

Didactic Scenario

1. Title

Creating Bridges

2. Keywords

Engineering, Construction, Bridges, Design, Materials, Strength, Statics, Creativity, Collaboration, Experimentation, Problem Solving

3. Basic information

STEAM Subject: ENGINEERING

Typical interaction time with the instructional scenario in teaching hours for in-school work:
150 minutes

General description of the scenario:

<u>Phases</u>	<u>Stage</u>	<u>Time</u>
Introduction to Engineering	Preparatory Stage	30 minutes
Bridge Design and Construction	Implementation Stage	90 minutes
Testing and Presentation	Evaluation Stage	30 minutes

Age group: 8-12 years old

Estimated difficulty level:

Very Easy	Easy	Moderate	Challenging	Very Challenging
	X			

Teaching resources

Materials:

- Sticks (e.g. skewers or ice cream sticks): For building the bridge.
- Adhesive tape: For connecting materials during construction.
- Paper or cardboard: For support or as additional construction materials.
- Scissors: For cutting materials, if needed.
- Weights (eg books, water bottles): To test the strength of the bridge.
- Diagonal and Rulers: For drawing and measuring dimensions.
- Notebooks and pencils: For recording ideas and plans.
- Pictures and examples of bridges: For the introduction and discussion.

School infrastructure:

- Work Surfaces. Tables or desks that allow students to work in groups and build their bridges.
- Good Internet Connection. If needed, to access online resources or videos related to engineering and bridges.
- Projector or Screen. To present information about bridges and engineering principles during the introduction.
- Headphones or Speakers. If the use of video or audio is required during the presentation.
- Space for Testing. A spacious area where students can test their bridges with weights without risking the equipment or other students.
- Security Materials. Materials to ensure student safety during construction and testing (eg, gloves, if required).

Additional material from external sources/online tools:

- Engineering for Kids (<https://engineeringforkids.com/>): Resource of activities and programs that combine engineering and education, ideal for elementary school students.

Differentiated instruction for students with different abilities and learning styles in the same class:

- Custom Activities: Create activities with different levels of difficulty. More advanced students can design more complex bridges, while beginners can focus on basic structures.
- Material Choices: Offer a variety of materials to build the bridges (eg sticks, cardboard, plastic bottles) so students can choose the ones that work best for them.
- Teamwork: Create groups of different ability levels so that more able students support others, promoting collaboration and mutual learning.

- Different Ways of Presentation: Encourage students to present their bridges in a variety of ways, such as through videos, written reports, or live demonstrations.
- Individual Support: Provide individualized guidance to students who need more help by offering extra material or homework guidance.
- Self-assessment: Encourage students to assess their own work and recognize their progress, enabling them to set goals for improvement.

Developed by: Development Center of Thessaly

4. Educational Problem

The script solves the problem of student alienation from science and engineering, as many students find these concepts abstract and difficult to understand. Through hands-on bridge construction, students have the opportunity to apply theoretical knowledge to real-world situations, enhancing their understanding of engineering principles, statics and forces. The scenario promotes collaboration and interaction, encouraging students to work in teams and develop communication and problem-solving skills. In this way, it makes learning more fun and experiential, engaging students' interest in science and technology.

5. Learning Objective (-s)

1. Understanding Fundamental Engineering Concepts. Students will gain knowledge of the fundamentals of mechanics such as statics, forces and loads.
2. Design and Construction Skills. They will learn to design and build bridge structures using various materials, applying their knowledge.
3. Problem Solving Skills. Students will develop the ability to identify and solve challenges during the construction process.
4. Cooperation and Teamwork. Through group work, students will learn to work together, share ideas and support each other.
5. Critical Thinking. They will strengthen their critical thinking skills by evaluating the stability of their constructions and analyzing the improvements that can be made.
6. Creativity. Students will be encouraged to use their imaginations to design original bridges, combining science and art.
7. Self-assessment. They will be encouraged to assess their own work and the progress they have made during the activity.

