

Lesson Plan – 21

Topic: Build and Test a Paper Bridge

Sub – Topic: Geometry, Measurement

Grades: Grade 6, 7 and 8

Duration: 1 - 2 hours

Aim:

1. To introduce students to a basic concept of engineering to help them understand why certain shapes are used and which shapes withstand the most force.
2. Focus on how bridges are engineered to withstand weight, while being durable and in some cases aesthetically pleasing.

Prerequisites:

1. Knowledge of parallel lines and different type of angles (acute, obtuse etc.)
2. Knowledge about different types of triangles and quadrilaterals.

Instructional Resources:

Materials Required:

- Two wooden blocks / pile of same type and numbers of note books
- Some sheets of paper (one blue, to show a river and others can be white)
- Some small wooden pieces / small pebbles or toy cars.



[Paper Bridge](#)

Procedure:

To Do and Observe:

1. Set the blocks (pile of notebooks) about 15 cm (6 inches) apart on a table or floor.
(Additionally you can place a blue color paper to show a river on which the bridge is to be build.)
2. Place a paper that spans the blocks / pile of notebooks and on it try to place as many pebbles or "cars" as possible. We can only stack them in the center of the roadway, not on top of the blocks. Note down the number of pebbles or car the structure had supported.
3. Next, fold the paper to make it stronger. Try folding the paper in different ways to construct the strongest roadway.
4. Place as many pebbles or "cars" as possible and note their numbers.
5. Discuss the results and determine which structure was the strongest and why.
6. Fold the paper like a paper fan making a corrugated roadway. Then place two paper sheets, one on top and the other on bottom of this corrugated paper making a series of triangles
7. **What's Going On?** Triangles form the strongest structures. A structure is anything that supports its own weight against gravity, plus the weight of another object. Weight provides two kinds of force: compression and tension. Compression is a push down on the structure that must be channeled to the ground. Tension is a pull that stretches the structure. Triangles

support both of these forces. Compression pushes down equally on two sides of the triangle, causing the base to be pulled equally in two directions, which creates tension.

8. The triangle is the strongest structure because all three sides bear the load. In a square, only two sides of the four bear the load. This equaling of the forces makes the triangle the strongest structure. The corrugated roadway utilizes this strength to increase the strength of bridges.
9. Try the same experiment, but alter the distance between blocks. Try different materials for your bridge. What works best?

In order to understand the tension and compression forces that are placed on a structure, create a "people arch" with your children. Two people stand facing each other, at least two feet apart. (You might kneel to become the same height as your child). Both lean toward each other, putting their hands on the other's shoulders. Where do they feel a push (compression)? Where do they feel a pull (tension)?



This same type of structure we see during the 'Janmastami Dahi Handi' competition where many people make this type of arch to make the base sturdy and stable.

Challenge the children to try the above experiment using the thickness of two or three sheets of paper. This will dramatically increase the strength of their structure, and enable greater load bearing.

Resources:

https://www.youtube.com/watch?v=KAW78Qf9d_U

Mathematics Lab, Vikram A Sarabhai Community Science Centre, Ahmedabad, India.