Large Scientific Infrastructures enriching online and digital Learning

Erasmus+ Programme 2020

Partnerships for Digital Education Readiness (Key Action 226)

Intellectual Output 3
The LaSciL demonstrators

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

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Version	**Editors**	**Comments**
1.0	Maria Panagopoulou	
2.0	Maria Panagopoulou, Fraser Lewis	

Executive Summary:

The main goal of this document is to present the 20 LaSciL demonstrators produced by the project consortium and the 30 educational scenarios that were created by teachers within the framework of LaSciL

More extensively the first chapter of this document consists of an overview of its contents. The second chapter has an overview of the LaSciL demonstrators including their distribution to the project partners and the astronomical topics they are referred to. Following this overview there is an analytic presentation of the demonstrators' chosen template as well as the validation of the demonstrators concerning this template. The last part of the second chapter consists of an extensive presentation of the 20 demonstrators developed by the consortium. The third chapter includes a short description of the process by which the teachers' scenarios were created, an overview of the subjects and the education levels they teach as well as an analytic presentation of the 30 educational scenarios they produced. The fourth chapter includes the conclusions of this process concerning the importance of the demonstrators and the teachers' scenarios for the next steps of the project. The last (fifth) chapter lists the bibliography that was cited within the document.

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The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

1. Demonstrators and teacher scenarios at LaSciL

According to the framework described in Intellectual Output 1 (IO1) the consortium of LaSciL developed 20 demonstrators that bridge science education and scientific research by making use of real astronomical practices and data. They promote the involvement of students and teachers in e-Science activities and are strongly connected to the project countries' curricula.

Figure 1: LaSciL demonstrator components

Based on these demonstrators and the framework of the project 29 teachers were trained during the LaSciL summer school organized in Heraklion (Crete, Greece). During the summer school they created their own educational scenarios that they will implement during the current school year.

The LaSciL demonstrators as well as these second-generation demonstrators, that were produced by the teachers, are uploaded to the LaSciL website with open access to the public so that teachers from all over Europe can use, reuse and adapt them to their needs.

This document presents the 20 demonstrators produced by the project consortium and the 30 educational scenarios created by teachers that were trained by the project partners.

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2. LaSciL Demonstrators

The demonstrators that were created by the project consortium are listed below and categorized based on their astronomical content. In the following pages there is a description of each demonstrator that includes the connections with the project countries curricula and the tools that each of them incorporates. Special mention is given to the chosen template that promotes inquiry-based learning. Following the internal validation of all demonstrators through extensive discussions and comments by all the members of the project consortium they were uploaded to the LaSciL website with open access to the public.

Table 1: LaSciL demonstrators overview

Solar System
Sun
Does the Sun actually move? (FORTH)
Determination of the differential rotation of the Sun (NUCLIO)
Let's predict a Coronal Mass Ejection (EA)
Our closest star (EA)
Planets
Become Galileo for a while (FORTH)
Giant planets in a cup of water (FORTH)
Today I am William Herschel (NUCLIO)
Jupiter's moons (EA)
Moon
How far is the Moon? (FORTH)
Small scale objects (asteroids, comets, meteors)
(Don't) Look up! (DFET)
What's that moving in the sky? (DFET)
Looks like a rock! (OeWF)
Astronauts and space exploration
Be an astronaut! (OeWF)
Caution-Contamination! (OeWF)
Orientation and attitude! (OeWF)
Instrumentation-telescopes
Introducing the telescope (EA)
Stars
Variable stars
Discovering variable objects in the sky (NUCLIO)
Using Gaia alerts (DFET)
Groups of stars
Imaging Open Clusters (DFET)
My constellation (NUCLIO)

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The following graph consists of a representation of the partners contribution to the production of the demonstrators per Astronomical subject and in total.

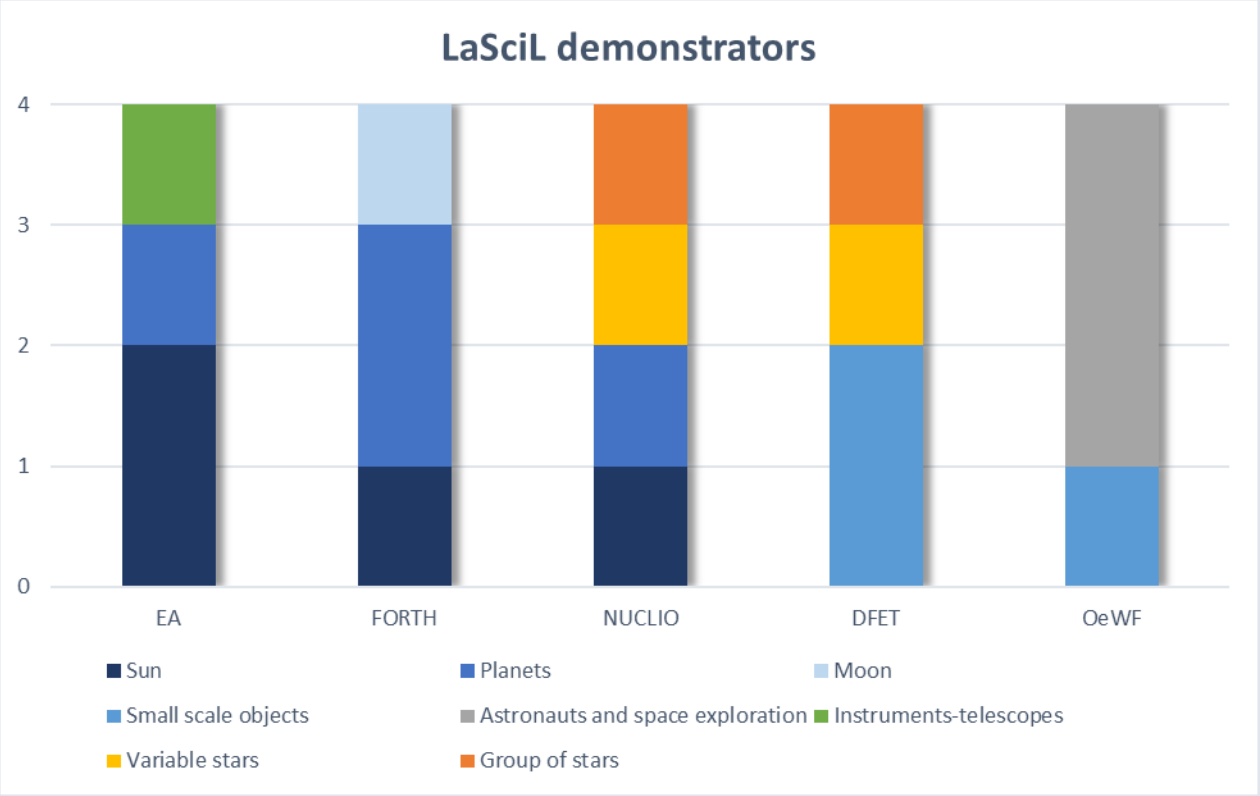

Figure 2: LaSciL demonstrators and each partner's contribution

2.1 Template for demonstrators

LaSciL demonstrators follow the **inquiry-based learning** approach that provides students the opportunity to follow scientific methods and processes, similar to those used by scientists during the production of new knowledge (Keselman, 2003). During an inquiry-based educational activity students usually explore cause and effect correlations (Pedaste et al., 2012) while trying to solve a problem (Pedaste & Sarapuu, 2006).

According to the literature review made by Pedaste et al. (2015) there are five stages a student follows during an inquiry-based learning activity. These are listed and described in the following graph.

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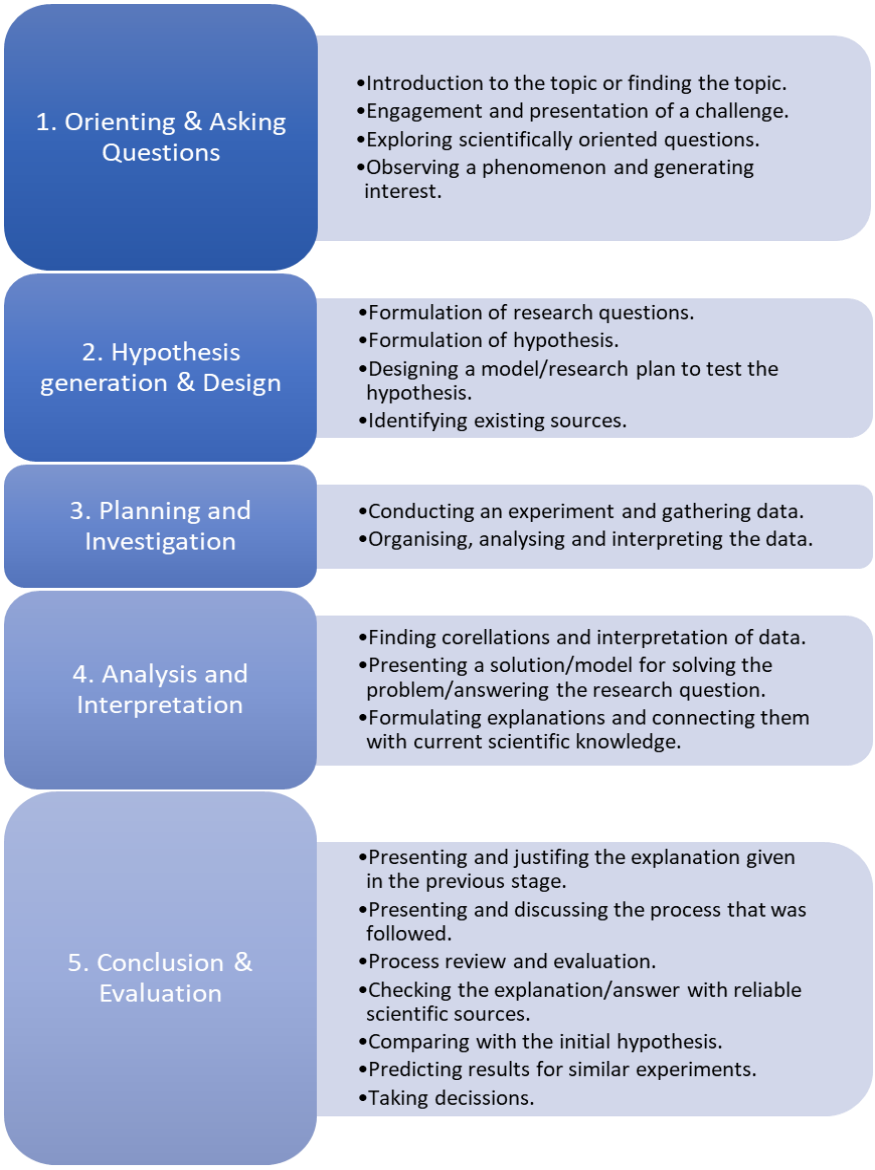

Figure 3: Inquiry-based learning steps

The template that was chosen for the demonstrators was based on the Inspiring Science Education (ISE) authoring tool that follows the same approach. It is an interactive environment that gives the opportunity of incorporating embedded images, videos, questions, links and tools. The final version can be shared through a link and the stages of inquiry-based learning appear as different sheets within the tool acting as steps for the students. Each demonstrator is uploaded to the Inspiring Science Education (ISE) platform resources making them available to a wide community of teachers.

