

Lesson 1: Warping the Earth Loom

By Richard Merrill

Primary subject: Math

Learning Outcomes:

1. follow directions, and derive conclusions from the directions
2. cooperate with others in a goal-oriented activity
3. learn the basic parts of a loom, and the concepts of weaving
4. visualize a result beforehand, and planning based on abstract concepts
5. demonstrate use of math concepts of fractions, measuring length using a measuring tape.
6. demonstrate use of arithmetic operations addition, multiplication
7. demonstrate use of math concepts of circumference or perimeter
8. demonstrate understanding of physics of fibrous materials, specifically strength, elasticity, and friction
9. document an activity, and keep records of the results.

This lesson plan is designed as an introductory activity with the EarthLoom.

Building an EarthLoom

Prior to this lesson an EarthLoom must be built or purchased.

To build it yourself: order the Earth Loom DVD and Instruction book from

<http://www.weavingalife.com/tools-downloads/#earthloomdvd>

This is a project requiring purchase or donation of materials including logs or lumber and large hardware, and volunteer time digging post holes, leveling the posts, cutting and fastening the logs or timbers, and filling the holes. What fun!

To purchase: we recommend a Story Loom, because it has feet and can be moved around to use indoors or out. <http://www.weavingalife.com/tools-downloads/#storyloom>

EarthLoom Lead-In Activities

Other lead-in activities are to view examples of hand-weaving and hand looms, of which the Earth Loom is a large example.

1. Navaho looms have many elements in common with Earth Looms. Explore Navaho looms at <http://www.navaho.org>
2. Weaving requires a set of parallel “warp” threads or yarns across and between which are woven “weft” threads or yarns.
3. The method of warping the Earth Loom comes from weavers in Donnegal, Ireland. They tie their warp threads on individually, allowing them to adjust the tension of each thread. Thanks to

Susanne Grosjean, a professional rug weaver from Franklin, Maine, for bringing this method back from her studies in Donnegal.

Materials:

Garden twine (the kind used to tie up tomatoes and bean poles)
Scissors for cutting the twine
Earth Loom warping instructions
Measuring tapes (25-foot are ideal)
Narrow strips of wood or cardboard approx. 2" wide by 4 ft long for warp rulers
Pencil, pen or marker for making the warp rulers

Activity 1: Determining the length of warp yarns.

The Earth Loom instruction book gives approximate warp lengths, but the actual lengths must be found by measuring the finished loom.

The conclusion to this activity is an answer to the question: how long is one warp yarn?

Questions to investigate. Find answers by measuring:

1. How much yarn is needed to go all the way around the top warp beam?
 - a. If logs have been used in the Earth Loom, this measurement will be the circumference of the log. If lumber has been used, this measurement will be the perimeter of the beam (see glossary for this lesson plan set).
2. How much yarn is needed to reach from the top warp beam to the bottom?
3. How much yarn is needed to go all the way around the bottom warp beam?
4. How much extra yarn is needed to allow for tying a bow at the bottom?
5. What is the total length of one strand of warp?
6. If the warp is cut twice as long as the total length, so it can be doubled and two warps tied on at once, what is the total length of the two warp strands together?
7. Try measuring one and cutting it, then tying it in place according to the instruction book. Is it the right length? Do you need to adjust your measurements?

When the measurements are correct, the next activity will help you determine how many warp yarns are needed, and how far apart they will be placed.

Activity 2: Determining how many warp yarns are needed.

The number of warp yarns depends on the answers to three questions:

1. How big is the weft material? Is it rope or rags, yarn or strings?
2. How far apart do the warp yarns need to be to weave with that material?
3. How wide do you want your finished cloth to be?

Question 1: How big is the weft material? Many rugs are made with rags torn in narrow strips and woven through a strong warp. Old clothing torn in strips makes excellent warp material. Heavy yarns donated by a woolen mill or yarn leftovers donated by knitters may be used. Materials of

different sizes may be used together. In this case, the warp needs to be able to accommodate the biggest material. **Activity for Question 1:** Gather different kinds of materials to weave with. Discuss and measure them. Find examples of materials woven with materials other than thread (bamboo mats and blinds might be an example).

