

Spiders – Nature’s Weavers

Grade Level - 1-2

Connections to Literature

- *The Spider Weaver: A Legend of Kente Cloth* by Margaret Musgrove
- *Are You a Spider* by Tudor Humphries and Judy Allen
- *Spiders* by Nic Bishop

Science Concepts/Standards

- Design and make things with simple tools and materials
- Compare and explain how external features of plants and animals help them survive
- Investigate a variety of familiar and unfamiliar habitats

Engineering and Technology Concepts/Standards

- Develop an understanding of the natural and human-made world are different
- Understand that things found in nature differ from things that are human-made
- Develop an understanding of the engineering design.
- Build or construct an object using the design process.

Mathematics Concepts/Standards

- Represent and interpret data.
- Reason with shapes and their attributes.
- Measure and estimate lengths in standard units.
- Relate addition and subtraction to length.

Reading/Language Arts Concepts/Standards

- Write a personal narrative about working as a team
- Describe how inventions can solve everyday problems

Big Ideas

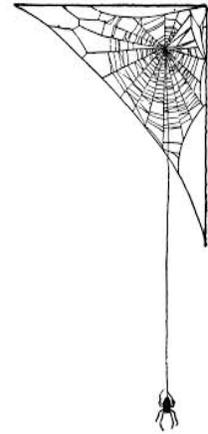
- Role of brainstorming to come up with ideas
- Attributes of shapes and how “strong” they are
- Relationship between the natural environment and the human-made world
- Ability to measure the weight of an object
- Proper use of the design loop
- Ability to present final design to a group/teacher

Essential Question

How can you design a web that will withstand the greatest amount of weight?

Content Information

Most in the STEM community would agree that it is critical that young students have an early understanding of the differences between the natural and human-made environments. Similarly, it is important for young students to understand that most engineers and technologists spend a great deal of time trying to create inventions, products, and systems that improve on the natural world. For example, Swiss inventor George de Mestral invented Velcro after examining the hooks on cockleburrs attached to his dog upon returning from a nature hike. In the book *The Spider Weaver: A Legend of Kente Cloth* by



Margaret Musgrove two weavers discover a magical-looking, beautiful spider web in the jungle. Inspired by the web's brilliant design and the weaver who created it, the men return to their village and create complex patterns of their own, which they come to call kents, a cloth that is now known throughout the world. This story presents a wonderful context for students to learn about the differences and similarities between the natural and human-made environments. Additionally, informational text can be used in the STEM lesson to examine the relationship between natural fibers and patterns made by spiders and human-made products that might ensue.

Using an informational text such as *Are You a Spider* by Tudor Humphries and Judy Allen (2003) or *Spiders* by Nic Bishop (2007) -- depending upon the age of the students-- as a springboard for learning could facilitate a rich STEM experience. The lesson might begin by reading the chosen text focusing on spiders and discussing the life and contributions of spiders. This could be followed by viewing videos of spiders making webs online. (See <http://www.youtube.com/watch?v=r5aKhWniWU&feature=related>.)

The students could also be asked to stand in a circle and toss a ball of yarn back and forth across the circle to form a human web. Finally, the students could be grouped into teams and asked to design a web using thread that would hold the greatest number of pennies. This STEM activity would address CCSS standards related to geometry and measurement, NGSS standards related to scientific inquiry and technological design, as well as STL standards related to engineering design, invention and innovation, and the design process.

To complete this activity, a wooden or Styrofoam frame, pushpins, coins, and fine sewing thread will be needed. The teams would introduced to the concepts of strength, geometric shapes and their attributes (triangles, squares, circles, etc.), measurement, spacing, weights, the design loop (how engineers make decisions), and product assessment and testing. After the teams have completed research where they examine natural spider webs using available informational texts, they will complete brainstorming sessions to determine the best way to improve the natural design to hold the greatest number of coins. *Note: The math content of this STEM activity could be further augmented by asking the teams to build a web that would hold the greatest amount of money using coins of different denominations.* After decisions about the design have been made, teams will use the pushpins around the parameter of the frame and then weave a human-made web by wrapping the thread around the pushpins. After the human web has been completed, the teams would assess the quality of their design, much like engineers would: they would place coins on the web to the point of failure and then revisit the design several times in an attempt to improve upon their design (refer to Figure 3). It would also be important for the teams to describe the rationale for their team design. It is at this point that the teacher would determine whether the students included comments about geometric shapes, measurement, spacing, etc.

