

# Comparing Units of Measurement

by Doug Ruhman

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**Grade level** 4

**Time required**

Three 45 minute class periods

**Materials/Technology**

Reference materials (e.g., Internet, books, video and interviews with tribal members)

**Summary**

In this integrated social studies-math-language arts activity, students research various tribal groups in North America to discover what traditional units of measurement were in use prior to contact with Europeans. The accuracy and overall effectiveness of these methods will be evaluated and compared to more widely accepted systems in use today.

**Objectives**

The student will:

- 1) research and explore traditional Native American methods of measurement.
- 2) demonstrate an understanding of these units through their application and analysis.

**Montana Math standard addressed**

Students demonstrate understanding of measurable attributes and an ability to use measurement processes.

**Assessment**

Use performance assessment criteria such as observation, discussion, oral reports and their completed measurement charts to evaluate each student's learning. Some guidelines are provided at the end of this activity.

**Background**

In my own limited research, I have found that for a variety of considerations listed below, many traditional plains people did not have great cause for standards of measurement. They often lived in relatively insular communities, most people traveled at a similar pace (on foot, on horseback), and distances (linear measurement) were often referred to in terms of time ("three days walk"), not in units of distance, although paces (or "steps") were used in some instances. In many cases, everyone in a community would know the area so well that elaborate systems to describe distances may not have been necessary. (Ask students: Could that work today?) Some people utilized measures whose units were based on objects in nature, or on human characteristics. Point out that this is also true for non-Indian cultures ("hands" to measure the height of a horse, and "spans", a measure of an outstretched palm; both are still in limited use today). Ask students to imagine that they have been asked to fetch an amount of water from a stream or lake. How do they think the needed quantity would have been expressed?

## Procedure

1) As an extension of studying about standard units of measurement (linear and volume), engage students in an exploration of the units of measurement that might have been utilized by different traditional Native American societies. These units might have been used in the construction of dwellings, the making of implements, travel, art, etc. Pose the exploration as a research challenge, encouraging students to utilize a myriad of resources to try and find some examples of such nonstandard measures. Depending on where students live, they may find that the most reliable method for finding information like this will be to approach local historians and/or tribal elders. Remind students of the necessity to show courtesy and respect when sharing cultural information with tribal members, and to ask for permission to share the information in the school environment. Spend one class period (45 to 60 min.) organizing for the data collection by:

A) Having students write research questions on 3x5 cards, for example:

1. What units of measurement (if any) did the Salish, Kootenai and Pend O'Reille people use before contact with Europeans?
2. In what ways did native people utilize those units?

B) Having students brainstorm ways of finding answers to their questions. They may use encyclopedias, CDs, Internet searches, text materials, etc. Encourage them to use local resources such as tribal colleges, libraries, and culture committees.

Allow time for students to conduct their research. If interviews with authorities are preferred, allow additional time to meet with people and gather the information.

- 2) Following the research phase, have students record their group's findings on the cards and then present their results to the class. You may want to add an additional math tie-in by having kids create a table that shows the name of the tribe, the name of the measurement unit, and a standard unit (inches, feet, centimeters) with which the traditional unit can be compared.
- 3) Then, have students pick classroom objects to measure in the researched nonstandard units. These could be recorded and presented in a chart which would include the name of the measured entity, the measure in nonstandard units, and the measure in standard units. Questions should follow from the teacher, along these lines:
  - In what ways might this nonstandard unit be an improvement on our current ones?
  - Which unit seems to give a more "accurate" result? Why?
  - What conditions might have led to the use of the nonstandard unit, or the lack of one? (Items to consider: terrain, resource availability, demographics, and contact with other peoples.)
- 4) For closure, have kids design a way to introduce their family members to the nonstandard measurements, and give a short report to the class on how they will do it. Reiterate to students that the point of this lesson was to examine the idea of units of measurement, and to understand that other cultures had similarly complex and accurate ways of measuring and

making order out of the world. Remind them that this last idea is a central tenet of mathematics.

### **Extensions**

- 1) Provide students with opportunities to handle and examine examples of Native American art (beadwork, quillwork, shield designs, drums, etc.). Have them look for patterns of symmetry and tell how the patterns might have been measured. Students can then measure and record the art items in nonstandard or standard units.
- 2) Have students continue their research by writing to tribal authorities at other, more distant locations. Have them report their findings to the class. Students could also find other units of measurement from indigenous people in other countries. Another way to manage this would be to assign each group of 3 or 4 kids to have to find other measurement units worldwide and make a chart showing several objects measured in those units.
- 3) Make a connection with students between money and measurement, being that currency is fundamentally a unit of measurement itself. Explore and display several examples of foreign currency, and draw comparisons between currencies and measurements of distance, volume, and weight. Of these, which is money most like? Why? It might be a good hook to begin with the finding and reading of the dictionary definition of quantity.

### **Assessment guidelines**

The following are some suggested performance assessment questions that may be used as guidelines in evaluating students:

- Did students accurately research and represent a nonstandard unit of measurement?
- Did students draw valid conclusions about Native American uses of measurement and the conditions surrounding them?
- Did students think critically about the usefulness and efficacy of our accepted system, and make valid comparisons to nonstandard units?
- Did students gain knowledge and application of research strategies?

### **Further information**

For further information about this activity, contact the author at:

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