

Living Archaeology Weekend - Lesson 3

Experimental Archaeology: Making Cordage

Teaching the Lesson

Overview

In one to two class sessions, students will study experimental archaeology by experiencing a technique and skill Kentucky's ancient Native peoples needed for everyday life: making cordage. In a mathematics connection, students will compute the amount of time and materials Native artisans might have needed to make cordage in ancient times, and they will estimate how long it would have taken to make cordage for a snare or net.

Vocabulary

cordage: several strands of fiber twisted together; string or rope

culture: the customs, beliefs, laws, ways of living, and all other results of human work and thought that belong to people of the same society

experimental archaeology: scientific studies designed to discover processes that produced and/or modified artifacts and structures that are found in archaeological sites

fiber: a slender threadlike strand or string. Bast fibers are the long fibers from a plant stalk.

replication: the act or process of reproducing artifacts, structures, and use patterns

sinew: animal tendon prepared to use as cord or thread

technology: the technique or means for making or doing something, often associated with tool making

Materials

-- 2-ply jute or twine, cut into one-foot lengths

-- for fibers, one spool of hemp rope (about 1/2 inch in diameter), milkweed or dogbane plant stalks (if you cannot obtain these Native plant fibers, use raffia. Some craft stores sell a variety of suitable basketry fibers.). Use these natural fibers or raffia in the same way as the purchased hemp rope.

-- Experimental Archaeology: Making Cordage PowerPoint

-- Experimental Archaeology Activity Handout Sheets – enough for each student or pairs of students

Preparing to Teach

Purchase the materials

Cut the 2-ply jute or twine into lengths

Prepare the fibers – hemp, milkweed/dogbane, or raffia - for the activity. Cut the purchased hemp rope into 15 inch sections. Untwist the rope and pull the fibers straight. If using natural fibers, cut year-old dead stalks of milkweed/dogbane, rub the stalks between both palms to remove debris, and carefully break open the stalks and strip the fiber away. Separate two long strands of several fibers each from the hemp rope or milkweed/dogbane plant section, starting from one end. If using raffia, separate the strands from the bundle and use the longest and widest pieces.

Get an LCD projector and prepare the PowerPoint for projection

Make copies of the student essay, and activity handout sheets and answers

Review the Teacher's Background

Teacher's Background

Archaeologists cannot ask prehistoric people how they made their tools, nor can they watch them make and use them. Thus, archaeologists must find other ways to learn about past **technological** systems.

Experimental archaeologists use techniques that ancient peoples may have used, and their experiments provide possible interpretations and a basis for further study, although they do not directly prove how prehistoric peoples used or made tools or structures. These studies help researchers better understand the processes that produced the artifacts and structures found at archaeological sites.

Experimental **replication** of structures, tools, and wear patterns on tools is one way to do this. Replication studies include the reproduction of stone tools, basketry, ceramics, and **cordage**. Using prehistoric techniques to make these items, archaeologists can address many questions about how people lived in the past. Examples include: How long would it take to make an arrowhead or spearpoint? Are some raw materials better for stone tool manufacture than others? What kind of clay is the best for ceramic vessels and where might prehistoric potters have found it? How long would it have taken them to make a small snare?

Experimental archaeologists also study how ancient peoples might have used tools. They do this by making and using replicated tools in ways that produce wear or damage patterns similar to those present on prehistoric artifacts. For example, to learn how the earliest hunter-gatherers may have butchered mammoths, archaeologists have used replica stone tools to butcher dead zoo elephants. They examine the resulting wear patterns on the stone tools as well as the cut marks the tools left on the bones of the butchered animal. They use the results of their studies to make inferences about how prehistoric peoples may have performed similar tasks.

Experimental archaeologists make cordage to learn how prehistoric peoples made it, the characteristics of the finished pieces, and how much time it took to make these important items. Prehistoric weavers made cordage from a variety of materials, including the leaves or stems of yucca or rattlesnake master, and the bast **fibers** of milkweed and dogbane. They also used human hair and animal **sinew**. Finished cordage varied in size from 1 millimeter (0.0394 inches) to several millimeters (prehistoric archaeologists use the metric system). The fibers selected and the intended purpose of the finished object may have determined the relative thickness of the cordage.

