ICONIC IMAGERY OF SPACE

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EDUCATIONAL CONTEXT

AGE

16-17 year old students (group of 10)

DURATION

First session May 9th 2023: 2 x 50 min (follow-up session on June 1st: 2023 2 x 50min)

PREREQUISITES

Students have learned about chemical evolution
in the previous lesson ("Wahlpflicht Gegenstand" - elective class with a focus on natural sciences & technology)
(Prior to the workshop, conceptual maps or cartoons can be utilized to elicit learners` knowledge and beliefs about the cosmos, providing a foundation for discussion and exploration during the workshop.)

EDUCATIONAL OBJECTIVES

WHAT DO YOU AIM FOR YOUR STUDENTS TO LEARN THROUGH THIS ACTIVITY

Students will:

- learn basic concepts of astronomy and get insights into astronomical tools and methods hands-on
- get an understanding of positions of planets and stars, their sizes and distances within our solar system and beyond
- develop visual and media competences
- learn how to design a scientific poster and integrate pictures taken with the robotic telescope and their observations
- gain information on the career path of an astronaut, the selection process at ESA and ÖWF and on some of their current and past projects
- have a positive and motivating learning experience

Erasmus+

COGNITIVE OBJECTIVES

Learners will learn how a telescope in general and how robotic telescopes (RT) in particular are built up, how they work and where the RT of the Faulkes network is located. The students will learn how to take pictures while telescoping and how to edit pictures (LaSciL methodology). Students will also work with the web application of Stellarium.org. They will be enabled to orient themselves geographically, and will learn about the various functions and possibilities offered by the tool. Students will also learn about size and scale of our solar system and beyond. They will solve basic mathematical/astronomical calculations, e.g. scaling. Students will learn to differentiate and name various planets, stars, galaxies, or satellites and learn basic facts and figures.

AFFECTIVE OBJECTIVES

Attitudes, emotions, values and beliefs may be challenged and changed as students gaze into space - first through iconic images of planet earth and its position within the universe (e.g. by viewing the videos “The Powers of Ten” by Ray and Charles Eames and the personal account “Pale Blue Dot” by Carl Sagan) and secondly by using (robotic) telescopes and looking into space. The goal is to motivate, fascinate and to trigger further questions about and raise interest in the practice of astronomical observations and the vast dimensions of space. The aesthetic dimension and the artistic practice of taking and editing pictures aims at making a positive and sustainable learning effect. The practice of storytelling, e.g. in the Carl Sagan way or reading mythological stories of the various star constellations aims to engage the learners on an emotional level.

psychomotor objectives

Students will deepen their digital skills and competences. They will be enabled to steer and to take and edit pictures with a robotic telescope. They will also be enabled to curate an exhibit of their learning products (collective scientific poster and individual images) As a follow-up activity Stellarium.org is used to produce individual star constellations on the day of birth of the student. By applying glass crystals as stars and planets on the print or by drawing star constellations on a piece of paper students`fine motoric skills are further supported (add-on: integration of the programs Scratch and Makey Makey with audio-visual content). Playing games and buildinging and constructing together (“scaling the solar system” in the school building) supports teamwork and spatial understanding - from a 2D screen simulation to a 3D experience with the rope and positioning the planets.

CONNECTION TO THE CURRICULA

• Write learning subjects and chapters of your country’s curricula where your activity could be implemented	• Physics • English • Biology • Arts • Digital Skills/Media Education (Digitale Grundbildung) • Elective Subject “Natur & Technik”/Nature & Technology (“Wahlpflichtgegenstand”)

EDUCATIONAL APPROACH

Constructivist learning, inquiry based learning & LaSCiL methodology

Orienting & Asking Questions

Ice breaker:
The Powers of Ten (film by Ray&Charles Eames produced for IBM in 1977): students watch the first five minutes and discuss the film.

Orienting:
Provide Contact with the content and/or provoke curiosity
Images of the physical site of the observatory in Portugal where the workshop on robotic telescoping was held will be shown, together with images from space taken with robotic telescopes.

Define Goals and/or questions from current knowledge:

1. Exploring the significance of the "Pale Blue Dot" (Carl Sagan, Chef astronomer of the Voyager 1 Solar Probe): Delve into the scientific, philosophical, and emotional implications of perceiving Earth as a tiny dot in space. Investigate how this image challenges our understanding of our place in the universe and prompts questions about the fragility and interconnectedness of life on our planet.
2. Students will learn about the Voyager 1 mission and its contribution. They will also gain a comprehensive understanding of the Voyager 1 spacecraft's mission objectives, its historical context, and the scientific discoveries it has made. Explore the key questions it aimed to answer, such as the composition and characteristics of distant planets and the nature of interstellar space.
3. Examining the environmental and societal implications: Reflecting on the "Pale Blue Dot" image as a catalyst for discussions on environmental consciousness and sustainability. Investigate how our perception of Earth's vulnerability in the vastness of space can inspire a sense of stewardship and drive efforts to protect our planet. Explore questions related to the impacts of climate change, biodiversity loss, and sustainable practices.
4. By using a 30m climbing rope and letting the participants calculate the distances between the planets (1m = 1AU), they will get a “feeling” for the measures of our planetary system and the solar probe.

A) Hypothesis Generation and Design:

Generation of Hypotheses or Preliminary Explanations:
Participants will generate hypotheses and preliminary explanations related to the significance of the "Pale Blue Dot" images and its implications for our understanding of Earth's place in the universe.
Learners will interpret, compare and describe an image of saturn taken with the robotic telescope out of the classroom.

Design/Model:
Cognitive Apprenticeship: Modeling - coaching - scaffolding - articulation - reflection - exploration.
Teacher/facilitator shows and explains how robotic telescoping works, how images are taken and edited, and how to design a scientific poster.

B) Planning and Investigation:

Plan Investigation:
Develop a structured plan outlining the activities and steps involved in exploring the images of space, including data collection, analysis, and interpretation.

Perform Investigation:
Engage participants in hands-on activities, discussions, and research to investigate the scientific, philosophical, and societal aspects related to the image and our cosmic perspective.

C) Analysis & Interpretation:

Analysis and interpretation:
Analyze the collected data, including participants' hypotheses, observations, and reflections, to identify patterns, draw conclusions, and deepen the understanding of Earth's place in the universe as depicted in the "Pale Blue Dot" image.

D) Conclusion & Evaluation:

Conclude and communicate result/explanation:
Summarize the findings and explanations derived from the workshop activities, emphasizing the implications for our understanding of Earth's significance and our role as stewards of the planet.

Evaluation/Reflection:
Engage participants in a reflective process, encouraging them to evaluate the workshop experience, share their insights, and consider images of how their perspectives have evolved throughout the workshop.

Consider other explanations:
Prompt participants to explore alternative hypotheses or interpretations, fostering critical thinking and a comprehensive exploration of the different perspectives related to the "Pale Blue Dot" image and our place in the universe.

Combining the imagery and data from the Voyager and Cassini probes with the capabilities of software like Stellarium result in a visually appealing and informative poster. The goal hereby is to learn about various types of software, like Adobe CC and Stellarium, to work together as a group and figure out what could be interesting for others to see.