

# Building a Bridge

## **Standard:**

**NGSS Standard:** 4-ETS1-2 – Engineering Design

Students will learn how to design and test a bridge using structural engineering principles.

**A. GRADE LEVEL:** 4th–6th Grade

**B. SUBJECT:** STEM/Engineering

**C. DATE:** [Insert Date]

**D. DURATION:** 3–4 days

**E. LESSON FOCUS:** Structural Engineering – Building and Testing a Paper Bridge

## **F. MATERIALS:**

- Construction paper (for building the bridge)
- Ruler or measuring tape
- Scissors
- Masking tape
- Small weights (e.g., washers or small bags of sand)
- Stopwatch
- Pen/pencil and paper for recording data

## **G. LESSON OBJECTIVES:**

- Students will design and build a simple bridge structure using paper.
- Students will apply concepts of engineering design to create a functional bridge.
- Students will test their bridge designs by adding weight and measuring the bridge's strength.
- Students will analyze the results and improve their designs based on observations.

## **H. PROCEDURES:**

### **1. INTRODUCTION:**

- Discuss the concept of bridges and their importance in transportation, engineering, and construction.
- Introduce different types of bridges, such as beam, arch, and suspension bridges, and discuss the basic concepts of structural engineering (e.g., support, load, force).
- Show pictures of different bridges and ask students to identify which ones are most likely to hold a lot of weight.

### **2. EXPERIMENT:**

- Provide students with the materials and instructions to design and build a paper bridge.
- Have students measure and cut the construction paper to create their bridge design. The bridge should span across two blocks or books (or a similar gap).
- Students should aim to create a bridge that can hold as much weight as possible. They will test the bridge by gradually adding weight and recording the results.

**3. OBSERVATION:**

- Students will observe how the bridge behaves under increasing weight and record the amount of weight the bridge can hold before it collapses.
- Encourage students to consider why their bridge collapsed or succeeded and to think about the importance of balance and design in bridge construction.

**4. GENERALIZATION:**

- Discuss what worked well and what didn't with the students' bridge designs.
- Guide students in identifying the key elements that contributed to their bridge's success (e.g., bridge shape, materials used).
- Discuss how real-world engineers use similar tests to make sure bridges are strong and safe.

**5. ASSESSMENT:**

- Evaluate each student's bridge design based on their ability to apply engineering concepts.
- Assess the students' problem-solving skills, creativity, and how well they were able to improve their designs based on testing results.
- Have students write a brief reflection on what they learned about structural engineering.

**Note 1: Clean-up**

- Remind students to clean up their workspaces by gathering materials and disposing of any scrap paper. Have them store their bridge models for future reference or to test again later.

**Note 2: Accommodation for ELL, ESE, etc.**

- Provide visual aids, such as diagrams or videos of bridge structures, to help English Language Learners (ELLs) and students with special education needs.
- Use simplified language or offer sentence starters for writing reflections.
- Pair students with stronger English speakers or provide extra time and guidance for instructions.