Archaeologists have found fragments of cordage and textiles in the dry rockshelters of the Red River Gorge.

Uncover Prior Knowledge

1. Share information from the **Teacher's Background** with your students
2. Distribute the twine to each student. Ask them if they can determine how the twine was made. Encourage them to pull it apart as part of their examination. The techniques indigenous people used to make the tools necessary in everyday life are unknown today. Thus, archaeologists are confronted with problems similar to what the students just experienced with the twine. To better understand how these ancient peoples made and used these objects, archaeologists must sometimes learn prehistoric manufacturing techniques, occasionally by trial and error. This is called **experimental archaeology**.

Ask students how they think archaeologists, who study artifacts, figure out the technologies and processes used by prehistoric peoples.

Discuss these questions: *How difficult do you think it would be to make twine or rope from natural materials? What materials could be used? How long would the process take from collecting the materials to completing the twine or rope?* Have students record their answers in a journal to compare to their thoughts after trying to make cordage.

3. Project the Student Essay for the class or pass the essay out to students. As a class or individually, read the essay. As class members read aloud, demonstrate how to highlight important information in the text. Share your rationale for selecting each piece of information. Assist students with defining vocabulary words. Discuss the importance of natural resources to the ancient peoples who once lived in the Red River Gorge.

Discovering New Knowledge - Making Cordage

Begin by demonstrating for students how to make cordage.

1. If right-handed, hold one end of Strand A and one end of Strand B together, side-by-side, in your left hand between your forefinger and thumb (or *vice versa* if left-handed). Pick up Strand A between your right forefinger and thumb, and twirl the strand *away* from your body (clockwise), Step 1 on the figure.
2. Take the twisted Strand A and bring it toward your body, *over and then under* Strand B, Step 2 on the figure.
3. Hold strands A and B between your left forefinger and thumb about where you crossed A over B. Repeat the twirling and crossing sequence: pick up Strand B, twirl it away from your body, and cross it over and under Strand A.
4. Continue these steps. **The twirling in one direction and crossing in another direction forms an interlocking pattern like that of machine-made rope.** If the cordage looks twisted in the same direction, this usually means the strands are being twirled in the wrong direction and thus the locking is not taking place.
5. Left-handed people will reverse the directions of twirling and crossing. They twirl the strands *toward* their bodies, and cross the strands *under then over*.
6. The process of making cordage is difficult to describe, and it sounds more complicated than it really is. Try it! It's surprisingly easy.

Now it's their turn! Access the PowerPoint and project the diagram, How to Twist Fibers to Make Cordage.

7. Divide the class into groups of 4 to 5 students. Give each student about 15 inches of fibers.
8. Assist each group, asking students who readily learned the procedure to help other students.

Discussion

9. Revisit the answers to these questions students recorded before the experience of making cordage: *How difficult do you think it would be to make twine or rope from natural materials? What materials could be used? How long would the process take from collecting the materials to completing the twine or rope?*

Have their thoughts changed? In what ways? Did all students have the same reaction to the experience?

Calculating materials and time

11. Access the PowerPoint and project the "Experimental Archaeology" activity sheet. Distribute copies of the "Experimental Archaeology" activity sheet to each student

or team. Explain that archaeologists who study prehistoric peoples use the metric system (1 millimeter equals 0.0394 inches). For an added challenge, direct students to convert millimeters to inches. As a class, work through the first problem. Students will complete the remaining problems working individually or in teams. Once everyone is finished, project the answer sheet.

Clean Up

12. Involve the students in cleaning up and putting away any left-over materials. Why would it have been important for people in a prehistoric culture to take care of their tools and materials? Why is it still important today?

Closure

Based on their experience with making cordage, have students share their impressions of what daily life might have been like for Kentucky’s ancient Native people. In what ways might it have been similar to their own daily lives? In what ways was it different?

Evaluation

1. Evaluate students' efforts to make cordage.
2. Evaluate the students' Experimental Archaeology activity sheets.

Open Response Assessment

Prompt

Experimental archaeologists replicate artifacts using techniques that ancient peoples may have used. Their studies help everyone better understand the processes that Native peoples used to make the tools and structures found in archaeological sites.

