"OUR GALAXIES PART 2"

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"Our Galaxies" lesson plan's aim is to enthuse students about astronomy by introducing the use of robotic telescopes in the classroom. It consists of two parts which can be implemented as a unit in a sequel or separately. In the first part students are asked to work as Scientists and generate a hypothesis about galaxies and their shapes. Students will in teams perform an investigation in the LCO archive to test their hypothesis and discuss their results in the plenary of the classroom. In the second part the students will learn about light and filters while planning their observations with robotic telescopes. They will also use Gimp to edit the images and showcase their work and what they have learnt in an exhibition in their school for their classmates and the local community.

EDUCATIONAL CONTEXT

AGE

10-12

DURATION

2 class periods / didactic hours (45 minutes) per lesson part

PREREQUISITES

Students should be familiar with the definition of a galaxy as collections of billions of stars. Visible light is broken down into light of the following colours: red, orange, yellow, green, cyan and violet.

MATERIALS

LAPTOPS, PROJECTOR, INTERNET CONNECTION, WIFI
CREATE EDUCATOR ACCOUNT IN THE LCO OBSERVATION PORTAL
DOWNLOAD GIMP ON COMPUTERS,
NOTEBOOKS, PEN/PENCILS AND ERASER
RECOMMENDED TO BE IMPLEMENTED IN THE ICT LAB

EDUCATIONAL OBJECTIVES

THE AIM OF THE ACTIVITY IS TO ENTHUSE STUDENTS ABOUT ASTRONOMY BY INTRODUCING THE USE OF ROBOTIC TELESCOPES IN THE CLASSROOM.

COGNITIVE OBJECTIVES

The students,
A. will learn about the use of RGB filters while requesting and editing images from robotic telescopes
B. will navigate the LCO Archive and LCO Observation portal

C. will work as Scientists:
C1.generate hypothesis,
C2. plan and perform in teams their investigation,
C3.analyze the data they gathered,
C4.showcase in teams their results in the plenary of the classroom
C5. evaluate/reflect

AFFECTIVE OBJECTIVES

The students ,
D. attitudes towards mistakes will change while performing their investigation in the LCO Archive were images of unsuccessful observations are displayed as well as successful observations in order to learn by comparing parameters of the requested observation and submitting their own requests.
E. will appreciate showcasing their results to the plenary of the classroom,
F. will appreciate the discussion/evaluation/reflection in the plenary of the classroom.
G. will be enthused by using robotic telescopes in the classroom.

PSYCHOMOTOROBJECTIVES

The students in teams will showcase their results

CONNECTION TO THE CURRICULA

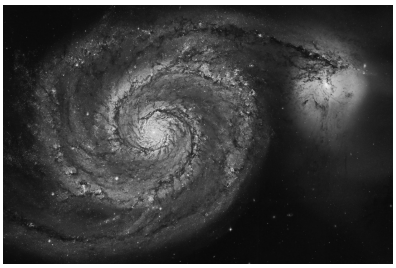
- **Curriculum of Greek Primary School 6th grade (11year olds)**
- **-Physics, unit: Light, chapter Light and Colors**
- **-Geography, unit A: Earth as a celestial body, chapter 6: Our solar system**
- **-ICT, creating and expressing via multimedia and presentations**

EDUCATIONAL APPROACH

Inquiry based learning

ORIENTING & ASKING QUESTIONS

The teacher is going to set the scene and intrigue the student's curiosity with the following questions:
Would you like to use a robotic telescope and request an image of a Galaxy in the classroom?
Have you seen astronomical images? Are they black and white or colorized?
Will the image that we will get from the robotic telescopes be colorized or in black and white?
At this point the teacher will show an image of M51 and point at the non-black parts of the image and ask what they depict?
Does white light split into different colors?



Then the teacher will show to the students the following images-filters and combine them in front of the light of the sun.