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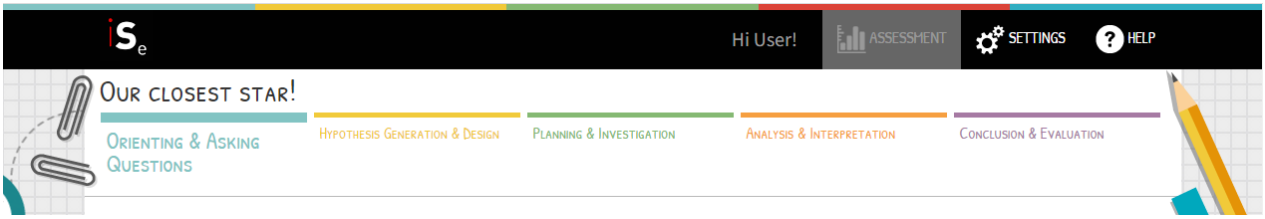

Figure 3: Steps of inquiry-based learning within the ISE authoring tool

To make sure LaSciL demonstrators follow an inquiry-based structure they were all validated by two members of the consortium (none of which were the writers of the specific demonstrator). For this process a tool that was developed within the European project FRONTIERS was utilized. The tool, which is presented in the following table, consists of questions that have to be marked based on a scale from zero to two where zero indicates the answer "No", one indicates the answer "partially" and two indicates the answer "Yes". A total/mean mark was extrapolated from the validations with a maximum score of ten.

Table 2: Inquiry-based structure validation questions

Orienting and Asking Questions
Does the orientation stage provide students sufficient contact/engagement with the topic/content to start students in an inquiry process?
Does the orientation stage successfully attract a student's attention to the targeted content by selecting appropriate delivery methods/tools – *you tube, pictures, graphs, links or specific information etc.*
Does this chosen tool allow for student enquiry?
Hypothesis Generation & Design
Based on the knowledge developed from the orientation stage, have students been allowed/directed to generate a hypothesis to investigate? – *this can be done through the use of guiding questions within the Hypothesis generating stage*
Have the students been directed to design an appropriate model/experiment for them to test their hypothesis?
Planning & Investigation
Does the lesson facilitate the planning of an experiment(s)/investigation(s) that allows for the students' hypothesis to be tested? – *this can be done through the use of experimental preparation-planning/Lit review/internet research/simulations.*
Analysis & Interpretation
Does the lesson support the students process of "Data Investigation" - providing students with a path to interrupt and identify the key issues/results from the data collected? – *Teachers can support this process through the use of 'directing questions', help students to ask the right questions to correctly interrupt their results*

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Conclusion & Evaluation
Are there opportunities provided for the learner to consider the research question/hypothesis and look at whether these are supported by the results of the study?
Does the learner present the findings to others and does he/she receive feedback? Does the learner reflect on the whole inquiry process?

In the following table the results of this validation and the total mark of each LaSciL demonstrator for its inquiry structure, based on the above tool, are presented.

Table 2: Inquiry-based structure validation questions

LaSciL Demonstrator	Total mark
(Don't) Look up! (DFET)	10/10
Imaging Open Clusters (DFET)	10/10
What's that moving in the sky (DFET)	10/10
Using Gaia alerts (DFET)	10/10
Become Galileo for a while (FORTH)	8.9/10
Giant planets in a cup of water (FORTH)	7.9/10
Does the Sun actually move? (FORTH)	8.9/10
How far is the Moon? (FORTH)	8.3/10
Determination of the period of differential rotation of the Sun (NUCLIO)	7.6/10
Discovering variable objects in the sky (NUCLIO)	8.9/10
My Constellation (NUCLIO)	9.5/10
Today I am William Herschel (NUCLIO)	9.2/10
Be an astronaut! (OeWF)	7.7/10
Caution-Contamination! (OeWF)	7.0/10
Looks like a rock! (OeWF)	6.1/10
Orientation and attitude! (OeWF)	8.0/10
Our closest star! (EA)	9.8/10
Let's predict a Coronal Mass Ejection (EA)	7.9/10
Jupiter's moons (EA)	9.4/10
Introducing the telescope (EA)	9.3/10

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2.2 Demonstrators

In the following pages there is a one-page description of each demonstrator based on the following template that includes all main components as well as the links to the countries' curriculums. These descriptions are available to the native languages of all partners through the LaSciL website where all demonstrators are uploaded.

Demonstrator presentation template

Title: *Please replace with the title of the demonstrator*

<table>
<tr><td colspan="2">Brief description: In a few sentences describe the topic of this demonstrator, the activities it includes and what the students will learn by implementing them.</td><td rowspan="4">Please place here a picture relative to the demonstrator</td></tr>
<tr><td colspan="2">Age: Write the age group of the students</td></tr>
<tr><td colspan="2">Duration: Write the duration of the demonstrator</td></tr>
<tr><td colspan="2">Digital tools used: Write the tools that are used within the demonstrator and are mentioned at the LaSciL toolbox (Intellectual Output 2)</td></tr>
<tr><td colspan="3">Links to the curricula:</td></tr>
<tr><td>UK</td><td colspan="2">• Please list the links of the demonstrator with the curricula of UK</td></tr>
<tr><td>Greece</td><td colspan="2">• Please list the links of the demonstrator with the curricula of Greece</td></tr>
<tr><td>Portugal</td><td colspan="2">• Please list the links of the demonstrator with the curricula of Portugal</td></tr>
<tr><td>Austria</td><td colspan="2">• Please list the links of the demonstrator with the curricula of Austria</td></tr>
<tr><td colspan="3">Direct link to the demonstrator</td></tr>
<tr><td colspan="3">Link to the demonstrator through the website of LaSciL</td></tr>
<tr><td colspan="3">Contributor: Please write the name of the partner that contributed this demonstrator</td></tr>
</table>

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(Don't) Look up!

Brief description: In this exercise students use the Down2Earth Impact Calculator to investigate what happens when an asteroid or comet hits the Earth. Through the investigation, students become acquainted with kinetic energy and frequency of impacts from space while also practicing making graphs.	
Age: 11-14 years old	
Duration: 1-2 hours	
Digital tools used: Down2Earth's Impact Calculator	

Links to the curricula

UK	Curriculum for Wales, AOL: • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology - Computation is the foundation for our digital world • Humanities - Enquiry, exploration and investigation inspire curiosity about the world, its past, present and future • Humanities - Our natural world is diverse and dynamic, influenced by processes and human actions
Greece	• 2nd Grade of Junior High School, Physics, Forces and motion • 1st Grade of High School, Physics (general orientation), Forces and motion • Skills Laboratory
Portugal	• 7th grade, Natural Sciences, Earth in Transformation • 7th grade, Physics-Chemistry, Outer Space • 9th grade, Physics-Chemistry, Motions on Earth • 11th grade, Physics-Chemistry, Mechanics • 12th grade, Physics, Mechanics
Austria	General secondary school: • Physics, 5th grade: dimensions, mechanics I, thermodynamics • Mathematics, 1st-4th grade: working with models and statistics, working with variable Mathematics, 5th grade: functions, trigonometry

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: DFET

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Imaging Open Clusters

Brief description: Students investigate a catalogue of relatively unstudied open clusters in our Galaxy to find appropriate targets to observe with the Faulkes Telescope Project telescopes.

Age: 15-18 years old

Duration: 2-3 hours

Digital tools used:

Stellarium

LCO tools

Links to the curricula	
UK	Curriculum for Wales, AOL: • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena. • Science and Technology - Computation is the foundation for our digital world. • Science and Technology, Matter and the way it behaves defines our universe and shapes our lives.
Greece	• Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 8th grade, Physics-Chemistry, Light • 11th grade, Physics-Chemistry, Waves and Electromagnetism
Austria	• General secondary school: physics: 8th grade: physics of particles, current research

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: DFET

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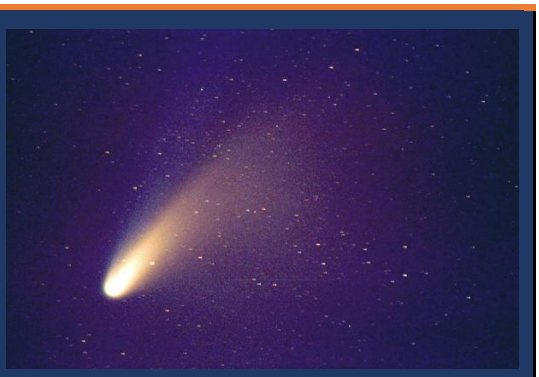
What's that moving in the sky?

<table>
<tr><td colspan="2"><u>Brief description</u>: In this exercise, students find a comet that's visible in the night sky and take images of it using the LCO robotic telescopes. Through the investigation, students become acquainted with observing, planning observations and interpreting astronomical images.</td><td rowspan="3">  </td></tr>
<tr><td colspan="2"><u>Age</u>: 11-18 years old</td></tr>
<tr><td colspan="2"><u>Duration</u>: 2-3 hours</td></tr>
<tr><td colspan="2"><u>Digital tools used</u>: Heavens Above Stellarium LCO tools</td></tr>
<tr><td colspan="3">Links to the curricula</td></tr>
<tr><td>UK</td><td colspan="2">Curriculum for Wales, AOL:
Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.
Science and Technology - Computation is the foundation for our digital world.</td></tr>
<tr><td>Greece</td><td colspan="2">6th Grade of Primary School, Science, Modern Physics-Technology-Environment-Space
Skills Laboratory</td></tr>
<tr><td>Portugal</td><td colspan="2">7th grade, Physics-Chemistry, Outer Space
9th grade, Physics-Chemistry, Motions on Earth
11th grade, Physics-Chemistry, Mechanics
12th grade, Physics, Mechanics
12th grade, Physics, Force Fields</td></tr>
<tr><td>Austria</td><td colspan="2">General secondary school:
Physics: 8th grade: physics of particles, current research
Mathematics: 1st-4th grade: working with figures and bodies 7th grade: Circles, spheres, conic section lines and other curves</td></tr>
<tr><td colspan="3"><u>Direct link to the demonstrator</u></td></tr>
<tr><td colspan="3"><u>Link to the demonstrator through the website of LaSciL</u></td></tr>
<tr><td colspan="3">Contributor: DFET</td></tr>
</table>

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Using Gaia Alerts

Brief description: Students interrogate the Gaia Alerts stream to find appropriate targets to observe with the Faulkes Telescope Project telescopes. Students learn about the ESA Gaia satellite mission and it's 'Gaia Alerts' stream which gives daily updates on astronomical objects which have changed in brightness and which may be of interest to professional and amateur astronomers. By examining this list, suitable targets (such as supernovae; exploding stars) can be found and then imaged using the Faulkes Telescope Project's access to the Las Cumbres Observatory's robotic telescopes.

