

Lesson Plan

3, 2, 1... LAUNCH A PROBE INTO THE LIBRARY!



Student information

- Target Group Description: 4th grade (ages 9–10)

Related prior knowledge and learning experiences:

- Students have basic understanding of gravity, force, and matter, introduced in earlier Natural Science units.
- Familiarity with measurement units, including length (centimeters, meters), as well as simple arithmetic operations (addition, subtraction, multiplication), useful for budget calculation and height estimation (Mathematics).
- Prior experience with collaborative group work, following instructions, and participating in classroom experiments or simulations.
- Some have been exposed to basic creative tasks (designing, cutting, gluing, drawing), relevant for constructing the probe landing system.
- Initial contact with space-related content (planets, the Sun, the Moon, and simple observations of the sky) through informal activities or curricular content in Environmental Studies.

Learning characteristics:

- Highly motivated by hands-on and playful learning tasks, especially those involving movement, construction, and experimentation.
- Respond well to visual and physical representations of abstract concepts.
- Still developing fine motor coordination and oral/written expression skills—benefit from structured reflection activities.
- Need guidance in budget planning and teamwork organization but show strong creative thinking and enthusiasm for challenges.

STEAM Scenario + Final learning products

1. Inspired by real challenges in space missions, students are tasked with designing a landing system for a space probe (represented by an egg) that can safely withstand re-entry and impact. This hands-on challenge mirrors engineering tasks in aerospace science and encourages sustainable thinking by simulating material constraints and budget limitations.

Guiding question:

How can we protect our space probe when it lands on Earth (or another planet)?

This project relates to the students' daily learning by integrating science, technology, and math into a creative and engaging context. It promotes problem-solving, teamwork, and understanding of basic scientific principles such as gravity, forces, and material resistance.

2. Final learning products

- A functioning "landing system" prototype built by each group.
- A "mission report" with explanations of design choices, materials used, and reflections on the outcome.
- A class exhibition of the different models with cost breakdowns and scientific posters.
- Optional: a short student presentation or video explaining the process.

INTENDED LEARNING OUTCOME

Cognitive

- Design and evaluate + a protective landing system for a space probe + in the context of a scientific and engineering challenge (Sciences, Math, Visual Arts).
- Measure, calculate and justify + cost and effectiveness of materials + in the simulation of a space mission (Mathematics).
- Communicate and reflect + the team's design process and results + through oral presentation and written report (Portuguese, Science).

Affective

- Develop curiosity and interest in space science and engineering. Foster responsibility and team collaboration.
- Encourage resilience in the face of failure and iteration. Behavioral
- Demonstrate creativity and problem-solving in designing a functional prototype. Respect agreed-upon roles and contribute to group tasks.

Connection with SDGs

- SDG 4 – Quality Education: promoting inclusive, hands-on, and inquiry-based learning.
- SDG 9 – Industry, Innovation and Infrastructure: understanding innovation processes and engineering thinking.
- SDG 12 – Responsible Consumption and Production: promoting awareness of cost, resources, and sustainability in material use.

PEDAGOGICAL APPROACH AND LEARNING MODES

Pedagogical approaches

- Inquiry-Based Learning; Project-Based Learning; Collaborative Learning; Learning Through Play (in the form of the egg-drop challenge)

Learning modes

- Face-to-face learning (in-class teamwork and experiments); Informal discussion and guided reflection with teacher-librarian; Possible use of mobile learning (photo/video documentation)

LEARNING ACTIVITIES

Indicate the learning activities students will engage in with clear instruction of the learning process

Introduction to the mission:

- Teacher introduces the concept of landing systems in space exploration.
- Students watch a short video or slideshow of real space probes and landings.
- Read a poem ("Ode to a Star") or short scientific text to spark imagination.

Team formation and budget planning:

- Divide class into 5 teams. Present the available materials and their "cost" (fictional currency: million euros).
- Each group plans their purchase without exceeding the 50-million-euro budget.

Prototype building:

- Students construct their landing systems using selected materials.
- Test ideas, discuss possible improvements, and record observations.



Testing the probe:

- Drop the egg from a minimum of 2 meters (or height defined by teacher). Observe and evaluate damage (if any).

Analysis and reflection:

- Each team documents the results and reflects on their design.
- Informal discussion on scientific principles (air resistance, gravity, shock absorption).

Final presentation:

- Display prototypes and posters in the school library.
- Presentations to peers, families, or other classes.
- Winning team chosen based on design success and cost-efficiency.