Student performance in this STEM activity could be assessed by determining the degree to which the teams utilized the engineering design loop, whether the students applied knowledge of geometry, measurement, shapes, and spacing, as well as evaluating the improvements made to the final product based on team testing with coins. Finally, teams could be assessed on their ability to describe the process used to create their human web during the team presentation.

This informational text/STEM-based lesson will provide young students with a measure of understanding about the intricate relationship between the natural environment and the human-made world as well as a glimpse into the roles that engineers, scientists, technologists, and mathematicians play in the development of inventions and products that we all take for granted. The lesson would also provide the young students with a great introduction to problem-based learning using informational text as the springboard for learning, the engineering design process, and the role of the all four STEM disciplines in providing solutions to human problems.

Deliverables

Students will develop a design by following the design loop. The students must first fill out the provided worksheet first, where they brainstorm different ideas for the design. Students are to complete a human-made web using only allowed to use the resources that are provided in the materials list.

Parameters

The final design must be created by use of the design loop and be turned into the teacher by the end of class.

Designing a Human-made Web



Pre-service teachers examine natural spider webs, and determine the best way to improve the natural design.

Evaluation

Design Brief Rubric	No Evidence 0 points	Limited Understanding 1-10 points	Fair Understanding 10-15 points	Good Understanding 16-20 points	Excellent Understanding 21-25 points
The design team brainstormed more than one idea					
The design team evaluated how they could improve the design					
The design team spoke clearly and with confidence when presenting their design					
The design team used the required materials to create a web that was able to hold a given number of pennies.					
Comments:					
Total Points: _____					

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Situation 1

Your class has just finished reading *The Spider Weaver: A Legend of Kente Cloth* by Margaret Musgrove. The Ashanti Village has noticed that the black and yellow spider has been catching a lot of food in her web. The problem is that her web can't withstand the weight of all of the insects. The people in the village want to create a web that can hold the weight of all of the food to help the spider. But, they need a little help! The Ashanti Village will use the web that can withstand the most weight.

Situation 2

Your class has just finished reading the book *Spiders* by Nic Bishop and you have discussed the life and contributions of spiders. You have also watched the video *Web Making 101* in order to examine the relationship between natural fibers and patterns made by spiders that resemble human-made products. You have also worked as a class to design a human web. Working as a member of an engineering design team, how can you design a web that will withstand the greatest amount of weight?

Challenge

In your assigned design team, you will design an intricate web using only the assigned materials. Using the design loop and the provided materials, design and create a web that can withstand the most weight.

Materials

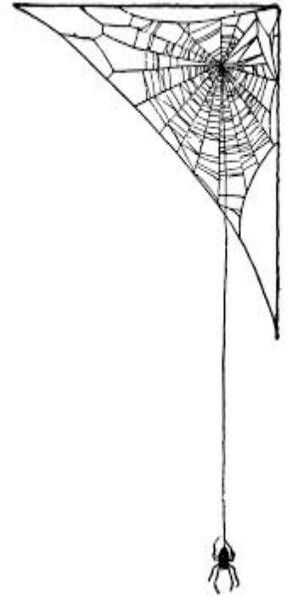
- Frame
- Thumb tacks
- 3 yards of string

Tools

- Digital Scale
- Scissors
- Pennies to test the weight that your web can hold

Test

- Test your design and redesign if needed.
- Present your final design to the teacher and class.
- The design that can hold the most weight will win the design challenge!



Brain Blast!



Idea 1)

Idea 2)

Idea 3)