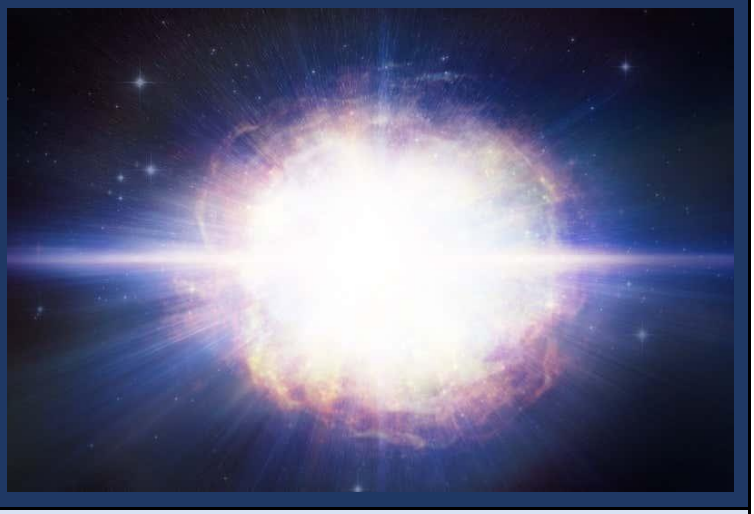
Age: 15-18 years old

Duration: 2-3 hours

Digital tools used:

Stellarium

LCO tools



Links to the curricula

UK	Curriculum for Wales, AOL: • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena. • Science and Technology - Computation is the foundation for our digital world. • Science and Technology, Matter and the way it behaves defines our universe and shapes our lives.
Greece	• Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 12th grade, Informatics Applications, Introduction to Programming
Austria	• General secondary school: physics: 8th grade: physics of particles, current research

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: DFET

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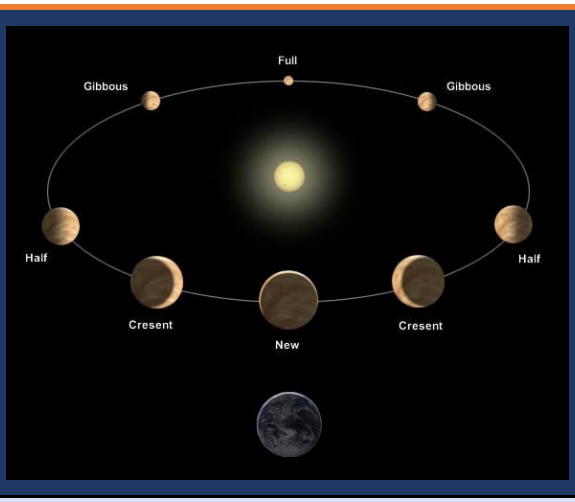
Become Galileo for a while

Brief description: Have you ever imagined being a sky observer at the time of Galileo in Pisa? Through the observations of Venus, you could be ahead of your time and make a scientific revolution showing that the planets revolve around the Sun.	
Age: 14-17 years old	
Duration: 3 hours	
Digital tools used: Stellarium	

Links to the curricula	
UK	• Curriculum for Wales, AOL - Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.
Greece	• 6th Grade of Primary School, Science, Modern Physics-Technology-Environment-Space, Solar System • 1st Grade of Junior High school, Physics, Measurement of time • 2nd Grade of Junior High school, Physics, Smooth circular motion • 1st Grade of High school, Physics, Periodic Motions, Smooth circular motion • 2nd Grade of High school, Physics (orientation),, Introduction, Types of Uncertainties • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 9th grade, Physics-Chemistry, Motions on Earth • 11th grade, Physics-Chemistry, Mechanics 12th grade, Physics, Mechanics • 12th grade, Physics, Force Fields
Austria	General secondary school: • Geography: 5th grade: Reflect structuring principles of the earth according to different points of view • Physics: 5th grade: dimensions, mechanic I • Physics: 6th grade: mechanic II • Mathematics: 5th grade: quantities, numbers and arithmetic laws, trigonometry • Mathematics: 6th grade: Vectors and analytic geometry in R^3
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: FORTH	

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Giant planets in a cup of water

Brief description: In this demonstrator we have to recall natural concepts such as the density, the upthrust and Newton's law of universal gravitation, in order to calculate the density of the gas planets in our solar system. Then the students can compare these values of density with the density of water. That is critical to see if the planet would float on the surface of a giant cup of water!	
Age: 16-18 years old	
Duration: 3 hours	
Digital tools used: Wordwall, Playposit	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology - Matter and the way it behaves defines our universe and shapes our lives.
Greece	• 1st Grade of Junior High school, Physics, Mass - Calculation of density • 2nd Grade of Junior High school, Physics, Gravitational Force • 2nd Grade of Junior High school, Physics, Pressure - Upthrust • 1st Grade of High school, Physics, Newton's law of universal gravitation • 1st Grade of High school, Physics, Periodic motions - smooth circular motion • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 12th grade, Physics, Mechanics
Austria	• General secondary school: physics: 5th grade: dimensions

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: FORTH

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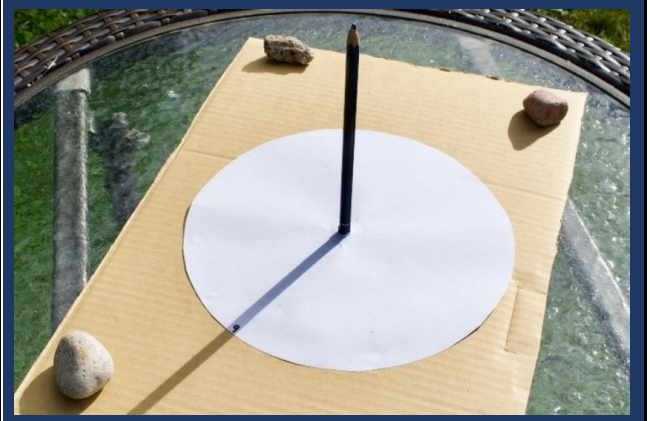
Does the Sun actually move?

Brief description: In this demonstrator we study the motion that the Sun seems to have across the sky (apparent) in combination with the shadows of terrestrial objects during the day. We construct a model to represent the rotation of the Earth, discuss its critical role for life and also discuss how important the scientific models are for research.	
Age: 10-11 years old	
Duration: 3 hours	
Digital tools used: Wordwall, Playposit	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena. • Science and Technology - The world around us is full of living things which depend on each other for survival.
Greece	• 6th Grade of Primary School, Science, Modern Physics-Technology-Environment-Space, Solar System • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 12th grade, Physics, Mechanics
Austria	• General secondary school: physics: 5th grade: dimensions
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: FORTH	

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How far is the Moon?

Brief description: Have you ever tried to see a small object alternately with one eye or the other? It seems to be moving, when in fact it is stable. This phenomenon is called parallax. Now think that you have a head the size of the Earth, so the one eye is at the northern hemisphere and the other eye is at the southern hemisphere and both of them are located at the same meridian. So if you observe the Moon alternately with one eye or the other, you'll realize that the position of the Moon is changing. This is the key to measure the distance to the Moon geometrically and we use the digital tool of Stellarium for that.

Age: 15-18 years old

Duration: 3 hours

Digital tools used: Stellarium

Links to the curricula

UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Mathematics and Numeracy - Geometry focuses on relationships involving shape, space and position, and measurement focuses on quantifying phenomena in the physical world
Greece	• 6th Grade of Primary School, Science, Modern Physics-Technology-Environment-Space, Solar System • 2nd Grade of Junior High school, Mathematics, Trigonometry • 2nd Grade of High school, Physics (orientation) Introduction, Types of Uncertainties • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 9th grade, Mathematics, Geometry and Measurement
Austria	General secondary high school: • 7th/8th grade: descriptive geometry mathematics • 1st-4th grade: working with numbers and measures, working with variables, working with figures and solids

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: FORTH

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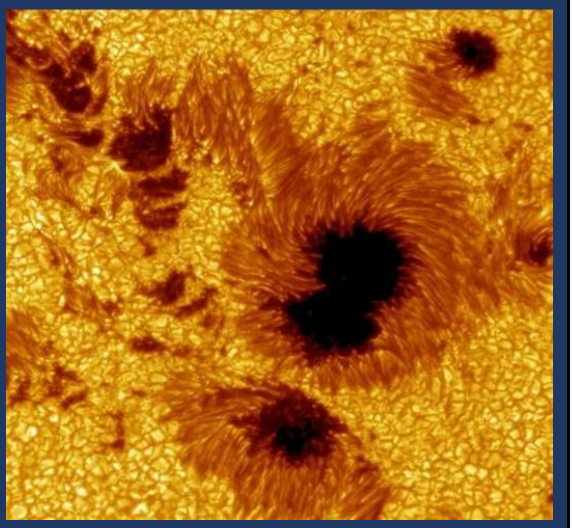
Determination of the period of differential rotation of the Sun

Brief description: Based on spectroheliograms provided by the Geophysical and Astronomical Observatory of the University of Coimbra, and using the Tracker (freeware), we ask three questions about the Sun: a)Is it the Sun spherical?, b)If it rotates, how long does it take to complete a rotation?, c)Does it rotate like a rigid body?. Students will have to transform the sequence of images into data, which will assume a graphic representation and, after that, they must achieve the proper mathematical function that will be adjusted. Finally, students must explore its physical meaning of this behavior and understand why it happens.



Age: 16-18 years old

Duration: 8 hours

Digital tools used: Tracker

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Computation is the foundation for our digital world
Greece	• 2nd Grade of High school, Physics (orientation), Circular motion • 3rd Grade of Junior High school, Physics, Periodical phenomena • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 9th grade, Physics-Chemistry, Motions on Earth
Austria	General secondary school: • Digital literacy mathematics: 4th semester: functional dependencies II • Digital literacy mathematics: 5th semester: [Linear] algebra and analytic geometry • Digital literacy mathematics: 6th semester: analysis • Physics: 7th grade: electromagnetic waves, nuclear physics • Physics: 8th grade: particle physics

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: NUCLIO

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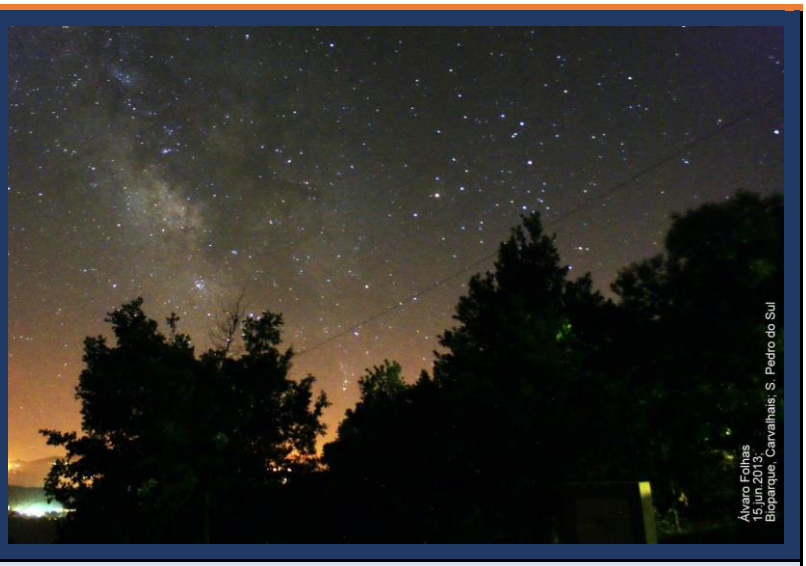
Discovering variable objects in the sky

Brief description: This project aims to provide an experience of photometry and construction & analysis of light curves from sets of images of objects of variable brightness, leading the student to an entire investigative project practice.	
Age: 16-18 years old	
Duration: 15 hours	
Digital tools used: Light grapher, SalsaJ	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology, Matter and the way it behaves defines our universe and shapes our lives • Science and Technology - Computation is the foundation for our digital world.
Greece	• 3rd Grade of Junior High school, Physics, Periodical phenomena • 1st Grade of High School, Physics, Periodical phenomena- circular motion • 2nd Grade of High School, Physics (orientation), Harmonic Oscillation • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 9th grade, Physics-Chemistry, Motions on Earth
Austria	General secondary school: • Digital literacy mathematics: 7th/ 8th grade: functions, basics of differential calculus • Physics: 6th grade: mechanics II • Physics: 7th grade: nuclear physics, electromagnetic waves, current research
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: NUCLIO	

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My constellation

Brief description: Students investigate the definition of constellations and its historical and cultural aspects, then build a 3D model of a constellation.	
Age: 7-14 years old	
Duration: 3 hours	
Digital tools used: Stellarium	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Expressive Arts - Creating combines skills and knowledge, drawing on the senses, inspiration and imagination • Humanities - Enquiry, exploration and investigation inspire curiosity about the world, its past, present and future.
Greece	• 2nd Grade of Primary School, Mathematics, Analytic Geometry • 4th Grade of Primary School, Mathematics, Analytic Geometry • 5th Grade of Primary School, Mathematics, Analytic Geometry • 6th Grade of Primary School, Mathematics, Analytic Geometry • 5th Grade of Primary School, Geography, Maps • 1st Grade of Junior High School, Geography, Maps • 2nd Grade of Junior High School, Geography, Types of maps • 2nd Grade of Primary School, Environmental Studies, Light and its sources • 6th Grade of Primary School, Physics, Propagation, Reflection, Diffusion and Absorption of light • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 8th grade, Physics-Chemistry, Light • 11th grade, Physics-Chemistry, Waves and Electromagnetism
Austria	General secondary school: • Mathematics: 6th grade: Vectors and analytic geometry in R^3 • Geography: 1st grade: View of the earth • Geography: 5th grade: Reflect structuring principles of the earth according to different points of view • Physics: 5th grade: dimensions
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: NUCLIO	