TEACHING RESOURCES AND MATERIALS

Indicate the needed resources (e.g., learning materials, digital and non-digital devices, software and apps, books, articles, human resources) and required learning environment (the physical space arrangement for the STEAM activities)

Materials (provided or simulated):

- Balloons, cotton balls, skewers, plastic cups, trash bags, paper, aluminum foil, string, gloves, etc.
- Eggs (one per group)
- Price list (fictional values to simulate budget management)
- Tape measures, scissors, glue, and markers
- Poster board or digital tools for reporting

Learning environment:

- School library and classroom
- Staircase or suitable height for dropping the probe
- Space for displaying projects

Human resources:

- Classroom teacher
- Teacher-librarian
- Science guest/teacher from the secondary school

ASSESSMENT

Indicate the assessment methods to understand learning process and identify learning outcomes

Assessment Formative assessment:

- Observation of group dynamics and problem-solving process
- Support during material planning and prototype testing

Summative assessment:

- Functionality of the final product
- Budget adherence and material justification
- Quality of written or oral presentation/report
- Peer and self-assessment rubrics



| | |
|-----------------|---|
| Lesson 1 | Introduction to space probes and mission launch <ul style="list-style-type: none"> • Science, Portuguese |
| Lesson 2 | Group division and material planning <ul style="list-style-type: none"> • Math, Citizenship |
| Lesson 3 | Prototype construction <ul style="list-style-type: none"> • Science, Visual Arts |
| Lesson 4 | Testing of landing system (egg drop) <ul style="list-style-type: none"> • Science |
| Lesson 5 | Reflection and written/oral reporting <ul style="list-style-type: none"> • Portuguese |
| Lesson 6 | Presentation and class exhibition <ul style="list-style-type: none"> • All (cross-curricular) |



Support Materials – STEAM Project “3, 2, 1... Launch a Probe into the Library!”

Mission Introduction Worksheet

Student Worksheet – “Welcome to the Space Mission”

Name:

Date:

Mission Question:

How can we protect our space probe when it lands?

1. What do you already know about space probes?
2. Why do probes need protection during landing?
3. What materials do you think could protect an egg?

Draw your idea for a space probe landing system.



Budget Planning Worksheet

Student Worksheet – “Mission Budget”

Your team has a budget of 50 million euros.

Choose your materials carefully.

| Material | Price per Unit |
|---------------------------|-----------------------|
| Balloon | 6 million euros |
| Cotton ball | 2 million euros |
| Skewer stick | 2 million euros |
| Plastic cup | 10 million euros |
| Trash bag | 9 million euros |
| A4 sheet of paper | 1 million euros |
| Cardstock sheet cut to A5 | 1 million euros |
| Aluminium foil (30 cm) | 3 million euros |
| Piece of styrofoam | 1 million euros |
| Straw | 1 million euros |
| Freezer bag | 1 million euros |
| String/Wire (1 meter) | 1 million euros |
| Rubber glove | 8 million euros |

Total Budget Used: _____

Did your team stay within the budget?

Yes No



Prototype Design Worksheet

Student Worksheet – “Designing the Landing System”

Team members:

Our design idea:

Which materials will we use?

Why did we choose these materials?

Sketch your prototype below.



Construction and Testing Worksheet

Student Worksheet – “Testing the Probe”

Objective:

Build and test a landing system that protects the egg.

Testing Results:

Drop Height:

Did the egg survive?

Yes No

What worked well?

What could be improved?

Describe what happened during the landing.



Science Reflection Worksheet

Student Worksheet – “Science Behind the Mission”

1. What is gravity?
2. What is air resistance?
3. Which materials absorbed the shock best?
4. Why is teamwork important in engineering?



Mission Report Template

Student Worksheet – “Mission Report”

Mission Name:

Team Members:

Materials Used:

Budget Used:

What was successful about your design?

What problems did your team face?

What would you change next time?



Poster and Presentation Worksheet
Student Worksheet – “Preparing the Exhibition”

Poster Title:

Scientific facts to include:

Interesting discoveries:

Mission slogan:

Draw or decorate your poster.



Final Reflection Worksheet

Student Worksheet – “What Did I Learn?”

1. What was your favorite part of the project?

2. What did you learn about engineering?

3. What did you learn about teamwork?

4. My group worked:

Very well

Well

We need to improve

5. Draw your favorite moment from the mission.



Teacher Assessment Checklist

| Criteria | Yes | No | Observations |
|---------------------------------|-----|----|--------------|
| Participates actively | | | |
| Cooperates with the group | | | |
| Uses materials responsibly | | | |
| Understands scientific concepts | | | |
| Plans within budget | | | |
| Demonstrates creativity | | | |
| Communicates ideas clearly | | | |

Assessment Rubric

| Criteria | Excellent | Good | Satisfactory | Needs Improvement |
|--------------------------|-------------------------|-------------------------|------------------------|----------------------------|
| Participation | Always participates | Frequently participates | Sometimes participates | Rarely participates |
| Teamwork | Excellent collaboration | Good collaboration | Some collaboration | Poor collaboration |
| Scientific understanding | Strong understanding | Good understanding | Basic understanding | Difficulties understanding |
| Creativity | Very creative | Creative | Some creativity | Limited creativity |
| Communication | Clear and confident | Clear | Some difficulties | Difficulties communicating |

Digital Activity Suggestions

- Create digital mission posters in Canva
- Produce a slideshow about space probes
- Record a short mission presentation video
- Photograph and document the testing phase

Other Suggestions

- Create a playground area with probes and conduct launches.

