



Engineering an Eagle's Nest

Lesson Overview

Using natural materials, students will design, make, and test a 1/10 scale model of an eagle's nest.

PA Education Standards addressed:

3.4.6.C1: Recognize that requirements for a design include such factors as the desired elements and features of a product or system or the limits that are placed on the design

3.4.6.C2: Show how models are used to communicate and test design ideas and processes.

3.4.7.C2: Explain how modeling, testing, evaluating, and modifying are used to transform ideas into practical solutions.

3.4.8.C2: Explore the design process as a collaborative endeavor in which each person in the group presents his or her ideas in an open forum

3.4.6.C3: Explain why some technological problems are best solved through experimentation.

3.4.8.D1: Test and evaluate the solutions for a design problem

Ages/Grade Levels:

This lesson is designed for grades 6-8 but can easily be adapted for younger or older students.

Timeframe:

One class period or about 50 minutes. To adapt this into multiple class periods, have your students go through the design process twice. The first build can be evaluated and then re-constructed to improve on the first version during a later class.

Materials:

1. One branched stick inserted into its base to represent a tree top
2. Various sticks used to construct the nest
3. Soft materials (dried grass, leaves, pine needles) to line the nest
4. One gallon jug of water to act as a weight to test the nest's structural integrity
5. Chocolate "mini-eggs" to simulate eagle eggs
6. Tongs to represent eagle talons/ beak (optional.)

Background:

Eagles carefully choose their nesting sites and build amazingly complex and strong structures. A typical nest is about six feet wide and two feet deep. The nests are built of sticks and carried to the nest in the eagle's talons. The eagles will then manipulate the sticks into place with their beaks. Rather than just piling up the sticks; eagles inter-lock them together. The nest is lined with moss, leaves, pine needles and other soft materials. Eagle nests are subjected to many forces and must be able to withstand them if reproduction is to be successful.

Lesson Objectives:

- *The students will design, build, and test a 1/10 scale eagle nest.
- *The students will be able to explain how modeling can transform ideas into concrete solutions to problems.
- *The students will evaluate their solutions to a practical problem and then apply their discoveries to improve their design.
- *The students will be able to work collaboratively in order best utilize their human resources.

Introduction: (5 minutes)

During the 1970s-1980s, when eagle populations were dangerously low, scientists experimented with building artificial nests in order to attract eagles. These early nests were made of wire mesh, aluminum sheet, and other man-made products. It was soon discovered that these were ineffective, difficult to secure, and aesthetically unpleasant. A switch was made to completely natural materials and construction techniques; the scientists literally went up a tree and wove together a nest of sticks. This lesson will allow students to design, build, and test a scaled down nest. The scale will be roughly 1/10 the size of an actual nest. There will be failure, evaluation, and re-design. Their nests should be designed to meet the following requirements: A. support one gallon of water (8.33 pounds.) B. withstand moderate shaking.

Process: (40 minutes)

Step 1:

Welcome to the treetop!

Divide the students into equal groups and distribute the nest building materials. Reinforce the notion of cooperation. Explain that each "tree" is different and students are not allowed to break the sticks. Eagles must utilize whatever length sticks they find.

Step 2:

Getting started.

Lay several sticks at a time across the crotch of the "tree" and supporting branches into a triangle shape. They need not be anchored or wedged. Allow the students to experiment as each "tree" poses different engineering problems to solve.

Step 3:

Busy Eagles.

Continue adding sticks and interlock them into a rough circle. Natural nests have many sticks hanging out outside the nest perimeter; this is fine.

Step 4:

Almost done!

Have the students build their nest into a bowl shape with a large flat perimeter. They then can line their nest with the soft materials that they weave into the superstructure. Have them add 1-3 chocolate eggs to their nest and take a picture if desired.

Step 5:

Nest Test!

Will your newly laid eggs survive the rigors of weight and wind?

An eagle nest can easily support the weight of an adult human. Have the students place a gallon jug of water onto their nest. Does it hold?

Next have the students lightly shake their “trees” base to simulate a windy day. Does it Hold?

Now have the students place their jug into the nest **and** shake it. Does it Hold?

If the nests failed, have the students consider why and what they would do to make their nest stronger.

Discussion Questions:

Why must an Eagle’s nest be strong?

Why do eagles bother building nests?

Why not make their nests from mud or grass like songbirds?

Did your nest pass the test? Why or why not?

Lesson Expansion Options:

1. Allow students to do some online research of their own, there are many videos and pictures of eagle nests.
2. Go on a school ground hike to gather nesting materials

Wrap up and sharing: (3-5 minutes)

In nature, survival is not guaranteed. Even if the eagle builds a solid nest, a raccoon or other creature could snatch their eggs away. Environmental pollution can reduce the area where they can hunt and fish successfully. You all live in eagle country and it is largely human action that can encourage or discourage successful eagle reproduction.

Eagle Nest Building

Names:

Date:

Period:

Today we are going to build our own models of an eagle nest. Do not be afraid to try out your ideas and readjust them if needed. Once your nest is made, you will test it for strength.

Step 1: Gather your building materials (sticks) around your “tree.” Think about ways in which you can position the sticks in order to build a strong nest.

Step 2: Getting Started: Begin by placing a few thicker sticks into a triangle shape for the base of your nest. Do not break sticks; the eagles must use what they find.



Step 3: Busy Eagles: Interlock sticks into a bowl shape. Do not just pile the sticks on to on one another, weave them into a strong structure and don't worry about sticks that hang out away from the nests, natural eagle made nests have those too!



Step 4: Almost done: Line your nest with soft leaves, grass, and pine needles. Make the inside a cozy place for eaglets to live. Add a few eggs to your nest if you want!



Step 5: Nest Test: Will your new nest survive the rigors of weight and wind? Place a jug of water on your nest. Did it hold the weight? Next shake your tree a little. Did the nest fall apart or hold up well? For the last test, put the jug back on AND shake the tree. What happened? If your nest failed, why do you think it failed?