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Today I am William Herschel

Brief description: Students explore the concepts of triangulation, parallax and angular displacement and how one can use them to derive distances to astronomical objects. Then, they simulate the historical observations of William Herschel that led to the discovery of Uranus, and use the results to derive its orbital distance and period.	
Age: 13-18 years old	
Duration: 3-4 hours	
Digital tools used: Stellarium	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology, Matter and the way it behaves defines our universe and shapes our lives • Science and Technology - Computation is the foundation for our digital world • Mathematics and Numeracy - Geometry focuses on relationships involving shape, space and position, and measurement focuses on quantifying phenomena in the physical world.
Greece	• 2nd Grade of High school, Physics (orientation), Circular motion • 3rd Grade of Junior High school, Physics, Periodical phenomena • 2nd Grade of High school, Physics (general education), Geometric Optics • 2nd Grade of Junior High school, Mathematics, Trigonometry • 2nd Grade of High school, Mathematics (general orientation), Trigonometry • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 8th grade, Physics-Chemistry, Light • 9th grade, Physics-Chemistry, Motions on Earth • 9th grade, Mathematics, Geometry and Measurement • 11th grade, Physics-Chemistry, Waves and Electromagnetism • 12th grade, Physics, Force Fields
Austria	General secondary school: • Physics: 5th grade: dimensions, mechanics I • Mathematics: 1st-4th grade: working with figures and bodies
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: NUCLIO	

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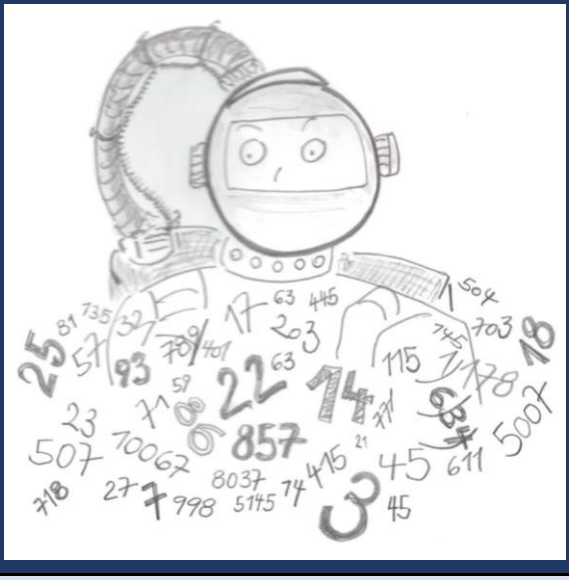
Be an astronaut!

Brief description: Being an astronaut means first and foremost: managing a lot of stress and making sense of the data you get! But who's to decide? This is where all the astronaut training tests and experiments come in. You'll learn how to make professional decisions in challenging circumstances! And along the way, you'll learn how to collect, evaluate, analyze, and communicate data.	
Age: 13-18 years old	
Duration: 3 hours	
Digital tools used: OeWF Mission Archive, Tableau, data talk	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology - The world around us is full of living things which depend on each other for survival.
Greece	• 4th Grade of Primary School, Mathematics, Statistics • 5th Grade of Primary School, Mathematics, Statistics • 6th Grade of Primary School, Mathematics, Statistics • 1st Grade of Junior High school, Mathematics, Statistics • 2nd Grade of Junior High school, Mathematics, Statistics • Skills Laboratory
Portugal	• 7th grade, Mathematics, Data Organization and Analysis • 8th grade, Mathematics, Data Organization and Analysis
Austria	General secondary school: • Mathematics: 1st-4th grade: working with models and statistics
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: OeWF	

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Caution-Contamination!

Brief description: You are probably aware that contamination plays a big role down here on earth. There is a lot of newspaper coverage about contamination of our water and soil. Believe it or not, contamination even plays a role if we want to visit Mars! According to the Outer Space Treaty from 1967, Earth and other planets have to be preserved from contamination. Research on contamination of space vehicles before launch has been done before. In this activity, we will investigate how contamination spreads as we explore new worlds.

Age: 15-18 years old

Duration: 3 hours

Digital tools used: GoogleMap, OeWF Mission Archive

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Science and Technology - The world around us is full of living things which depend on each other for survival.
Greece	• 4th Grade of Primary School, Environmental studies, Environmental issues on the planet I live in • Skills Laboratory
Portugal	• 5th grade, Natural Sciences, Earth Materials • 7th grade, Physics-Chemistry, Materials
Austria	General secondary school: • Mathematics: 1st-4th grade: working with models and statistics • Mathematics: 6th grade: functions • Biology: 1st-4th grade: ecology and environment • Biology: 6th grade: ecosystems and environmental problems • Biology: 7th grade: Infectious diseases, hygiene measures and prophylaxis • Geography: 5th grade: Geo ecosystems and their anthropogenic deformation

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: OeWF

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Looks like a rock!

Brief description: Meteorites pose a great danger to space travel. Not only for various satellites, but also for the lives of astronauts in space stations. To learn more about meteorites, you don't necessarily have to run a lab in space. Some meteorites come dangerously close to Earth, and many hit the ground with varying energy.	
Age: 15-18 years old	
Duration: 3 hours	
Digital tools used: visme, data talk	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.
Greece	• 2nd Grade of Junior High School, Physics, Forces and motion • 1st Grade of High School, Physics (general orientation), Forces and motion • Skills Laboratory
Portugal	• 9th grade, Physics-Chemistry, Motions on Earth
Austria	General secondary school: • Mathematics: 1st-4th grade: working with models and statistics • Mathematics: 5th grade: functions • Biology: 6th grade: Structure and composition of the earth, geodynamical forces of formation • Physics: 4th grade: Curved paths on earth and in space • Physics: 5th grade: dimensions, mechanics I, conservation of energy, thermodynamics • Physics: 6th grade: mechanics II, conservation of energy
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: OeWF	

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Orientation and attitude!

Brief description: You don't have to be on another planet for the ability to orient yourself well to be an advantage. Nevertheless, orientation training is an important unit in astronaut training. Sometimes, however, it is already helpful if you can orient yourself well on Earth. Helpful for this is also the ability to estimate distances well. In the school context, estimating different quantities plays an important role.	
Age: 15-18 years old	
Duration: 3 hours	
Digital tools used: OeWF Mission Archive, codap, google earth/mars	

Links to the curricula

UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Mathematics and Numeracy - Geometry focuses on relationships involving shape, space and position, and measurement focuses on quantifying phenomena in the physical world.
Greece	• 5th Grade of Primary School, Geography, Maps and Orientation • 1st Grade of Junior High School, Geography, Maps and Orientation • 1st Grade of Junior High School, Mathematics, Measurement-Length • 3rd Grade of Junior High School, Mathematics, Algebraic Expressions • Skills Laboratory
Portugal	• 7th grade, Geography, Geography and Territory
Austria	General secondary school: • Mathematics: 1st-4th grade: working with figures and bodies, working with models and statistics • Mathematics: 5th grade: trigonometry,Vectors and analytic geometry in R^2 • Mathematics: 6th grade: Vectors and analytic geometry in R^3 • Geography: 5th grade: Reflect structuring principles of the earth according to different points of view • Physics: 2nd grade: the world we live in • Physics: 5th grade: dimensions, mechanics I • Physics: 7th/ 8th grade: descriptive geometry

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: OeWF

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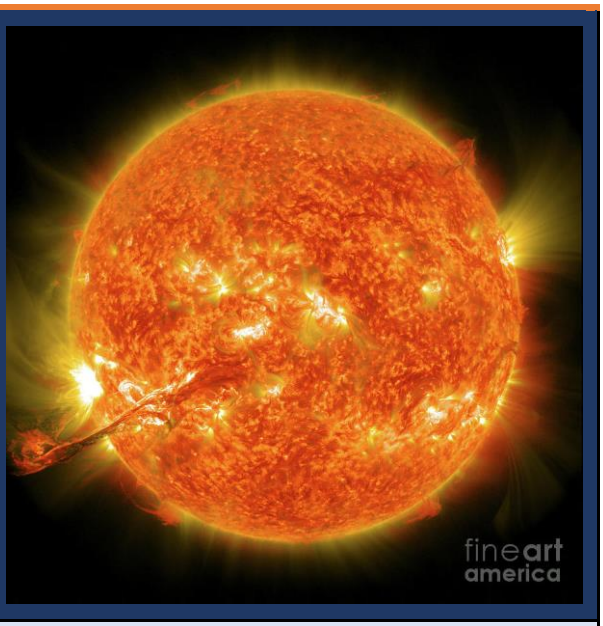
Let's predict a Coronal Mass Ejection!

Brief description: Students learn about Coronal Mass Ejections (CMEs) and their effects on human civilization. In their attempt to predict if they will observe a Coronal Mass Ejection, they use scientific data to construct a diagram of the number of Coronal Mass Ejections over time and they try to spot a pattern. They also compare this diagram with various diagrams of sunspots over time linking CMEs with the solar cycle. They discuss the scientific practices that they implemented and the importance of expressing a prediction by using possibilities.	
Age: 15-18 years old	
Duration: 3 hours	
Digital tools used: CODAP for Data Science	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.
Greece	• 3rd Grade of Junior High school, Physics, Magnets and Earth's magnetic field • 2nd Grade of Junior High school, Mathematics, Cartesian coordinates and fuction graphs • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 12th grade, Physics, Mechanics • 12th grade, Physics, Force Fields
Austria	General secondary school: • Mathematics: 1st-4th: working with models and statistics • Mathematics: 6th grade: Descriptive statistics; probability • Mathematics: 7th grade: Discrete probability distributions digital literacy • Physics: 7th grade: electromagnetic waves
Direct link to the demonstrator	
Link to the demonstrator through the website of LaSciL	
Contributor: EA	

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Our closest star!

Brief description: Students calculate the astronomical unit using pictures from the transit of Venus in 2004. They learn the three different measurement units of distance in space (astronomical unit, light year and parsec) and they study the parallax method. At the end they discuss the improvement of technology and its contribution to science, the experimental errors, and the importance of cooperation in science. They reflect on the methods and tools they used.

