STEM in

LESSON PLAN

Designing and testing paper bridges

In this activity, students will build paper bridges and test how much weight they can hold by adding objects like coins.

45-60 min **Duration**

Recommended age for this game

10-12 years

Learning Objectives

- Understand basic engineering concepts such as load, tension, and balance.
- Develop problem-solving skills through experimentation and testing.
- Foster creativity and teamwork in a hands-on activity.

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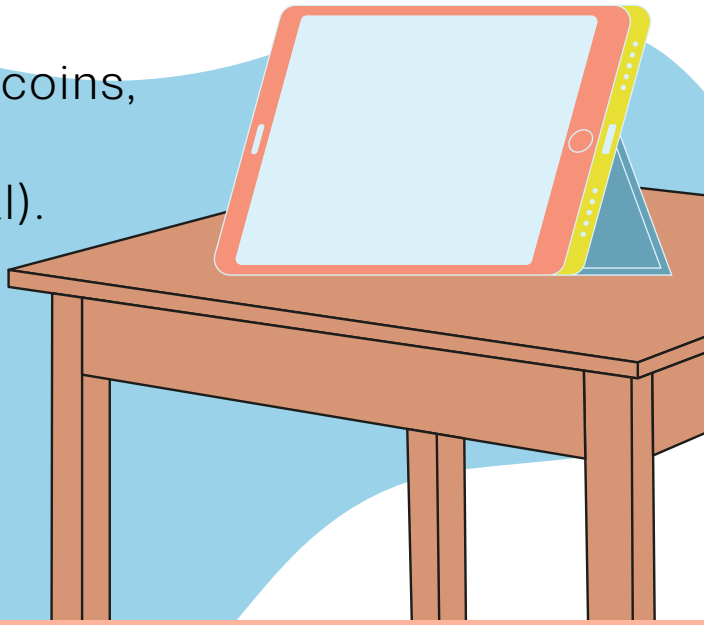
Materials and tools needed

- A4 sheets of paper (multiple per group).
- Tape and scissors.
- Small objects as weights (e.g., coins, erasers, or small toys).
- A ruler and stopwatch (optional).
- Two supports, such as stacks of books or boxes, to serve as bridge endpoints.



Guidance for Teachers

Activity description

Students will design and build paper bridges that span a gap between two supports.

They will test their bridges by adding weights to determine their strength and stability.

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Guidance for Teachers

Preparation

- Gather all necessary materials in advance and organize them into kits for each group.
- Prepare an example bridge design to demonstrate during the introduction.
- Set up the testing stations with supports and weights.

Implementation steps

- INTRO: Discuss the concept of bridges and introduce key terms like tension, compression, and load.
  Demonstrate also a simple paper bridge design and explain the goal of the activity: to create a bridge that holds the most weight.

- DESIGN PHASE: Guide students to brainstorm designs individually or in groups. Encourage them to sketch their designs and think about how they will distribute weight.

- BUILDING PHASE: Allow students to build their bridges using only the provided materials. Provide assistance and encourage experimentation.

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- TESTING: Have students test their bridges by adding weights incrementally. Record results and encourage students to observe which designs are most effective.

- ITERATION: Discuss what worked, what didn't, and how designs could be improved. If time permits, allow students to rebuild and retest their bridges.

Follow-up and reflection

- Assign a task for students to research real-life bridge designs and explain how engineering principles apply.

- Discuss how lessons from this activity could apply to solving real-world problems.

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Student Activities

Activity description	Expected outcome	Technology integration
Sketch a Bridge Design	Students will plan their designs and predict their performance.	Use drawing apps or online tools like Canva to create sketches.
Build a Paper Bridge	Students will construct their bridges and refine their designs.	Document the building process using a camera or tablet.
Test the Bridge's Strength	Students will measure how much weight their bridge can hold.	Record data in a spreadsheet or use apps for weight simulation.
Observe and Evaluate	Students will analyze why certain designs were more effective.	Create a presentation of results using Google Slides or Canva.
Redesign and Improve	Students will refine their designs based on test results.	Use digital simulations or videos of real bridge construction.

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Reflective questions for students

- What part of your design made your bridge strong or weak?
- How did the weight distribution affect your bridge's performance?
- If you could use a different material, what would it be and why?
- How did testing help improve your understanding of engineering concepts?
- What challenges did you face during the design process, and how did you solve them?

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Differentiation ideas

Advanced Students

- Challenge them to incorporate arches, trusses, or other advanced bridge structures.
- Encourage them to calculate weight-to-material efficiency ratios.
- Have them research famous bridges and apply those designs to their projects.

Students with special needs

- Provide templates or pre-cut paper to simplify the building process.
- Use larger, easier-to-manipulate materials like cardstock instead of regular paper.
- Allow extra time for testing and provide one-on-one support as needed.

Tips

- Emphasize collaboration and make teamwork an integral part of the activity.
- Encourage creativity and experimentation rather than focusing solely on outcomes.
- Provide positive reinforcement for effort and innovative thinking.
- Use real-world bridge examples to inspire students.
- Ensure the testing process is fair and consistent for all groups.

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Additional materials and references

- Video How bridges are made
- Website PBS Kids' Building Big
- Books about Bridge Engineering for children
- Real-Life Example: Golden Gate Bridge
- Guide to Building Bridges With Kids

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