

Drinking straw bridge

Participant numbers	up to 48
Max number of teams	8
Team size	4 to 6 (younger children may work better in small groups)
Timing	up to 2 hours to include briefing, build, testing and review
Key themes	Teamwork, creative thinking, problem solving, time management
Number of facilitators	for up to 4 teams - one facilitator for up to 8 teams - at least two facilitators

Prior to the event

- Check with the teacher concerned that
 - this activity is suitable for the children/students given the materials to be used
 - there will be enough space available to run this activity
- Discuss the event with your local SHE Adviser and ensure they have undertaken any risk assessments as necessary

Lesson Focus

The focus is on how bridges are engineered to withstand weight, whilst being durable and in many cases aesthetically pleasing.

Overview

Students, working in teams, must

- present a design concept by creating a sketch of their bridge design.
- evaluate team members' bridge designs, choose the best design and justify their choice based on the criteria and constraints of the challenge.
- build a prototype of their bridge design and test it by applying weights.

Materials required

Per team

100 plastic or waxed paper drinking straws - not the 'bendy' variety
75cms masking tape
2 pairs of scissors
Tape measure

Plus

Each team also requires two points at least 75cms apart across which to build their bridge.

Facilitators will also need a plentiful supply of pennies and plastic cups for testing strength of the bridges.

How to run the activity

- Read out the brief: the students have to design and build a winning bridge. See overview above. Today, we are going to act as teams of engineers. We have been hired to create a bridge to cross one of the local rivers. Our design objective is to make a bridge that spans the river and supports the most weight i.e. the traffic that will pass over it. To simulate the load of the cars, our bridge must have a place to securely hold a small cup in the centre of the span and the bridge cannot be taped to the support structure i.e. the tables. Engineers often have many design constraints or limitations that are part of their job assignment. Today, our design constraints not only include weight constraints, but also limited budget and materials using only straws and tape as our construction materials.
- **Strength and tension - demonstration**
Ask each student pick up a straw and pull it apart from both ends. Is the straw strong? Discuss tension and the tensile strength of the plastic straw.
Have students push inward from both ends of the straw. Is the straw strong now?
Discuss compression and the compressive strength of the plastic straw.
Then ask the students to cut a one inch piece from their straw then ask them to push inward from both ends of the one inch piece. Is this piece stronger than a whole straw? Ask the students discuss in their teams how this knowledge may influence their bridge design.

ACTIVITY SHEET

- **Design - team activity**

Each student should create a sketch of their proposed bridge design then discuss the design with their team to evaluate which is best, based on criteria and constraints given as well as their knowledge of the compressive and tensile strength of the straws.

- **Check understanding of the brief again** by having the students vote thumbs up/down, if appropriate, to agree/disagree with statements relating to the rules/ procedures:

- You can use more than one hundred straws. (Thumbs down)
- You can cut the straws. (Thumbs up)
- A small cup has to be able to sit on your bridge. (Thumbs up)
- You can leave a big mess on the floor. (Thumbs way down)

- **Provide each team with the briefing sheet** - attached below - and materials as listed above

- Reinforce the rules and start the activity and the timer. Give the teams a time check after five minutes and a one and two minute warning prior to 'time up'.

- **Build phase**

Allow thirty minutes. Circulate and check that students are adhering to rules. Caution students to budget their use of tape. Prompt students to consider alternate ways of joining straws. Ask the students measure 75cms on their table and remind them that the bridge must span this distance without being fixed to anything. Answer any questions that arise regarding rules or procedures.

On completion of the activity

- **Assessment**

- Review students' designs and ask each team to justify their choice of bridge design.
- Ask if teams' design changed during construction and if so why
- Measure each bridge to ensure it meets the required span

- **Testing**

Ask one group volunteer to go first. Have them bring their bridge to two tables, 75cms apart, at the front of the room. Place a small cup in the middle of the bridge. Show the group how to add weights. If pennies are used, you may want to place ten pennies at a time in the cup. Other objects can be used as weights such as ordinary household kitchen weights.

Count units of load as you go and carry on doing this until failure occurs, either bending to spill the load or the bridge collapses.

Then ask the first team to test the next group's bridge, etc. until all bridges have been tested. The winning bridge is the bridge that holds the most weight.

- Provide small prizes or certificates for the winning team. You could also have a prize for Most Creative Design.

Review and conclusions

- Ask the teams if they had a plan before starting to construct their bridge
- Ask what each team (starting with the least successful) would do differently if they were to repeat the exercise
- Older students could be asked to evaluate the effectiveness of their own bridge designs and those of other teams, and present their findings to the group.

Drinking Straw Bridge

Team briefing sheet

Your aim

To build a bridge with a span of at least 75cms within the time available and with the materials provided. The bridge that supports the most pennies wins!

Materials

100 plastic drinking straws
75cms masking tape
2 pairs of scissors

Specifications

- No other materials may be used.
- The bridge must have a span of 75cms distance between two supports.
- The bridge must be portable - it cannot be attached to the supports.
- The bridge must have a space in the middle to hold a small cup to enable the judge to add penny weights to test the strength of your design.
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Time allowed

The project must be completed in 30 minutes.