Age: 15-18 years old

Duration: 3-4 hours

Digital tools used: Online pixel ruler

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena • Mathematics and Numeracy - Geometry focuses on relationships involving shape, space and position, and measurement focuses on quantifying phenomena in the physical world.
Greece	• 2nd Grade of High school, Physics (general education), Geometric Optics • 2nd Grade of Junior High school, Mathematics, Trigonometry • 2nd Grade of High school, Mathematics (general orientation), Trigonometry • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 8th grade, Physics-Chemistry, Light • 9th grade, Mathematics, Geometry and Measurement • 11th grade, Physics-Chemistry, Waves and Electromagnetism
Austria	General secondary school: • Mathematics: 5th grade: trigonometry • Mathematics: 7th grade: Circles, spheres, conic section lines and other curves • Mathematics: 7th/8th grade: descriptive geometry • Physics: 5th grade: dimensions

Direct link to the demonstrator

Link to the demonstrator through the website of LaSciL

Contributor: EA

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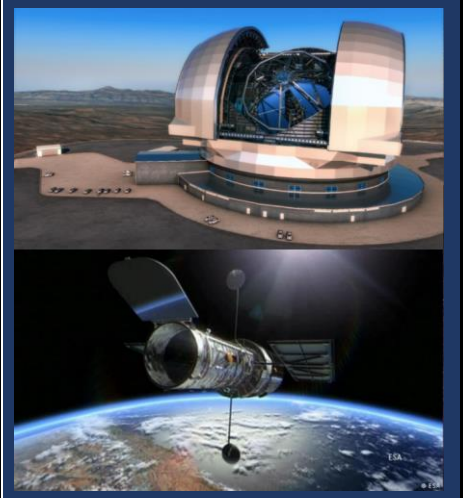
Introducing the telescope

Brief description: Students learn about the principle of operation of the telescope. Through a series of puzzles, they investigate fundamental optics behind the instrument using interactive apps and obtain a deeper understanding of it. We start with an introduction to modern observatories and then proceed to create a simple model of a telescope. Then we investigate: magnification, upside down images, focusing, the impact of the Earth's rotation and telescope light gathering power.	
Age: 14-16 years old	
Duration: 4-13 hours	
Digital tools used: Astronomy field of view calculator, Telescope simulator, Ray optics simulator, Stellarium, Stelvision	

Links to the curricula	
UK	Curriculum for Wales, AOL • Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.
Greece	• 3rd Grade of Junior High school, Physics, Nature and Propagation of light • 3rd Grade of Junior High school, Physics, Refraction and applications • 2nd Grade of High school, Physics (general orientation), Telescopes and Microscopes • 2nd Grade of High school, Physics (general orientation), Geometric Optics • 2nd Grade of High school, Physics (general orientation), Refraction and lenses • Skills Laboratory
Portugal	• 7th grade, Physics-Chemistry, Outer Space • 8th grade, Physics-Chemistry, Light • 11th grade, Physics-Chemistry, Waves and Electromagnetism
Austria	General secondary school: • Physics: 4th grade: the world of the visible
Link to the demonstrator through the website of LaSciL	
Contributor: EA	

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Jupiter's moons

<table>
<tr><td colspan="2"><u>Brief description</u>: In this activity students will learn about the discovery of the 4 largest moons of Jupiter made by Galileo. Using innovative digital tools, they will follow the footsteps of the great scientist in establishing the scientific method for observing the sky.</td><td rowspan="3">  </td></tr>
<tr><td colspan="2"><u>Age</u>: 14-16</td></tr>
<tr><td colspan="2"><u>Duration</u>: 2 hours</td></tr>
<tr><td colspan="2"><u>Digital tools used</u>: Pixel ruler, Sky and telescope_Jupiter moons</td></tr>
<tr><td colspan="3">Links to the curricula</td></tr>
<tr><td>UK</td><td colspan="2">Curriculum for Wales, AOL
• Science and Technology, Being curious and searching for answers is essential to understanding and predicting phenomena.</td></tr>
<tr><td>Greece</td><td colspan="2">• 2nd Grade of High school, Physics (orientation), Circular motion
• 3rd Grade of Junior High school, Physics, Periodical phenomena
• 5th Grade of Primary school, Mathematics, Fractions
• Skills Laboratory</td></tr>
<tr><td>Portugal</td><td colspan="2">• 7th grade, Physics-Chemistry, Outer Space
• 9th grade, Physics-Chemistry, Motions on Earth
• 12th grade, Physics, Mechanics
• 12th grade, Physics, Force Fields</td></tr>
<tr><td>Austria</td><td colspan="2">General secondary school:
• Physics: 4th grade: the visible world, curved paths on earth and in space
• Physics: 5th grade: dimensions</td></tr>
<tr><td colspan="3"><u>Link to the demonstrator through the website of LaSciL</u></td></tr>
<tr><td colspan="3">Contributor: EA</td></tr>
</table>

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3. Teacher scenarios

In the following pages there is a description of the educational scenarios that were developed by teachers during the LaSciL summer school. As shown in the following graph, the majority of educators that participated in the process teach Physics but there were also teachers of other subjects like Music, French and Mathematics, highlighting the interdisciplinary nature of Astronomy and the increased interest of teachers about this field.

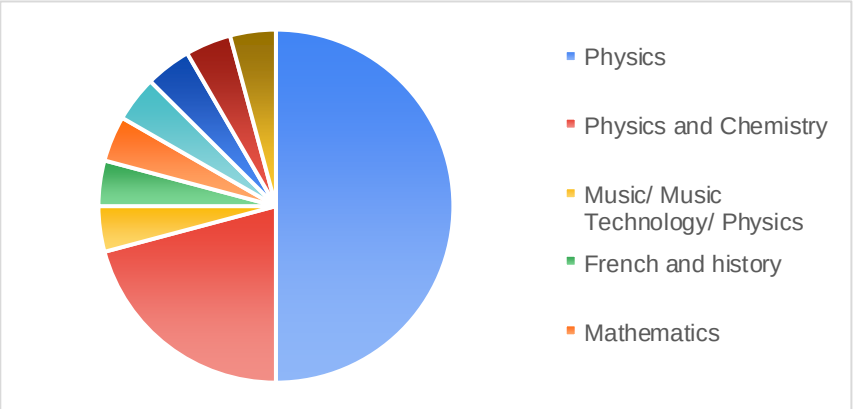

Figure 4: Teachers' subject

The teachers that participated also covered a wide range of grades showing that there is interest about introducing Astronomy to every level of education.

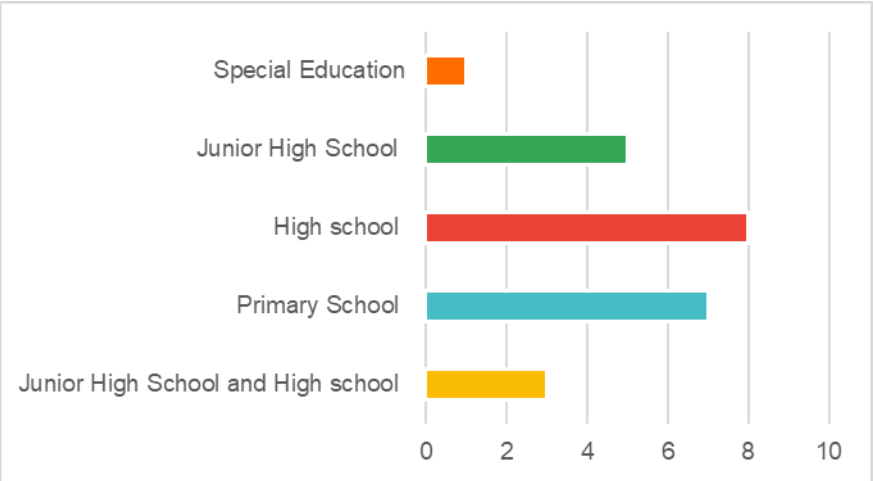

Figure 5: Grade of teachers' students

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The educational scenarios developed by the teachers were validated by the project consortium. Making sure not to discourage the educators, some helpful comments were sent to them for the improvement of their scenarios. The comments were always based on the teacher's initial idea and were taking into account his/her background and capabilities. The ultimate goal was the implementation of the best possible version of the teachers' scenarios in the classroom. The final educational scenarios are uploaded to the LaSciL website with open access to the public.

In the next pages the educational scenarios that were developed by the teachers are presented based on the following template.

Teacher scenario presentation template

Title: *Please replace with the title of the respective educational scenario*

<table>
<tr><td colspan="2">Brief description: In a few sentences describe the topic of this demonstrator, the activities it includes and what the students will learn by implementing them.</td></tr>
<tr><td>Age: Write the age group of the students that can implement this scenario.</td><td rowspan="4">Digital tools used:
• Please list the tools incorporated within the educational scenario</td></tr>
<tr><td>Duration: Fill out the duration of the scenario.</td></tr>
<tr><td>Link to the curricula: Write the connection of this scenario with the educator's country curricula.</td></tr>
<tr><td>Languages: Write the languages in which the scenario is written</td></tr>
<tr><td colspan="2">Educator information</td></tr>
<tr><td colspan="2">Name and Surname: Fill out the name and surname of the educator</td></tr>
<tr><td colspan="2">Country and school: Please write the country and school where the educator is being currently occupied.</td></tr>
<tr><td colspan="2">Link to the scenario (through the LaSciL website):</td></tr>
</table>

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1.How important is light to the human vision?

Brief description: In this activity, students will learn about light and color through exploration of hands-on activities and virtual labs that lead them to exploration of the sun as a star (luminous object), of the moon as an illuminated object, the color of the stars, the color of objects, light emitted by the sun and of the electromagnetic spectrum. Students will have the opportunity to explore the color of different objects when illuminated by lights of different colors, to build a simple spectrometer, to explore the overlap of two of the three primary color lights (red, green and blue), to build a Newton disk and to detect infrared light in a TV remote control. Students will also have the opportunity to share their knowledge with the community.

Credit: NASA Image of the Day /A Supernova's Shockwaves

Age: 12-14 years old

Duration: 6 hours

Link to the curricula: Light: Light and vision

Languages: English, Portuguese

Digital tools used:

- Padlet
- Phyphox
- phET Colorado

Educator information

Name and Surname: Barbara Moiteiro

Country and school: Portugal, Agrupamento de Escolas José Belchior Viegas Escola E. B. 2,3 Poeta Bernardo Passos

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

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2.Be Galileo for one day, or more…but in the other days be yourself

Brief description: Students will build Galileo's telescope in groups. To do this they will have to investigate what happens to light when it changes from one medium to another (refraction) and how different types of lenses (concave and convex) perform. Through investigation, students will become familiar with the phenomenon of light refraction, the characteristics of the images produced by lenses and some of the applications of optical phenomena.

Credits: Wikipédia - Galileu Galilei, por Justus Sustermans 1636

Age: 12-14 years old

Duration: 6 hours

Link to the curricula: Light: Optical phenomena

Languages: English, Portuguese

Digital tools used:

- edpuzzle
- Simulator by Galileo museum
- YouTube videos
- Golabz
- phET Colorado
- Telescope simulator
- Stellarium

Educator information

Name and Surname: Berta Rodrigues

Country and school: Portugal, ESCOLA D. AFONSO III – FARO PORTUGAL

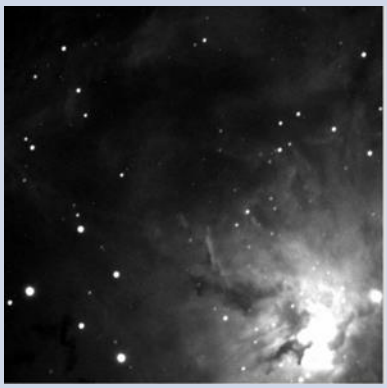
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

3.A voyage in sound and time: An introduction to sonification

Brief description: In this project, students investigate the questions 'Why Use Sound In Astronomy? To do Art, or Science, or both?'. They will do activities exploring sonification - representing various data as audio - and links between sound and human study of space, inspired by the work of today's contemporary scientists such as Wanda Diaz-Merced and Nicolas Bonne, among others. It will open up possibilities to students for making science accessible to more people, especially those who, like Wanda, are blind or visually impaired, as well as demonstrating that sonification has a wider impact too.