Question 2: How far apart do the warp yarns need to be? Our experience has shown us that if the material is the size of your little finger (more or less), the warp yarns should be spaced apart the width of your index finger. In inches, this amounts to somewhere between $\frac{3}{8}$ inch and $\frac{1}{2}$ inch, or between 1 cm and $1\frac{1}{3}$ cm. **Activity for Question 2:** Measure the widths of students' index fingers. An average may be estimated without calculating, or if you are enterprising, you may do a sub-activity with students of calculating the average width of the index fingers, and use that for your warp spacing. Round it to an even dimension, or not, as you prefer, depending on your students' math level.

Question 3: How wide do you want your finished cloth to be? In general, the wider the cloth is, the longer it takes to weave. Some students may catch on quickly and be fast weavers. Others may catch on just as quickly, but enjoy the over-and-under process, the tactile experience, and the colors enough not to want to weave quickly. Strike a balance between a wide, impressive finished piece and a weaving experience that yields visible rewards. You might want to try a narrower warp (12"-18") for the first project. A larger Earth Loom can accommodate two such warps with working room between them. **Activity for Question 3:** Hold a measuring tape along the bottom warp beam, and visualize how wide you would like your fabric. Discuss how the wider the fabric, the longer it takes to weave, and how you can choose a balance between width and timely results that will make your finished weaving pleasing to make and to look at.

Steps to take:

1. Arrive at a final width, and divide that width by the average finger width. The result is the number of warp threads.
 - a. Example: Desired warp width: 18". Average finger width $\frac{3}{8}$ ". $18''$ divided by $\frac{3}{8}'' = 48$ warp threads.
2. Make two warp rulers with strips of paper. Make a tick mark for each warp thread.
3. Divide that number by two to get the number of double-length warp yarns you will need.
4. Recall the total length of each double warp yarn.
5. What is the total length of warp yarn will you need? Multiply the result of step 2 by the length in step 3.

Activity 3: Warping the Earth Loom

Warping the Earth Loom will probably require a step ladder, and pairs of students. One student will hold the ladder while the other climbs up and fastens the warp to the top beam.

Steps in the process:

1. Measure and cut warps according to Step 4 in the previous activity.
2. Double the warps by bringing the ends together. Hold the folded warp yarn in the middle.
3. Have students work together to place or toss the warp over the top beam.

4. Fasten the center warp pair to the top with a “lark’s head” knot, as shown in the instruction book.
5. Alternating teams, and working from the center outward on both sides, tie all the warp yarns to the top beam, spacing them according to the warp ruler.
6. Tie the center warp pair.
 - a. Bring the pair of yarns in front of the beam, and pass them underneath the beam.
 - b. Bring the ends up behind the beam and to the front, with one end on each side of the pair of warp yarns.
 - c. Tie the ends in a bow knot in front, snugging the knot down so the warp threads are tight like the strings of a harp.
7. Tie the remaining pairs, working from the center outward, keeping the warp threads parallel by measurement and by eye.
8. Adjust the tension of the pairs where needed by untying the bow knot, tightening the yarns, and retying the bow. The warp yarns will stretch, but can be tightened.
 - a. What makes them stretch? Would you call them “elastic”?
 - b. What are the warp yarns made of?
 - c. What would be other good materials for warp yarns for the Earth Loom?

Conclusions: You will notice that the tying process grouped warp pairs together, leaving wide gaps between pairs, seemingly out of keeping with your careful measurements. When weaving commences, the pairs will separate naturally, and the warp will behave as you planned.

The warps should make a surface of tight, springy strands, that can be strummed like a harp. They probably won’t make music! Adjust them so the warps all lie in the same plane, with none of them too far in front or behind the rest. They don’t need to be perfectly flat, as the weaving will even them out. They just need to be flat enough that it won’t be confusing to decide which is which when you go over and under them.

Closure:

Many weavers feel that warping the loom is the most important part of weaving. Congratulations on your accomplishment!

Discussion:

- Why would weavers feel the warp is so important?
- Look at woven fabric in your environment. How important was the warp to the final product?
- What part did the warp play in the final fabric?
- How is a warp like the foundation of a house?
- Can you think of other projects in which preparation is very important to the final outcome?