Directions

Pick a tool or object created by ancient peoples and describe two experiments archaeologists might conduct in order to determine the object’s purpose and how the people made it. Explain how the experiments would help determine the purpose and production process.

Open Response Scoring Guide				
0	1	2	3	4
Non participation	<ul style="list-style-type: none"> •The student describes one experiment. •The student has little or no success in explaining how these experiments help determine the selected artifact’s purpose and production process. 	<ul style="list-style-type: none"> •The student describes 1-2 experiments. •The student is partially successful at showing how these experiments help determine the selected artifact’s purpose and production process. 	<ul style="list-style-type: none"> •The student describes two experiments that generally help determine the selected artifact’s purpose and production process. 	<ul style="list-style-type: none"> •The student clearly and effectively describes two experiments that accurately help determine the selected artifact’s purpose and production process.

Name: _____

Experimental Archaeology

1. If it takes 10 minutes to make 25 centimeters of cordage, how long would it take to make 10 meters of cordage? 100 meters?
2. If you increased your speed from 10 minutes per 25 centimeters to 7 minutes per 25 centimeters, how long would it take to make 10 meters of cordage? 100 meters?
3. If it takes one milkweed stalk to make 2 meters of cordage, how many stalks would it take to make 50 meters?
4. It takes approximately 2 meters of cordage to make a snare to catch a small animal. How long would it take to make the cordage for the snare if you can make 25 centimeters in 10 minutes?
5. Archaeologists found a cordage net measuring 42 meters by 120 centimeters at an archaeological site. How long do you think it took to make the net? How would you find out? (Outline the process below. Use the back of this sheet if you need more space).

Experimental Archaeology Activity Sheet Answers

1. To answer the questions, follow this general process for 10 meters of cordage:

- a. Convert to centimeters
 $100 \text{ cm} \times 10 \text{ m} = 1,000 \text{ cm}$
- b. Set up the ratio
 $10/25 = X/1,000$
- c. Solve for X
 $25X = 10,000$
 $10,000 \div 25 = 400 \text{ minutes}$
- d. Convert to hours and minutes
 $400 \div 60 = 6.6 \text{ hours or } 6 \text{ hours } 40 \text{ minutes}$

For an added challenge, convert millimeters to inches/feet
1 millimeter equals 0.0394 inches

for 100 meters of cordage

- $100 \text{ cm} \times 100 \text{ m} = 10,000 \text{ cm}$
- $10/25 = X/10,000$
- $25X = 100,000$
- $100,000 \div 25 = 4,000 \text{ minutes}$
- $4,000 \div 60 = 66.6 \text{ hours or } 66 \text{ hours } 40 \text{ minutes}$

2. for 10 meters of cordage

- $100 \text{ cm} \times 10 \text{ m} = 1,000 \text{ cm}$
- $7/25 = X/1,000$
- $25X = 7,000$
- $7,000 \div 25 = 280 \text{ mins.}$
- $280 \div 60 = 4.6 \text{ hours or } 4 \text{ hours } 40 \text{ minutes}$

for 100 meters of cordage

- $100 \text{ cm} \times 100 \text{ m} = 10,000 \text{ cm}$
- $7/25 = x/10,000$
- $25X = 70,000$
- $70,000 \div 25 = 2,800 \text{ minutes}$
- $2,800 \div 60 = 46.6 \text{ hours or } 46 \text{ hours } 40 \text{ minutes}$

3. conversion is not necessary

- $1/2 = x/50$
- $2x = 50$
- $50 \div 2 = 25 \text{ stalks}$

4. $100 \text{ cm} \times 2 \text{ m} = 200 \text{ cm}$

- $10/25 = x/200$
- $25x = 2,000$
- $2,000 \div 25 = 80 \text{ minutes}$

$$80 \div 60 = 1.3 \text{ hours or } 1 \text{ hour } 20 \text{ minutes}$$

5. First compute the number of square meters in the net.

$$100 \text{ cm} \times 42 \text{ m} = 4,200 \text{ cm}$$

$$4,200 \times 120 = 504,000 \text{ sq. cm.}$$

$$504,000 \div 10,000 = 50.4 \text{ sq. m.}$$

Then, measure the approximate length of cordage in each square meter of the net. Multiply that amount by 50.4, the number of square meters in the net. If there are 3 meters of cordage in each square meter, then there are $3 \times 50.4 = 151.2$ meters of cordage in the entire net. Figuring 10 minutes per 25 centimeters of cordage, compute the amount of time required.