Age: 11-14 years old

Duration: 1-2 hours

Link to the curricula: Astronomy, Music technology, ICT, Music, Physics, Computer science, History, Visual Art & Graphics

Languages: English

Digital tools used:

- AfterGlowAccess
- Black Hole Hunter
- Two Tone

Educator information

Name and Surname: Gray Jeremy

Country and school: UK, Isle of Wight Education Federation

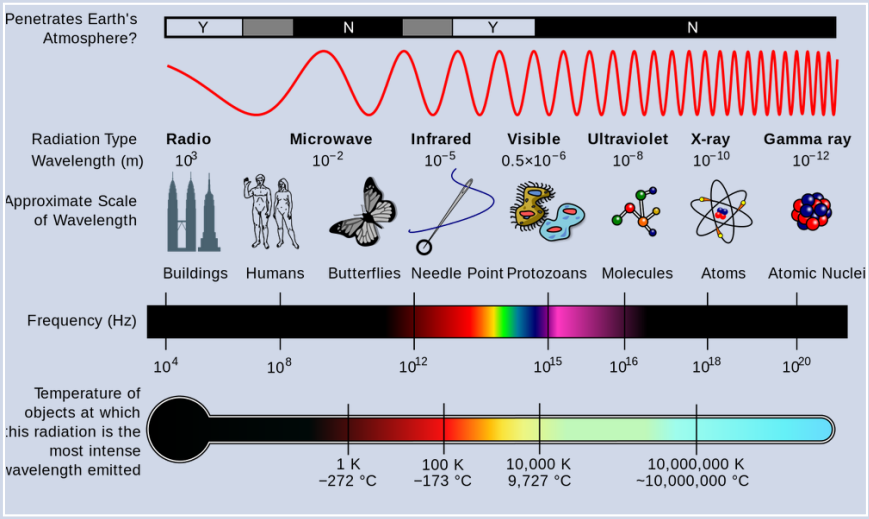
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

4.The structures of the Universe

Brief description: An awareness about the scientific, technological and social meaning of human intervention in our environment and in culture in general.



Age: 12-15 years old

Duration: 1 year project

Link to the curricula: How do the structures of the Universe contribute to its sustainability?

Languages: English

Digital tools used:

- Stellarium
- SalsaJ
- LCO tools

Educator information

Name and Surname: Margarida Teixeira

Country and school: Portugal, Agrupamento de Escolas Frei Gonçalo de Azevedo

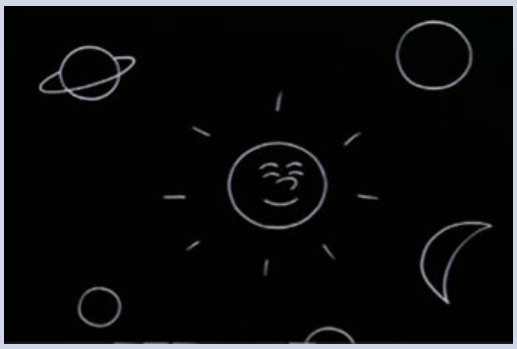
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

5.Et pourtant elle tourne

Brief description: Triggered by a video in French, students are invited to talk about Galileo's life, to learn what he discovered and the conflicts/controversies he faced. In the end, they create their own models of planets and a small theatrical performance showing the controversy between Galileo and his contemporaries.



Age: 14-15 years old

Duration: 3 hours

Link to the curricula: French: History, Art, Science, Culture

Languages: Greek/French

Digital tools used:

- YouTube videos

Educator information

Name and Surname: Anastasia Megalokonomou

Country and school: Greece, 1st Junior High School of Thermi

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

6.H-R diagram of Pleiades cluster

Brief description: Students will measure the apparent magnitude and color index of stars. The data will be acquired through the robotic telescopes of Skinakas (Observatory in Greece) and will be analyzed using the appropriate software.

Age: 17-18 years old

Duration: 4 hours

Link to the curricula: Physics, second grade of high school: Light, Electromagnetic spectrum, Gravitational field, Atomic structure)
Physics, third grade of High School: Black body radiation, Waves

Languages: Greek

Digital tools used:

- YouTube videos
- SalsaJ
- LCO tools

Educator information

Name and Surname: George Klimis

Country and school: Greece, Pagritio High School

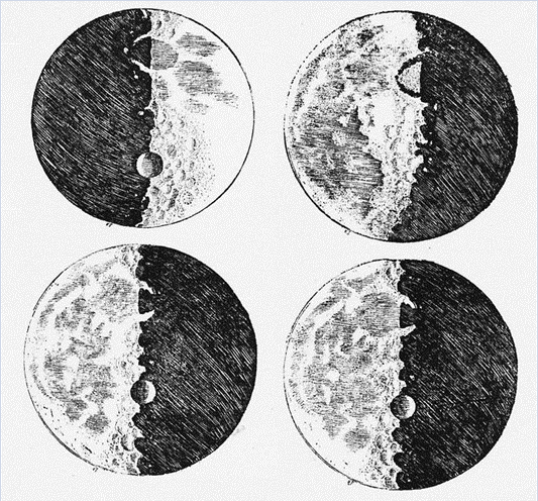
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

7.Measuring the lunar mountains

Brief description: With reference to the corresponding work of Galileo and using modern technology students measure the height of a lunar mountain and at the same time we wonder what the discovery of mountains on the Moon meant for the prevailing Aristotelian physics of Galileo's time.



Age: 14-16 years old

Duration: 3 hours

Link to the curricula: Physics, third grade of junior high school: Propagation of Light
Mathematics, second grade of Junior High School: Pythagorean theorem

Languages: Greek

Digital tools used:

- NASA Visualization studio (Moon phase and libretion)
- AstroImageJ

Educator information

Name and Surname: George Tsagliotis

Country and school: Greece, Junior High School of Thrapsanou

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

8.From the Earth to the Moon and the Sun

Brief description: The Moon is the natural satellite of Earth. It is our closest celestial body and the only one that has been conquered by humans. But how close is it? How much closer is it compared to the Sun? What is the relationship between the two distances? Will we work easier if we round the numbers? These questions will be answered by the students during this educational scenario.

Age: 11-12 years old

Duration: 2 hours

Link to the curricula: 5th and 6th grade of Primary School: Geography (Solar System), Mathematics (length, Fraction)

Languages: Greek

Digital tools used:

- YouTube videos
- Stellarium

Educator information

Name and Surname: Dimitra Armetzou

Country and school: Greece, 9th Primary School of Comotini

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

9.The dark side of the Moon

Brief description: The Moon is the natural satellite of Earth. It is our closest celestial body and the only one that has been conquered by humans. Through this educational scenario the students learn about the dark side of the Moon through scientific data and processes that help them shake down many myths about this phenomenon.

Age: 11-12 years old

Duration: 1 hour

Link to the curricula: 5th and 6th grade of Primary School: Geography (Solar System), Greek Language (Science Fiction)

Languages: Greek

Digital tools used:
- YouTube videos
- Stellarium

Educator information

Name and Surname: Dimitra Armetzou

Country and school: Greece, 9th Primary School of Comotini

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

10.Phases of the Moon

Brief description: The Moon is the natural satellite of Earth. It is our closest celestial body and the only one that has been conquered by humans. Every night the view of the Moon from Earth changes. Through this scenario students use scientific data and processes to explain this phenomenon.

Age: 11-12 years old

Duration: 1 hour

Link to the curricula: 5th and 6th grade of Primary School: Geography (Solar System), Physics (Light and shadow)

Languages: Greek

Digital tools used:
- YouTube videos
- Stellarium

Educator information

Name and Surname: Dimitra Armetzou

Country and school: Greece, 9th Primary School of Comotini

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

11.Motions of the Moon

Brief description: The Moon is the natural satellite of Earth. It is our closest celestial body and the only one that has been conquered by humans. The different motions of the Moon are responsible for different phenomena observed from Earth. Through this educational scenario students explore these motions.

Age: 11-12 years old

Duration: 1 hour

Link to the curricula: 5th and 6th grade of Primary School: Geography, Physics, Greek Language

Languages: Greek

Digital tools used:

- Simulator of the Moon's motion around the Earth

Educator information

Name and Surname: Dimitra Armetzou

Country and school: Greece, 9th Primary School of Comotini

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

12. Φεγγάρι ή Σελήνη
(Two different names for Moon in Greek)

Brief description: The Moon is the natural satellite of Earth. It is our closest celestial body and the only one that has been conquered by humans. Students learn about the Moon by answering questions like what is the Moon or where does its light come from. They also study the two Greek words for Moon, their roots and derivative words.

Age: 11-12 years old

Duration: 1 hour

Link to the curricula: 5th and 6th grade of Primary School: Geography, Physics, Greek Language

Languages: Greek

Digital tools used:
- Tagxedo

Educator information

Name and Surname: Dimitra Armetzou

Country and school: Greece, 9th Primary School of Comotini

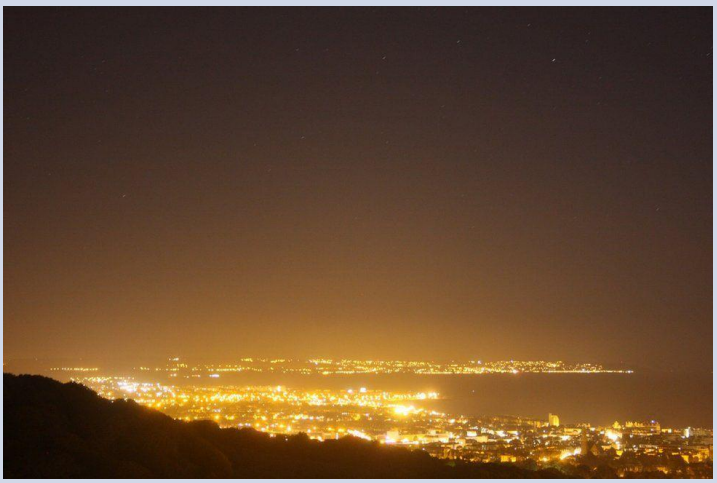
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

13.Measuring Light Pollution

Brief description: Using a mobile app that shows the sky students measure magnitudes of visible stars from their area to measure light pollution in an indirect way. They record their observations / measurements and they photograph the observed area. They then plot the size of the visible stars against the distance from the largest urban center in our area and discuss ways to limit their 'bright imprint/light pollution'. Finally, the students discuss and propose ways to limit light pollution in their regions.



Age: 15-18 years old

Duration: 4-7 hours

Link to the curricula: Skills Laboratory, Geography, Physics, Computer Science

Languages: Greek

Digital tools used:

- Google Earth
- Mobile Observatory
- Cartes du ciel

Educator information

Name and Surname: Dimitris Prasopoulos

Country and school: Greece, Technical High School of Alexandroupolis

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

14.Naming the craters and other formations of the Moon

Brief description: Students search the names of the Moon's formations and craters. They record the data and build biographies of scientists/important people. They discuss and discover through their research the achievements, ideas, discoveries and effects of these important people in their everyday lives.

Age: 12-18 years old

Duration: 2-5 hours

Link to the curricula: Skills Laboratory, History, Geography, Physics, Computer Science

Languages: Greek

Digital tools used:

- Google Earth
- Virtual Moon Atlas

Educator information

Name and Surname: Dimitris Prasopoulos

Country and school: Greece, Technical High School of Alexandroupolis

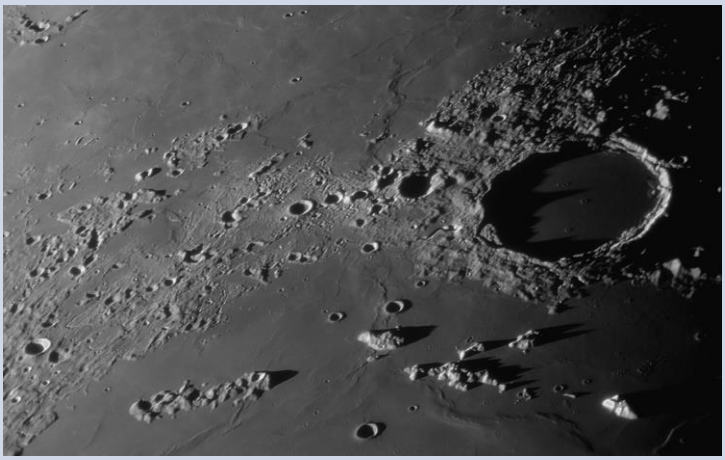
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

15.Measuring the craters on the Moon and comparing them with regions of Greece

Brief description: Using a photograph of the Moon's disk (near the full moon) students compare the size of craters of the Moon with Plato crater (101 km in diameter). They record the data and calculate the errors of their measurements. The students process the error data in a graph and create circles corresponding to the craters on Google Earth.



