OBSERVING CELESTIAL BODIES

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DEBATE, SCENE PLAY and OBSERVATION

EDUCATIONAL CONTEXT

AGE

11-19

DURATION

~1 DAY PROJECT, IF TAKEN ONLY PARTS: 2-3 H

PRE INFORMATION

OBSERVING CELESTIAL BODIES THROUGH DIFFERENT STEPS: UNDERSTAND WE ARE CONNECTED WITH A WIDER SPHERE THAN WE THINK, HOW CAN WE OBSERVE CELESTIAL BODIES OUT THERE, WHAT IS OUT THERE, FOCUS ON A SPECIFIC CELESTIAL BODY.

EDUCATIONAL OBJECTIVES

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

COGNITIVE OBJECTIVES

Through different methods knowledge gets generated: Debates in groups/ class- plenum, another method would be the 4-wall method or the fishbowl method; They learn about:

- the search for extraterrestrial life
- the ethics of space exploration
- the impact of light pollution on astronomy
- different robotic telescopes
- how to use them
- how to generate data
- and what to do with it- how to implement it in your private life also
- planet transit- observations
- work with different mediums
- Understand the benefits of automation: Robotic telescopes are automated and can be operated remotely, which allows for **more efficient and reliable data collection**.
- Gain **hands-on experience** with real data: Observing with robotic telescopes allows students to gain hands-on experience with real data and the scientific method.
- Learn about **the latest technology**

- Develop **critical thinking** skills: Observing with robotic telescopes can help students develop critical thinking skills, such as analyzing data, making observations, and drawing conclusions.
  Increase interest in this field: Learning about robotic telescopes can inspire students to pursue careers in these fields, such as astronomy, physics, engineering, or computer science.

AFFECTIVE OBJECTIVES

emotions, empathy, imagination, creativity, role-playing, experiential learning, social skills, emotional intelligence, cognitive development, perspective-taking, self-awareness, storytelling, communication skills.

- Curiosity: Learning about the mysteries of the universe can spark curiosity and a desire to explore and understand more about the world around us.

- Perseverance: Discovering celestial bodies often requires persistence and patience. Students must learn to persevere through challenges and setbacks, such as inclement weather or equipment malfunctions, in order to achieve their goals.

- Critical thinking: Studying celestial bodies requires critical thinking skills, as students must analyze data and make informed decisions based on their observations and research.

- Teamwork: Many astronomical projects involve collaborative efforts, and students may work together in teams to collect and analyze data or to complete research projects.

- Appreciation for diversity: The study of astronomy provides an opportunity to appreciate the diversity of our universe, including the different types of stars and galaxies, as well as the cultural and historical significance of astronomical discoveries across different civilizations.

- Wonder and awe: The study of celestial bodies can inspire a sense of wonder and awe, encouraging students to develop a deeper appreciation for the natural world and their place in the universe.

PSYCHOMOTOR OBJECTIVES

physical activity, movement, coordination, balance, dexterity, fine motor skills, gross motor skills, hand-eye coordination, body awareness, spatial awareness, kinesthetic learning, muscle memory, proprioception, sensory integration, motor planning, physical fitness, exercise.

CONNECTION TO THE CURRICULA

- DESIGN
- GEOGRAPHY
- ROBOTIC
- PHYSICS
- ETHICS
- PHILOSOPHY
- NAWI-Classes (= Natural Science)

EDUCATIONAL APPROACH

Inquiry based learning

Reasons why:

Inquiry-based learning is an approach to education that involves asking questions, investigating a topic, and developing a deeper understanding through active exploration and discovery. This approach has many benefits, including:

- Encouraging curiosity: Inquiry-based learning promotes curiosity by encouraging students to ask questions and seek answers through exploration and discovery.

- Developing critical thinking skills: By asking open-ended questions and exploring a topic from multiple perspectives, students develop critical thinking skills and learn to analyze information, evaluate evidence, and draw logical conclusions.

- Promoting engagement: Inquiry-based learning promotes engagement by allowing students to take ownership of their learning and pursue topics that interest them.

- Fostering creativity: Inquiry-based learning encourages creativity by giving students the freedom to explore and discover new ideas, experiment with different approaches, and develop innovative solutions to problems.

- Developing problem-solving skills: Inquiry-based learning promotes problem-solving skills by encouraging students to identify and address real-world problems, develop hypotheses, test their ideas, and evaluate the results.

- Supporting lifelong learning: By teaching students how to ask questions and seek answers independently, inquiry-based learning helps to develop skills that are essential for lifelong learning.

