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AEROSPACE IN CLASS
LEARNING SCENARIO

How Things Fly:
Water Bottle Rocket

Funded by the **Airbus Foundation** and coordinated by **European Schoolnet** (EUN) - the network of 34 European Ministries of Education, the **Aerospace in Class Project** is about passing STEM resources from the **Airbus Foundation Discovery Space**, a digital portal for aerospace exploration, connecting students, parents and educators across the globe with professionals in the field, bringing today's research and technology to life. The creation of this Learning Scenario is supported the **STEM Alliance** an initiative that brings together industries, Ministries of Education, and education stakeholders to promote STEM education and careers to young Europeans and by **Scientix**, funded from the European Union's H2020 research and innovation programme – project Scientix 4 (Grant agreement N. 101000063). The content of the document is the sole responsibility of the organizer and does not represent the opinion of the European Commission (EC), nor is the EC responsible for any use that might be made of the information contained.

European Schoolnet

How things fly: Water Bottle Rocket.

By Luis Vaquerizo.

ABSTRACT

Students will design, build and launch a water bottle rocket. They will work with weight, force, thrust, pressure, speed and acceleration by doing measurements and calculations.

KEYWORDS

Water bottle rocket, weight, force, thrust, pressure, speed, acceleration.

Table of summary	
Subject	*Technology, maths, science, English, STEM.*
Topic	*"Rocket science".* *Maths and science: measurements, formulas, calculations.* *Technology: students project, design, build and launch.* *English: present, future, hypothesis.*
Age range of students	*14 - 15 years old.*
Preparation time	*30 minutes: Prepare the offline teaching material, check that all links work.*
Teaching time	*300 minutes: 6 periods of 50 minutes.*
Online teaching material	*http://vishub.org/excursions/715 This is a 7-slides presentation with links. 1st slide: How students made a water bottle rocket. 2nd slide: Science of flying. 3rd slide: Summary of science of flying. 4th to 7th slide: Students explain how they made their own WBR working in pairs.*
Offline teaching material	*2 litres plastic bottle (one per group), duct tape, cardboard, 1 garbage bag per group, one reel of light cotton rope, 1 egg per group, cotton, bubble wrapping*

	plastic, 1 precision scale, 1 tire air pump, 1 water bottle rocket launcher.
Airbus Foundation Discovery Space resources used	*List here all links of the Airbus Foundation Discovery Space resources used for this learning scenario.* https://www.airbus.com/company/sustainability/airbus-foundation/discovery-space/kids/science-of-flight.html

LICENSE

INTEGRATION INTO THE CURRICULUM

Competences related with:

- *Mathematics: formulas, calculations, units.*
- *Physics: weight, force, thrust, pressure, speed, acceleration.*
- *English as a foreign language: expressing student's ideas in present and future, making predictions and hypothesis (what may happen – if… then… because…)*

AIM OF THE LESSON / LEARNING OBJECTIVES

Students will:

- *Realize they can use physics concepts and math calculations to understand how the rocket fly.*
- *Find out they can build and launch a water bottle rocket.*
- *Express their own ideas in English using present and future to make predictions and formulate hypothesis.*

RESULTS OF THE LESSON

At the end of this lesson, the students will:

- *Know how physics concepts are involved in our daily life.*
- *Be able to use maths to find out how objects behave.*
- *Realize they can design, build and launch a water bottle rocket.*
- *Express hypothesis in English.*

TRENDS

Inquiry-Based Science Education, project-based learning, STEM learning, collaborative learning.

21ST CENTURY SKILLS AND CREATIVITY / DESIGN THINKING / INQUIRY-BASED SCIENCE EDUCATION

Problem Solving: Students will be able to measure and calculate physics magnitudes related with the water bottle rocket.

Creativity: Students will design, build and launch their rocket.

Critical Thinking: Students will think, write and explain their hypothesis.

Collaboration: Students will work in groups to design, build and launch their rocket.

Innovation: Students will have their own ideas even though they fail.

Communication: Students will explain their design to the other groups.

Productivity: In this learning scenario, students produce a document with all water bottle rocket specifications.

Initiative and Self-Direction: Students are encouraged to have their own ideas, even though they fail.

Media Literacy: Students use internet resources to find out information. They also write the documentation with IT.

ACTIVITIES

Name of activity	Procedure	Time
Introduction: 1st day	The teacher shows the slide show that explains how students made and launched a WBR. This way they understand what they are going to do.	12 min
Introduction: 1st day	The teacher chooses one of the videos of chapter 2 “10,000 airplanes in the sky”	3 min

Hands-on: 1st day	The students start measuring, cutting, making… the rocket, payload, canopy, fins… They also take pictures or record videos of their work.	35 min
Science of flying: 2nd day	The teacher explains the slide show (summary) that explains the *science of flying. He may choose the long slide show with more details*.	17 min
Science of flying: 2nd day	The teacher chooses one of the videos of chapter 2 “10,000 airplanes in the sky”	3 min
Hands-on: 2nd day	The students go on working on their WBR. They also take pictures or record videos of their work.	30 min
Science of flying: 3rd day	The teacher goes on explaining the slide show (summary) slides 25 to 34 that explains the calculations.	17 min
Science of flying: 3rd day	The teacher chooses one of the videos of chapter 3 “Finding your way through the clouds"	3 min
Hands-on: 3rd day	The students go on working on their WBR. They also take pictures or record videos of their work.	30 min
Students slide show: 4th day	The teacher shows the presentations (slides 4, 5, 6 and 7) made another course. Students will have to make their own slide show.	15 min
Science of flying: 4th day	The teacher chooses one of the videos of chapter 3 “Finding your way through the clouds"	3 min
Hands-on: 4th day	The students go on working on their WBR. They also take pictures or record videos of their work.	32 min
Take off: 5th day	The group goes to a place where there is no risk to launch the WBR. The students also take pictures or record videos of the activity.	50 min
Final presentation: 6th day	The students present the slide show with all the steps of the project.	50 min

ASSESSMENT

Students will be assessed by:

1. The project: Students will design, build and launch a WBR, make calculations and write hypotheses, collect data and make conclusions. They also have to protect the egg-astronaut. Teachers will provide feedback to enhance students' understanding.

2. The designing and testing of their WBR: Learners will be peer assessed on their WBR. Teachers will provide feedback to enhance students' understanding.

STUDENT FEEDBACK

Please help us to get better at what we do by completing this feedback form.

We want you to be honest about what you thought and felt about the lesson.

Title of the activity:

Lesson/Grade: Date:

Please mark appropriate number 5 = extremely 1 = not at all	5	4	3	2	1
This lesson topic was helpful					
This lesson held my attention					
This lesson was easy to understand					
The lesson duration was enough					
The lesson was well-prepared					
The lesson stimulated me to discuss and learn					
The teachers were effective in leading the class					
The slide shows helped me to understand the activities					
Making the WBR was an important part of the project					
Launching the WBR made me understand how it works					
Please answer the questions					
What I liked about this lesson:					
What I did not like about this lesson:					
What was innovative for this lesson?					
What was confusing for this lesson?					
What I would suggest to improve the lesson:					

TEACHER'S REMARKS

ABOUT THE AEROSPACE IN CLASS PROJECT

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ANNEX