Age: 12-18 years old

Duration: 2-5 hours

Link to the curricula: 5th and 6th grade of Primary School: Mathematics, 5th grade of Primary School: Geography/History, 1st grade of Junior High School: Mathematics/Physics/History, 1st and 2nd grade of Junior High School: Geography

Languages: Greek

Digital tools used:

- Google Earth
- Virtual Moon Atlas
- Pixel ruler

Educator information

Name and Surname: Dimitris Prasopoulos

Country and school: Greece, Technical High School of Alexandroupolis

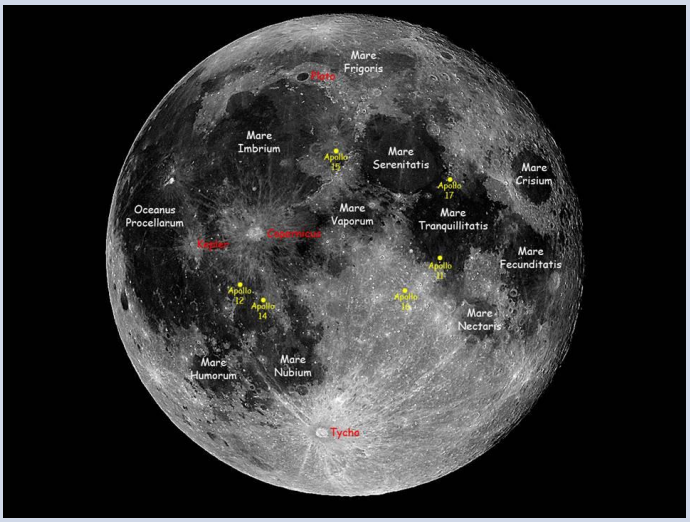
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

16.Important people on the Moon: Create your own map of the Moon

Brief description: From a photograph of the Moon students distinguish the most distinct/impressive craters and surface formations. They find the names of these formations and search on the internet the information they are most interested in about these formations. Students collect and process the information by creating short or longer articles. They then use a photo of the Moon's disc (near the full Moon) to prepare a map of the Moon. The educator can also organize an astronomical observation of the Moon.



Age: 12-18 years old

Duration: 5-10 hours

Link to the curricula: Geography, Physics

Languages: Greek

Digital tools used:

- Virtual Moon Atlas

Educator information

Name and Surname: Dimitris Prasopoulos

Country and school: Greece, Technical High School of Alexandroupolis

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

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17.Put a ring on it!

Brief description: Students learn why some planets have rings and what they are made of. They then investigate and practice ways of painting rings whilst making a 3D model of a made-up planet with rings using Styrofoam balls and acrylic sheets.

Age: 11-14 years old

Duration: 2-3 hours

Link to the curricula: Structure of the solar system KS3, Art (methods in painting and drawing), KS3 (Light, Color theory)

Languages: English

Educator information

Name and Surname: Dimitrios Theodorakis

Country and school: UK, Nottingham High School

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

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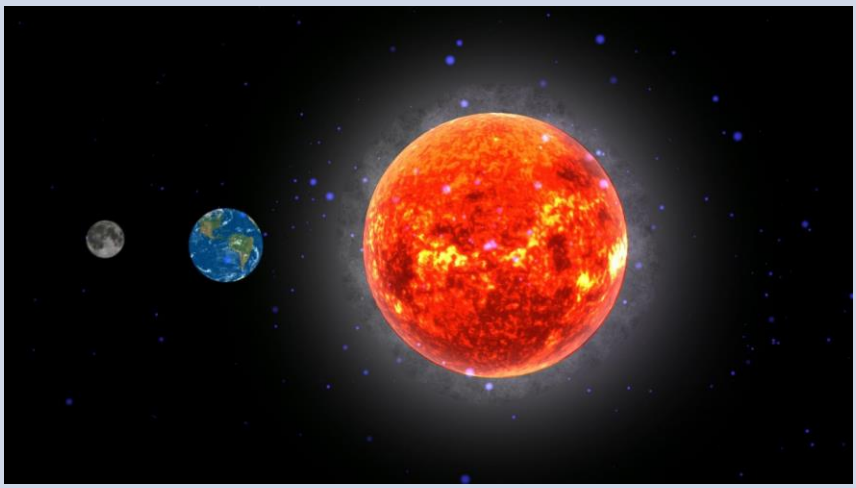
18.The motions of Sun, Earth and Moon through Scratch

Brief description: By studying the motions of the Sun, Earth and Moon students learn how to use the code of Scratch which acts as a great introduction to programming and robotics. The students will try to create through Scratch their own model of these celestial bodies and their movements. They will also discuss scale in their model and pictures they have seen on the Internet.



Age: 10-12 years old

Duration: 2 hours

Link to the curricula: Solar System, Robotics

Languages: Greek

Digital tools used:

- Scratch
- YouTube videos

Educator information

Name and Surname: Iliana Ntovolou

Country and school: Greece, Ellinogermaniki Agogi

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

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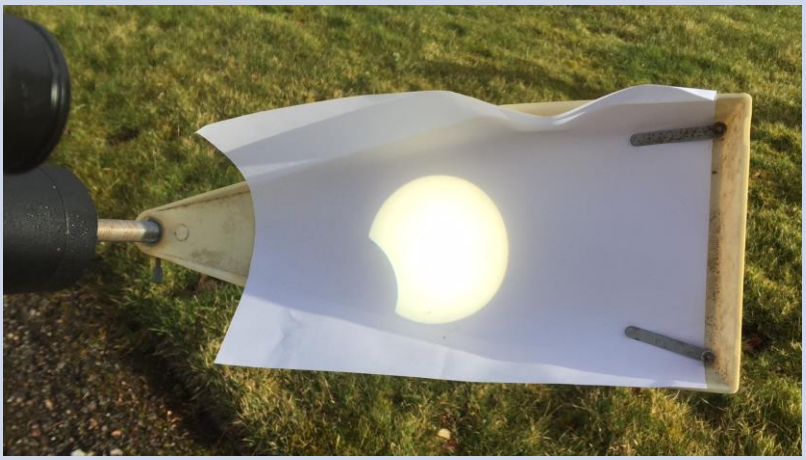
19.Safe observing and sketching Sunspots

Brief description: Students learn about the need to study solar activity by scientists and become familiar with the methods of safe observation of our Sun. Through the observation of the Sun from a solar telescope and also through the construction of a solar projector, they know and draw the spots of the Sun. They compare images of the Sun from different dates (data from SOHO) and note the change in positions of the spots.



Age: 10-12 years old

Duration: 3 hours

Link to the curricula: 6th grade of Primary School, Science

Languages: Greek

Digital tools used:

- SOHO Movie Theater
- Padlet
- YouTube videos

Educator information

Name and Surname: Clio Milioni

Country and school: Greece, Ellinogermaniki Agogi

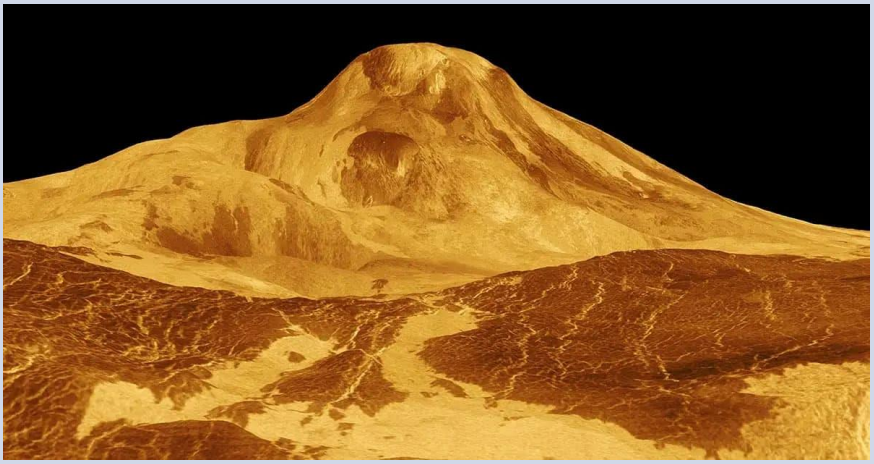
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

20.Volcanoes on Venus

Brief description: Through this scenario students study the warmest planet of our Solar System and the volcanoes on its surface. They discuss the scenario of them being responsible for the toxic atmosphere of Venus and they explore the way volcanoes explode.



Age: 10-12 years old

Duration: 3-4 hours

Link to the curricula: Skills Laboratory, Physics, Mathematics, Geography

Languages: Greek

Digital tools used:

- YouTube videos

Educator information

Name and Surname: Theodora Koukourikou

Country and school: Greece, Special Primary School of Argos

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

21.Moonlanders

Brief description: Through this scenario students discuss the possible ways the Moon could be created and they study its surface. They explore how craters are formed and the different parameters that affect their size.

Age: 7-9 years old

Duration: 3-4 hours

Link to the curricula: 2nd and 3rd grade of Primary School (Skills Laboratory, Environmental studies)

Languages: Greek

Digital tools used:

- YouTube videos

Educator information

Name and Surname: Theodora Koukourikou

Country and school: Greece, Special Primary School of Argos

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

22.Constellations and their mythology

Brief description: Through this scenario students learn about the constellations, their mythology and its connection to the culture of each civilization. They also discuss the use of stars for orientation and the constellations that appear in different seasons in their area and different places in the world.

Age: 8-10 years old

Duration: 3-4 hours

Link to the curricula: 3rd and 4th grade of Primary School (Skills Laboratory, Environmental studies, History, Art, Mathematics)

Languages: Greek

Digital tools used:

- YouTube videos
- Stellarium

Educator information

Name and Surname: Theodora Koukourikou

Country and school: Greece, Special Primary School of Argos

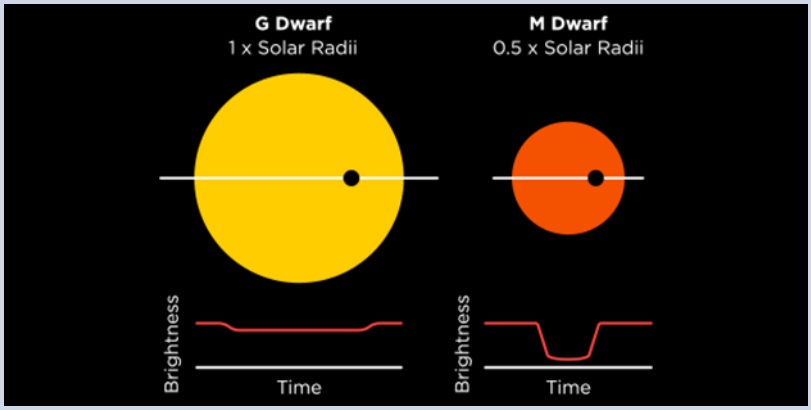
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

23.Exoplanets and Newton's law of universal gravitation

Brief description: The present teaching scenario is an attempt for students to understand the decisive role that technology has in the collection and analysis of data. Students study exoplanets by using observational data and by drawing conclusions following scientific methods.