HYPOTHESIS GENERATION AND DESIGN

The teacher will highlight that there are certain parameters that need to be taken into account when planning an image request from robotic telescopes in order for the result to be successful.
Parameters:
Which instrument (telescope) to use?
What will the time exposure going to be?
What are the targets coordinates?
Which filters are we going to use?
The teacher will ask the students what filters we have to ask for in order to have a colorized image of a galaxy and generate a hypothesis about it.
Hypothesis:
“If we ask for Red (R)-Green (V)-Blue (B) filters when requesting an image from a robotic telescope we can colorize it.”

PLANNING AND INVESTIGATION

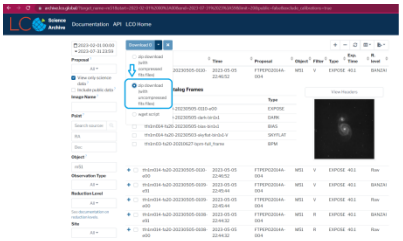
Plan Investigation
The teacher asks students to team up, visit the LCO Observation portal and log in to the LCO educators account and navigate together through the portal in order to note down the parameters they will have to fill in the request.

Secondly, the teacher will present to the teams the LCO Archive and explain how to conduct their investigation e.g.toolbar and terminology (what instrument are we going to use a telescope of 2m, 1m or 0,40m?, what will our exposure time be?).

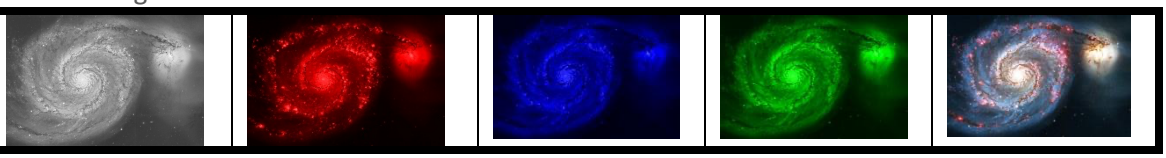
Students plan their investigation.

Perform Investigation
The students in teams investigate in the LCO Archive about the galaxy they are going to submit a request for an observation. Teacher supports the teams with feedback if needed.
Each team shortly presents in the plenary of the classroom their findings. After each presentation and the feedback given the teacher submits the request.

After all the requests are completed and the RGB images downloaded labeled and filed in each teams computer under the instructions of the teacher (choose to download it with uncompressed fits files) the teams meet again. It is important that the teacher has a backup plan for the team that might not be successful in the requested images e.g. has made the request of the required galaxies in advance so that each team can follow the image editing in Gipm and not feel disappointed. It is also very important to have underlined the value of learning from errors. Scientists value the knowledge of an error and persist on testing their hypothesis. This will change students' negative thinking patterns about errors and help them cope with them since Scientists and educators share their errors in the LCO Archive.



The Teacher hands out a sheet with step by step instructions to edit the RGB images. Then the teacher gives an example of editing RGB fits files and then asks the teams to open Gimp and edit together RGB fits files in order to get a colorized jpg image of their galaxy. The teacher supports the teams and gives feedback.



Here are some useful videos:
https://www.youtube.com/watch?v=93fTrU2R1q4
https://www.youtube.com/watch?v=JZlmEkMHdSY

ANALYSIS & INTERPRETATION

The teams discuss about the data they gathered they analyze and interpret their outcome of their work and prepare to present it in the plenary of the classroom. The teacher asks the teams to send the files of their work. Gives feedback and prints the extracted jpg colorized image of their galaxy as well as the RGB images. Informs the teams about printing them, hands them to the teams and asks them to make a black frame out of a black canson paper and laminating pouches for the presention.

CONCLUSION & EVALUATION

The teams present in the plenary of the classroom the outcome of work and discuss if their hypothesis is true and false.

Evaluation/Reflection

After the presentation of the outcome of every team's investigation a class discussion/reflection will follow. Teams reflect upon their investigation and the outcome. The teacher asks the teams to exhibit their work to the whole school and local community.

Consider other explanations

Did the investigation go as planned?
Were they able to test their hypothesis with the gathered data?
Did the outcomes reach an agreement or not?
What explanations are there?