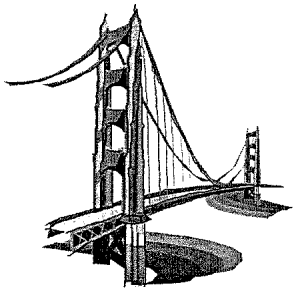
Structures

Description: The activity is designed to test a student's ability to build a long, strong, stable bridge from common materials.



Groups: Upper elementary groups of 2-4.

Estimated Time: 20 minutes

Key Question: What is the best method to use in building a bridge that will span a given distance and support a given weight?

Content Expectations addressed: Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.

Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.

Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science through history and within society.

Teacher background: The basic bridge structures are beam, suspension, arch, and truss. A beam bridge is the most basic form and consists of a horizontal beam that is supported at each end by piers. The weight of the beam pushes straight down on the piers. The beam itself must be strong so that it doesn't bend under its own weight and the weight of anything placed on it. When the load pushes down on the beam, the beam's top edge is pushed together (compression) while the bottom edge is stretched (tension). Suspension bridges are used to span long distances and withstand gusty winds. Arch bridges have great natural strength. Instead of pushing straight down, the weight of the arch bridge is carried outward along the curve of the arch to the supports at each end. These supports are called abutments. They carry the load and keep the ends of the bridge from spreading out. Arch bridges are used when both length and load factors must be considered. Truss bridges are constructed with a series of triangles that make a rigid structure. These bridges can support heavy loads such as trains and have been the dominant bridge design since 1570.

Science Process Skills: Following directions, problem solving, and teamwork.

Materials: 50 plastic straws per group 1 meter of masking tape chalkboard eraser scissors, measuring tape

Procedure: At the Olympiad site, students are given 50 plastic straws and a meter of masking tape. They have 20 minutes to construct a bridge that can support at least one chalkboard eraser placed flat on the center of the bridge perpendicular to it. Also, the longer the bridge, the better.

No pins, string or other materials may be used. Scissors may be used and straws may be cut to desired length. The bridge will span two similar devices such as two desks or two chairs. The bridge may not be taped or hooked to the desks or chairs. Note that if two chairs are used, it may be necessary to have someone sit on each of the chairs when the weight is being added to the bridge so that the whole structure does not collapse.

Resources:

Websites

http://www.pbs.org/wgbh/nova/bridge
Contains extensive background information on bridge design and examples of each type.

http://www.iit.edu/~hsbridge/database/search.cgi/:/public/documents/pictures
Offers photographs taken during a recent bridge building contest.

http://www.bechtel.com/buildingMind/spanGame.html
An interesting bridge building and testing game online.

Book:

Leonhart, Fritz, Bridge MIT Press, Cambridge, 1990

Periodical:

ScienceScope January 2000, “Building Bridges” pp. 48-49