Overall, inquiry-based learning is a powerful approach to education that fosters curiosity, critical thinking, creativity, problem-solving, and lifelong learning, and that is what I want them to learn.

Orientation:

- How are robotic telescopes able to observe distant galaxies with such accuracy?
- What makes robotic telescopes different from traditional telescopes?
- How are robotic telescopes programmed to detect and study celestial objects?
- Share surprising or little-known facts about robotic telescopes, such as the fact that they can be operated remotely from anywhere in the world or that they can capture images in different wavelengths of light, revealing different features of celestial objects.
- Demonstrate the technology: Provide demonstrations or simulations of how robotic telescopes work and how they gather data on celestial objects. This can help your audience understand the technology behind robotic telescopes and pique their interest in learning more.

GOALS

- Understand the benefits of automation: Robotic telescopes are automated and can be operated remotely, which allows for more efficient and reliable data collection.
- Gain hands-on experience with real data: Observing with robotic telescopes allows students to gain hands-on experience with real data and the scientific method.
- Learn about the latest technology
- Develop critical thinking skills: Observing with robotic telescopes can help students develop critical thinking skills, such as analyzing data, making observations, and drawing conclusions.
- Increase interest in this field: Learning about robotic telescopes can inspire students to pursue careers in these fields, such as astronomy, physics, engineering, or computer science.

HYPOTHESIS GENERATION AND DESIGN

- How are robotic telescopes able to observe distant galaxies with such accuracy?
- What makes robotic telescopes different from traditional telescopes?
- How are robotic telescopes programmed to detect and study celestial objects?
- How do people work in an observatory?
- How can I get data about celestial objects and where?
- What can I do with that data and why do I need it?

PLANNING AND INVESTIGATION

I plan to do it in the 1st classes in my Geography class (students ~10-11 y.), with my 5th (students ~15 y.) and 6th classes (students ~16y.) in Geography, Science Classes, and Ethics classes.

ANALYSIS & INTERPRETATION

Observing celestial bodies with LCO Archive can be done by following these steps:

Access LCO Archive: Go to the LCO Archive website and create an account if you don't already have one. Once you have an account, log in to the LCO Archive.

Select a telescope: Choose the telescope you want to use for your observation. You can choose from a variety of telescopes, depending on your location, the time of day, and the weather conditions.

Search for an event: Use the search function to find a celestial body that you want to observe. You can search by the name of the planet, the date, and the time of the transit.

Select the observation: Once you have found the transit event you want to observe, select the observation and add it to your observing queue.

Plan your observation: Plan your observation by setting the start and end times for your observation, as well as the exposure time and the number of frames you want to capture.

Submit your observation: Once you have planned your observation, submit it to the LCO Archive. Your observation will be added to the queue and the telescope will automatically start observing the transit event at the specified time.

Download your data: Once your observation is complete, you can download the data from the LCO Archive and analyze it using software tools such as GIMP/ Salsa J.

CONCLUSION & EVALUATION

LCO Archive provides access to a network of telescopes that can be used to observe exoplanet transits and contribute to the study of exoplanet properties. The archive is easy to use, with a simple interface that allows users to search for transit events, plan observations, and download data for analysis.

Observing planet transits with LCO Archive has several advantages. It allows for high-quality observations of exoplanet transits that can contribute to the scientific understanding of exoplanet properties, such as size, density, and orbital characteristics. The network of telescopes available through LCO Archive provides a global observing platform, allowing users to access telescopes from anywhere in the world.

Planet Transits, Robotic Telescopes and how and where to gather information

1. Pre- information

a. Planet transits

A planet transit occurs when a_____passes in front of its host star from our perspective on Earth. This event causes a_____in the brightness of the star, which can be detected and studied by_____. The timing of a planet transit depends on the _____and its position relative to its _____.

For example, if a planet has an orbital period of 365 days and its orbit is aligned such that it passes in front of its star as seen from Earth, then a transit would occur _____However, most planets have shorter orbital periods, so their transits occur _____.

The transit timing can also depend on the_____relative to its star and Earth. If the planet's orbit is tilted relative to the plane of the star's orbit as seen from Earth, then transits will occur _____or not at all.

Overall, the timing of planet transits is complex and depends on a variety of factors, but astronomers can predict them with high accuracy using computer models of the planet's orbit and the star's behavior.

b. Robotic telescopes

Watch these video links and answer the following questions to the best of your ability.

