

Teaching Script

1. Title

Making Catapults

2. Keywords

Catapult, Mechanics, Forces, Motion, Design, Construction, Experimentation, Statics
Weight, Collaboration, Creativity

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 script:

<u>Phases</u>	<u>Stage</u>	<u>Time</u>
Introduction to Catapults	Preparatory Stage	30 minutes
Catapult 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 the construction of the catapult frame.
- Tires or tires: To propel the catapult.
- Plastic bottles or caps: For the construction of the ejection mechanism.
- Adhesive tape or glue: To connect the materials during construction.
- Paper or cardboard: For support or additional building materials.
- Scissors: For cutting materials, if needed.
- Diagonal and Rulers: For drawing and measuring dimensions.
- Weights (eg balls or small objects): To test the catapult during launch.
- Notebooks and pencils: For recording ideas and plans.
- Pictures and examples of catapults: For the introduction and discussion.

School infrastructure:

- Work Surfaces. Tables or desks that allow students to work in groups and build their catapults.
- Good Internet Connection. If needed, to access online resources or videos related to mechanics and catapults.
- Projector or Screen. To present information about catapults and principles of engineering during the introduction.
- Headphones or Speakers. If the use of video or audio is required during the presentation.
- Testing Area. A spacious area where students can test their catapults without risk to 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.
- Science Buddies (<https://www.sciencebuddies.org/>): Provides ideas and instructions for engineering-related experiments and constructions, including catapults.
- YouTube video, make your own catapult (for kids).
<https://www.youtube.com/watch?v=Zg1Pz0WUMW4>

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 catapults, while beginners can focus on simpler constructions.
- Choices of Materials: Offer a variety of materials to make the catapults (eg, sticks, plastic bottles, tires) 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 catapults in a variety of ways, such as 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. Through hands-on catapult construction, students have the opportunity to apply theoretical knowledge to real-world situations, enhancing their understanding of engineering principles, forces, and motion. The scenario promotes collaboration, interaction and active participation, encouraging students to work in groups and develop 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 about forces, motion and the construction of mechanisms.
2. Design and Build Skills: They will learn to design and build catapults, applying engineering principles.
3. Problem Solving Skills: Students will develop the ability to identify and solve challenges during the manufacturing process.

4. Cooperation and Teamwork: Through teamwork, they will learn to cooperate, 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 imagination to design original catapults.
7. Self-evaluation: They will learn to evaluate their own work and recognize their progress.

6. Phases of the Scenario

Phase 1

Title: Introduction to Catapults

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 the basic concepts of catapults and the engineering principles that govern them. The instructor begins with a presentation that breaks down the history of catapults, how they work, and the different types that exist, such as simple and compound catapults. Students engage in observation and discussion activities, identifying catapults in videos or pictures and examining how forces act when objects are launched. This phase aims to spark students' interest in engineering and prepare them for the process of designing and building their own catapults afterwards.

Activity Sheets:

Activity Sheet - Phase 1: Introduction to Catapults

Purpose: To understand the basic concepts of catapults and the principles of engineering.

Activity 1: Identify Types of Catapults

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

Catapult with spring
Catapult with gravity
Catapult with latch
Belt catapult

Descriptions:

- A) It uses the force of a spring to launch objects.
- B) Activated by dropping a weight.
- C) It has a mechanism that locks and releases objects.
- D) It uses belts to transfer energy.

Activity 2: Design a Catapult

Instructions: Draw a simple version of a catapult that you would like to build. Use the fields below to design and describe your catapult.

Catapult Type: _____

Design (design):

! [Design here]

Reason for choosing this type: _____

Activity 3: Class Discussion

Directions: Answer the following questions in class:

Which type of catapult do you find most interesting and why?

How do you think catapults can be used in everyday life?

Phase 2

Title: Catapult 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 catapult using simple materials. First, the teams discuss their ideas and design the catapult, determining the type and materials they will use, such as sticks, rubber bands, plastic bottles and duct tape. As they progress through construction, they apply the engineering principles they have learned, such as statics and force, by experimenting with different layouts and mechanisms. The instructor provides guidance and support, encouraging

students to experiment and discover the function of their catapult through the process of trial and improvement. This phase promotes creativity, teamwork and problem-solving skills, offering 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 phase 3 of the scenario, students have the opportunity to test the catapults they have built and share the results of their work with the class. First, teams launch objects using their catapults, measuring the distance they travel and observing how they function under different conditions. Students record the results and analyze the performance of their constructions. Each team then presents their catapult, explaining the design process, challenges they faced, and lessons learned from testing. Peers provide feedback and engage in an open discussion about the various approaches and strategies used. This phase enhances critical thinking, communication skills and interaction among students, promoting collaboration and knowledge sharing.

Activity Sheets:

Activity Sheet - Phase 3: Test and Presentation

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

Activity 1: Testing the Catapult

Instructions: Test your catapult by launching objects. Fill in the following:

- Catapult Type: _____
- Launch distance: _____ meters
- Notes from the Test:
 - Insisted: _____
 - Broken/Crash: _____

Activity 2: Introducing the Catapult

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

1. What is the purpose of your catapult?

○ _____

2. What challenges did you face during the build?

○ _____

3. What did you learn from this process?

○ _____

Activity 3: Peer Feedback

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

- Positive Points: _____
- Suggestions for Improvement: _____

7. Evaluation Methodology

A methodology combining 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, teamwork, and support among group members. In the testing phase, students will be evaluated on their catapult performance, application of engineering concepts, and creativity in design. During the presentation, clarity of explanation and analytical ability to identify challenges and solutions will also be assessed. In addition, students will complete a self-assessment sheet to judge their own participation and progress, enhancing their self-awareness. This approach provides a holistic view of learning, focusing on both the process and the end result.

8. Additional Resources for the teacher

N/A