes...

Ohio: Mathematics > Mathematical Processes Standard

- Use mathematical processes and knowledge to solve problems.
- Apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Note: The following benchmarks are embedded within the grade level indicators.

Benchmark(s) Grades K-2

A, B, D, and I

Benchmark(s) Grade 3

B, C, F, G, and K

Grades K-3

Objective

Student will:

- Understand the concept of units of measure, non-standard and standard.
- Establish personal or common referents for units of measure to make estimates and comparisons.
- Describe and compare the relationships among units of measure.

- Recognize and explain the need and benefit for fixed units and tools for measuring an object's length.

Assessment

Students will be able to:

- Measure the length of their foot using a non-standard and a standard unit of measurement for comparison of data.
- Explain the reason and benefit for using fixed standard units of measure and appropriate tools.

Sample items to gauge student understanding:

1. The following are all standard units of measure. True or false?
 - a. inches
 - b. yards
 - c. centimeter
 - d. feet (*true*)
2. The above units are used most to measure_____?
(*length*)
3. Tell why is it important to use a standard unit of measurement?
(*accuracy, consistency*)

Vocabulary

- Measurement
- Standard unit (U.S. customary unit)
- Inch
- Centimeter

Materials

- Paper
- Pencil
- Paper clips (large and small)
- Rulers
- Tape measures

Activity 1

What's the benefit?

Teacher will:

1. Introduce the concept of measurement and the various ways to measure objects – non-standard and standard.
2. Introduce the glass slipper from Cinderella as an object of that can be measured.
3. Instruct each student to trace one of their own feet on a piece of paper. (Younger students may work in pairs.)
4. Pass out paper clips to students and have them measure their foot tracing from heel to toe using the paper clips. (*Give each student large paper clips and small paper clips to illustrate a difference in the foot measurements using various non-standard units of measure.)

5. Have students provide a total for the number of large clips used to measure the foot tracing, and a total for the number of small clips used to measure the foot tracing.
6. Facilitate discussion to find out how and why the two measurements of the same foot tracing differ (e.g., different size feet, use of different sized paper clips, etc.).
7. Facilitate discussion on how measurement results are varied due to the use of different sized paper clips. (Question prompt: What is the criterion of measure one would use with the paper clips? Is there a way to standardize the outcome of the measurement?)
8. Have students repeat the activity using a standard unit of measure, such as inches or centimeters found on a ruler or tape measure, and compare the results to the paper clip data.
9. Facilitate discussion on the benefits of using standard units of measure (e.g., consistency, reliability, consensus, etc.) vs. non-standard measure.

Note: Students in grades K-1 will require teacher assistance to complete this activity.

Students will:

1. Participate in teacher lead discussions about units of measure.
2. Trace one of their feet from heel to toe on paper.
3. Measure their traced foot from heel to toe using paper clips.
4. Recognize that the same length of an object may have different measurements if different units of measure are used.
5. Repeat the measurement activity using a standard unit of measure, such as inches or centimeters.
6. Compare the results of the standard and non-standard units of measure.
7. Identify benefits for the use of standard units of measure.