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Age: 15-17 years old

Duration: 3 hours

Link to the curricula: 2nd grade of High School (Orientation Physics: Law of Universal Gravitation)

Languages: Greek

Digital tools used:

- DIY Planet Search
- MicroObservatory
- NASA Exoplanet Archive

Educator information

Name and Surname: Evaggelia Koutra

Country and school: Greece, 1st High School of Heraklion (Crete)

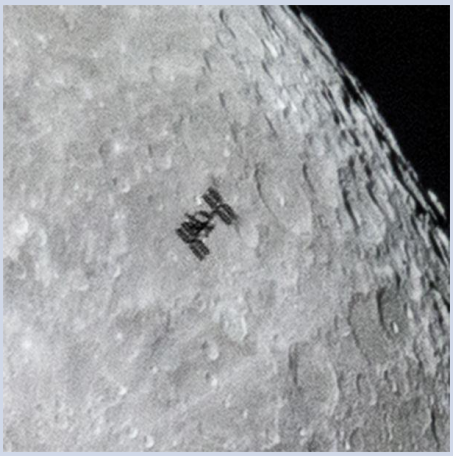
Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

24.Gravitational force

Brief description: Students study the motion of planets, natural and artificial satellites of our Solar System (Moon and space station around the Earth, Earth and other planets around the Sun). Students cooperatively hypothesize, investigate, confirm or deny their hypotheses, reach conclusions (mainly qualitative) and present them to the rest of the classroom.



Age: 12-15 years old

Duration: 2 hours

Link to the curricula: 2nd grade of Junior High School (Physics: Forces, Gravitational Force, Motion)

Languages: Greek

Digital tools used:
- phET Colorado
- YouTube videos

Educator information

Name and Surname: Niki Mamzeridou

Country and school: Greece, 1st Junior High School of Thermi

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

25.Dark matter

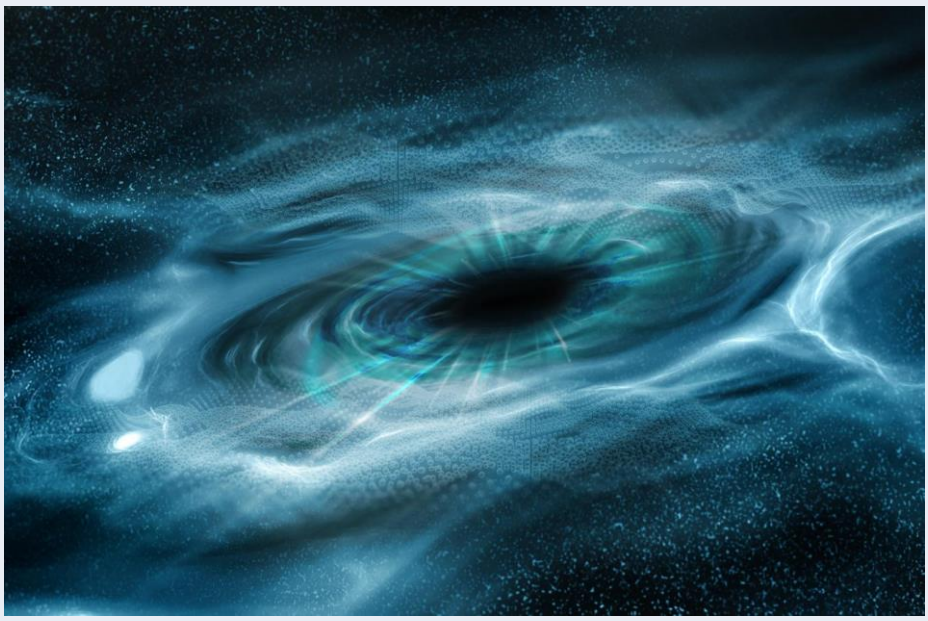
Brief description: Although dark matter is a very abstract subject some of the basic concepts are based on evidence that can be explained very well by experimental demonstrations. Wanting to approach this complex subject we chose to conduct a simple experiment using the centripetal force apparatus in circular motion with the aim of relating the speed of an object moving in a circular orbit to the mass of the object around which they are rotating. Then using the law of universal gravitation, Newton's 2nd law of motion and the centripetal acceleration equation students will derive the mathematical relationship by which they can calculate the mass of the sun using planetary orbits.

Age: 16-18 years old

Duration: 2 hours

Link to the curricula: High School (Physics: Forces, Gravitational Force, Circular Motion)

Languages: Greek



Educator information

Name and Surname: Nikos Michas

Country and school: Greece, Ellinogermaniki Agogi

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

26.Morning star or evening star?

Brief description: Venus is the second closest planet to the Sun and is the second brightest object (at max.) in the night sky after the Moon. In Greek it is often called «Αυγερινός» (morning Star) ή «Αποσπερίτης» (evening star). When Venus is visible for about three hours after the sunset it is called Evening star and when it is visible for about three hours before sunrise it is called Morning Star. It has a similar size compared to Earth but its atmosphere presents completely different characteristics. The goal of the scenario is for students to be able to calculate the Sun-Venus and Earth-Venus distances through scientific methods.

Age: 14-15 years old

Duration: 2 hours

Link to the curricula: 2nd grade of Junior High School (Physics, Mathematics, Literature)

Languages: Greek

Digital tools used:

- NASA Solar System Exploration
- In the sky
- Open book
- YouTube videos

Educator information

Name and Surname: Nikolaos Christodoulakis

Country and school: Greece, Pagritio Private School (Crete)

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

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27.Moon's dresses

Brief description: The toddlers are trying to find a solution to the Moon's dressmaker problem. He/She can't take measurements to make her a dress, because her shape changes every day. The little researchers undertake to unravel the mystery and find out what is going on by starting with brainstorming and their previous knowledge, continuing with measurements, observations, experiments, constructions, internet searches and through various actions they get to know the 8 Phases of the Moon. They also evolve their collaboration, communication, creativity and critical thinking skills. The results of the students' research are compared and matched with the photos from the 8 Phases sent by the Skinakas Observatory.

Age: 4-6 years old

Duration: 4 hours

Link to the curricula: Kindergarten (Greek Language, Mathematics, Technology, Science: Planet Earth and Space, Earth's and Moon's options)

Languages: Greek

Digital tools used:

- WordWall
- Corillo
- Kidspiration
- Wheel of names
- Padlet

Educator information

Name and Surname: Constantina Tallou

Country and school: Greece, 7th kindergarten of Ioannina

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

28.Game: Phases of the Moon for toddlers

Brief description: With this fun game implemented in the classroom or schoolyard, toddlers learn by playing about the phases of the Moon. This scenario combines active learning and movement with educational activities.

Age: 4-6 years old

Duration: 1 hours

Link to the curricula: Kindergarten (Greek Language, Mathematics, Technology, Science: Planet Earth and Space, Earth's and Moon's options)

Languages: Greek

Educator information

Name and Surname: Constantina Tallou

Country and school: Greece, 7th kindergarten of Ioannina

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

29.Moon's trajectory

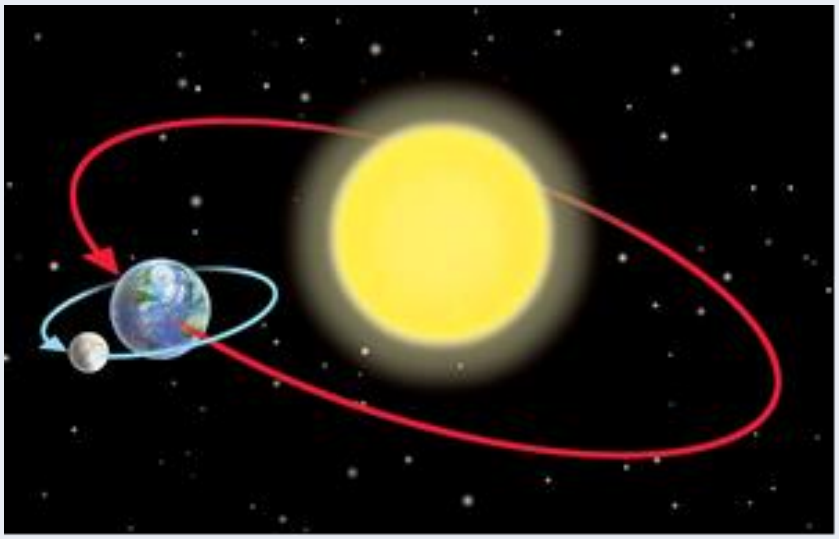
Brief description: Most students believe that the Moon has a circular orbit, moving in a constant distance from the Earth. By studying the time durations of laser pulses emitted by Earth and reflected to the Moon by mirrors installed by space missions, they will calculate the Earth-Moon distance. Students will map the Moon's orbit around the Earth and they will plot its distance from Earth revealing the complexity of its trajectory.

Age: 15-16 years old

Duration: 3 hours

Link to the curricula: 3rd grade of Junior High School and 1st grade of High School Physics

Languages: Greek



Educator information

Name and Surname: Dimitrios Tsakiris

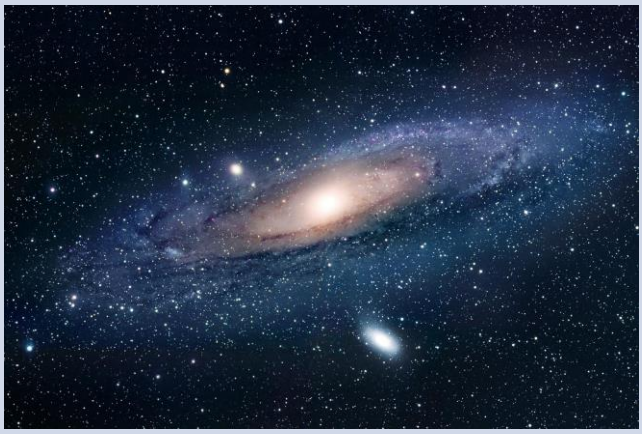
Country and school: Greece, 3rd Junior High School of Alexandroupolis

Direct link to the teacher scenario

Link to the scenario through the LaSciL website

The LaSciL project has been co-funded with support from the Erasmus+ funding scheme of the European Commission with grant agreement: 2020-1-UK01-KA226-SCH-094579

30.Exploring Galaxies



Brief description: Students are wondering about characteristics of the galaxies, for example what is the shape of each galaxy and the Milky Way; how many galaxies exist in our universe and other relevant questions. Students in generalhave not realized the distances between galaxies, or the distances between stars. Performing this scenario, students observe images from the James Webb Space telescope, are using the AAS worldwide telescope and Stellarium where one can easily zoom in the sky and explore celestial objects such as galaxies etc. They find the distance of galaxies from Earth; they categorize different shapes of galaxies. Additionally, students identify the shape of different galaxies by participating in the citizen science project, Galaxy Zoo (Zooniverse). Students are working in small groups of four. The didactic scenario is performed using tablets or in the class of computers of the school.

Age: 12-15 years old

Duration: 3 hours

Link to the curricula: Junior High School, Geography

Languages: English, Greek

Digital tools used:

- World Wide Telescope
- Zooniverse
- The James Webb Space Telescope gallery
- COSMOS-The SAO Encyclopedia
- YouTube videos

Educator information

Name and Surname: Maria Eleftheriou

Country and school: Greece, 7th kindergarten of Ioannina

Direct link to the teacher scenario in English and in Greek

Link to the scenario through the LaSciL website

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4. Conclusions

The project consortium developed 20 demonstrators based on the framework of LaSciL and uploaded them to the LaSciL website. Following their training at LaSciL summer school the participating educators created their own educational scenarios (30 in total) which were validated and uploaded to the LaSciL website with open access to the public.

LaSciL demonstrators consist a main component of the teachers training and inspiration to create their own educational material in the framework of LaSciL. Along with the second-generation demonstrators that were developed by the teachers, they will be the core of the project's implementation phase. The demonstrators of LaSciL will be thoroughly evaluated in the context of Intellectual Output 4 (IO4).

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5. References

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