6. Phases of the Scenario

Phase 1

Title: Introduction to Engineering

Indoor	Outdoor	Mixed
X		

Phase duration in minutes: 30 minutes

Detailed description of the scenario phase: In Phase 1 of the scenario, students are introduced to basic engineering concepts and the importance of bridges in everyday life. The instructor begins with a presentation that discusses the different types of bridges, such as suspension, arch, and flat, and explains the principles governing statics and force transfer. Students engage in observational activities and identify bridges in their surroundings, either through pictures or by visiting local bridges. This phase aims to spark students' interest in engineering and prepare them for the bridge design and construction process afterwards.

Activity Sheets:

Activity Sheet - Phase 1: Introduction to Engineering

Purpose: To understand basic engineering concepts and types of bridges.

Activity 1: Identify Types of Bridges

Instructions: Read the descriptions below and match them with the correct type of bridge.

1. Suspension bridge
2. Arched bridge
3. Flat bridge
4. Bridge plate

Descriptions:

- A) Bridge supported by arches and distributing the forces.
- B) Bridge suspended by cables.
- C) Bridge with flat surface and simple construction.
- D) Bridge with straight supports that carry the weight.

Activity 2: Design a Bridge

Instructions: Design a bridge you like. Use the fields below to design and describe your bridge.

- Bridge Type: _____
- Design (design):

! [Design here]

- Reason for choosing this type: _____

Activity 3: Class Discussion

Instructions: Answer the following questions in class:

1. Which bridge impressed you the most and why?
2. How do you think the bridges hold the weight?

Rating:

- Check students' answers and ideas for understanding of key bridge concepts.
- Note any questions or comments that arise during the discussion.

Phase 2

Title: Bridge Design and Construction

Indoor	Outdoor	Mixed
X		

Phase duration in minutes: 90 minutes

Detailed description of the scenario phase: In phase 2 of the scenario, students work in groups to design and build their own bridge using simple materials. First, the groups discuss their ideas, determining the type of bridge they want to create and the materials they will use, such as sticks, cardboard and tape. After the design process, students proceed to construct the bridge, applying the engineering principles they have learned, such as statics and force distribution. The instructor provides guidance and support throughout the process, encouraging students to experiment and adjust their constructions, with the goal of achieving the greatest strength and functionality. This phase promotes creativity, teamwork and problem-solving skills, giving students the opportunity to put theory into practice.

Activity Sheets: N/A

Phase 3

Title: Testing and Presentation

Indoor	Outdoor	Mixed
		X

Phase duration in minutes: 30 minutes

Detailed description of the scenario phase: In the 3rd phase of the scenario, students have the opportunity to test their bridges and present the results of their work. First, teams place their bridges on a prepared test area and add weights (such as books or other objects) to test the strength and stability of their construction. Students monitor the reactions of their bridges, noting any failures or successes. After the tests, each team presents their build to the class, explaining the design process, the challenges they faced, and the results of the tests. Classmates provide feedback and discuss lessons learned from the experience. This phase enhances students' critical thinking, self-esteem and communication skills, enabling them to share their knowledge and experience with others.

Activity Sheets:

Activity Sheet - Phase 3: Test and Presentation

Purpose: To test our bridges and share the results of our work.

Activity 1: Testing the Bridge

Instructions: Test your bridge by adding weights. Fill in the following:

- Bridge Type: _____
- Total Weight Supported: _____ kg
- Notes from the Test:
 - Insisted: _____
 - Broken/Crashed: _____

Activity 2: Presentation of the Bridge

Instructions: Prepare a short presentation about your bridge. Use the following questions for guidance:

1. What is the purpose of your bridge?

○ _____

2. What challenges did you face during the build?

○ _____

3. What did you learn from this process?

○ _____

Activity 3: Peer Feedback

Instructions: After presenting your bridge, give feedback to your classmates. Use the following fields:

- Positive Points: _____
- Suggestions for Improvement:

7. Evaluation Methodology

A methodology that includes observation, presentation and feedback is proposed for scenario evaluation. The teacher can monitor student participation during the design and construction phases, using an observation board to note active participation and support among group members. In the testing phase, students will be evaluated on criteria such as bridge strength, application of engineering concepts and innovation in design. During the presentation, the challenges and solutions they found should be mentioned, with feedback from classmates and the teacher. In addition, students will complete a self-assessment sheet to judge their own participation and progress, thus enhancing their self-awareness. This approach provides a comprehensive view of learning, focusing on both the process and the end result.

8. Additional Resources for the teacher

N/A