$$100 \text{ cm} \times 151.2 \text{ m} = 15,120 \text{ cm}$$

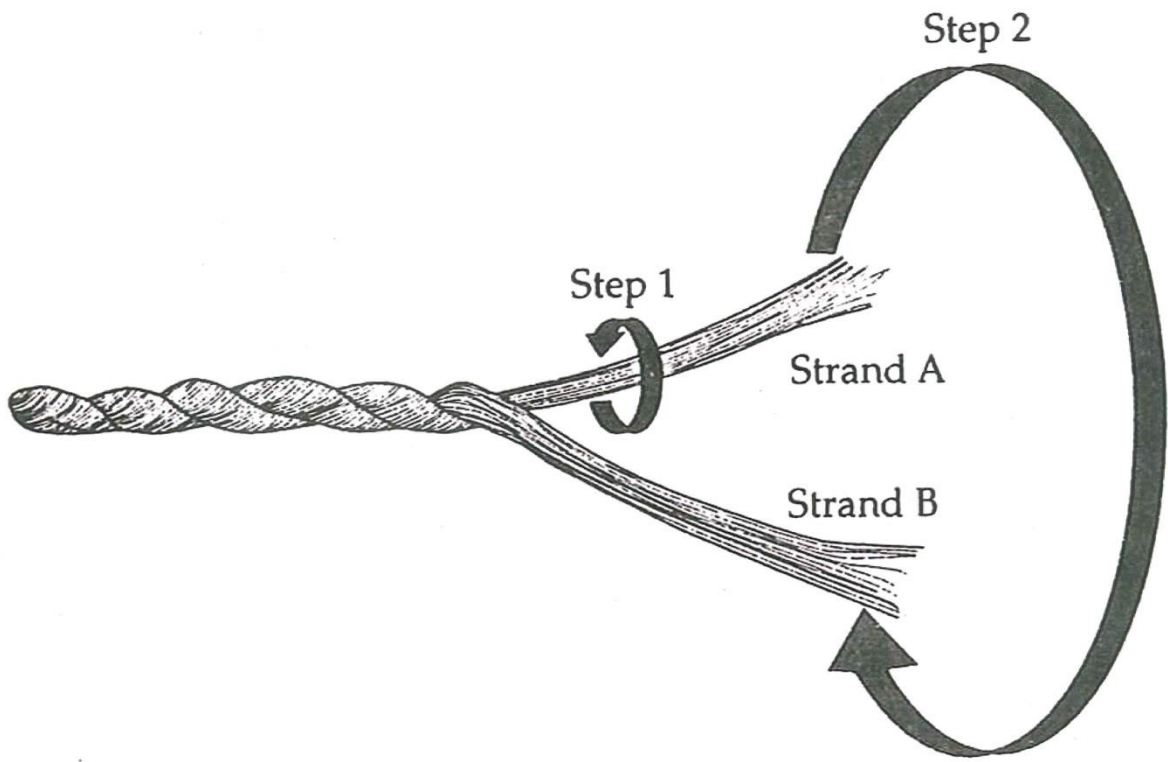
$$10/25 = X/15,120$$

$$25X = 151,200$$

$$151,200 \div 25 = 6,048 \text{ minutes}$$

$$6,048 \div 60 = 100.8 \text{ hours}$$

Adapted with permission from *Lesson 16 - Experimental Archaeology: Making Cordage*, pages 81-86, in *Intrigue of the Past: A Teacher's Activity Guide for Fourth Through Seventh Grades*, by Shelley J. Smith, Jeanne M. Moe, Kelly A. Letts, and Danielle M. Patterson, U.S. Department of the Interior, Bureau of Land Management (1993). Adapted from *Living Archaeology Weekend: Lesson 3 Experimental Archaeology: Making Cordage* (2009) and *Visual Arts Toolkit—Lesson Plan-Experimental Archaeology*, KET and Judy Sizemore (2016).



How to Twist Fibers to Make Cordage