"How Robotic Telescopes are Revolutionizing Astronomy" by SciShow Space
https://www.youtube.com/watch?v=IY9HUzry0gA

"Robotic Telescopes: The Future of Astronomy" by Deep Astronomy
https://www.youtube.com/watch?v=7OJQlZ0VfJ0

"The Rise of Robotic Telescopes" by Space.com
https://www.youtube.com/watch?v=AXvzLZ4t4j4

"The Science of Robotic Telescopes" by NOVA PBS Official
https://www.youtube.com/watch?v=5FwK5jJf5W8

"Robotic Telescopes: A Revolution in Astronomy" by Universe Today
https://www.youtube.com/watch?v=H5W5k8gqIc0

a. What is a robotic telescope?

b. How are robotic telescopes different from traditional telescopes?

c. What are the advantages of using a robotic telescope?

d. What are some of the applications of robotic telescopes?

e. How do robotic telescopes help scientists to conduct astronomical research?

f. What are some of the challenges associated with operating robotic telescopes?

g. How do robotic telescopes contribute to citizen science projects?

h. What are some of the most important robotic telescopes currently in operation?

i. How do you think robotic telescopes will evolve in the future?

2. LCO ARCHIVE

Find and interpretate data about Venus's transit 2004:

To find data about the Venus transit 2004, follow these steps:

(1) Go to the mreclipse.com website and click on the "Transit of Venus" tab.
(2) Scroll down to the "Venus Transit 2004" section and click on the "Click here for the 2004 transit data!" link.
(3) You will be taken to a page with links to download the transit data. https://www.mreclipse.com/TV/TV2004galleryA.html Download the 8 first pictures.
(4) Save the files to your computer.
(5) Go to the SalsaJ website (http://www.salsa-j.net/) and download the latest version of the software.
(6) Install SalsaJ on your computer and launch the program.
(7) In SalsaJ, go to the "File" menu and choose "Open Image Series".
(8) Browse to the folder containing the Venus transit images and select the first image in the sequence.
(9) SalsaJ will automatically detect the sequence and load all of the images into a new window.
(10) To create a GIF animation of the sequence, go to the "File" menu and choose "Save Image Sequence".
(11) Choose the GIF format and adjust the settings as desired (e.g. frame rate, image size).
(12) Click "Save" to create the GIF animation.
(13) And that's it! You should now have a GIF animation of the Venus transit 2004 sequence created using SalsaJ.

What to analyze now:

1) Transit timing: By looking at the sequence of images, you can measure the timing of the transit - i.e. how long it took for Venus to cross the face of the Sun. This can help you calculate the orbital period of Venus and its distance from the Sun.

2) Transit duration: You can also measure the duration of the transit - i.e. how long Venus remained in front of the Sun. This can help you determine the size of Venus's disk and its distance from the Earth.

3) Transit geometry: By analyzing the shape and size of Venus's silhouette as it passes in front of the Sun, you can learn more about the geometry of the transit. This can help you calculate the size of Venus and its distance from the Sun.

4) Solar activity: If there are sunspots or other features visible on the surface of the Sun in the images, you can analyze their behavior during the transit. This can help you study the dynamics of the Sun's magnetic field and its effect on the transit.

5) By creating a gif file, it is possible to see how the orbit of the Venus around the sun looks like.

3. Conclusion & Evaluation

WRITE A CONCLUSION AND EVALUATE THE LEARNING PROCESS. INCLUDE THOSE QUESTIONS:

- Which parts haven´t you already known before?
- What part of what you learned interested you most?
- Was your interest aroused to continue to deal with the topic?
- Was the information prepared well and understandably?
- Could you see any learning progress?
- Would you recommend work further with it?
- What are the advantages and disadvantages of Salsa J?

Solutions WORKSHEET:

A planet transit occurs when a planet passes in front of its host star from our perspective on Earth. This event causes a small dip in the brightness of the star, which can be detected and studied by astronomers. The timing of a planet transit depends on the orbital period of the planet and its position relative to its star and Earth.

For example, if a planet has an orbital period of 365 days (the same as Earth's orbital period around the Sun), and its orbit is aligned such that it passes in front of its star as seen from Earth, then a transit would occur once per year. However, most planets have shorter orbital periods, so their transits occur more frequently.

The transit timing can also depend on the position of the planet relative to its star and Earth. If the planet's orbit is tilted relative to the plane of the star's orbit as seen from Earth, then transits will occur less frequently or not at all.

Overall, the timing of planet transits is complex and depends on a variety of factors, but astronomers can predict them with high accuracy using computer models of the planet's orbit and the star's behavior.