The structures of the Universe

Margarida Teixeira de Sousa from Agrupamento de Escolas Frei Gonçalo de Azevedo - Portugal

Metadata

General Info

Title: The structures of the Universe

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

Keywords: Astronomy; Telescopes; STEAM Learning; Creating open educational material.

Educational Context

Students 12-15 years old: Middle school

Prerequisites: No expertise needed in Space Situation, just exercise a participatory citizenship

Duration: School year 2022/2023 (And now for ever…)

Educational Objectives

Cognitive Objectives:

Develop:

- literacy scientific;
- reasoning and the ability to solve problems (observation and question, research, hypothesis formulation and test the hypothesis, interpretation or analyze and note conclusions);
- communication, for share the results.

Affective: Stimulate autonomy and personal and team development; Contribute to the student's ability to develop interpersonal relationships.

Psychomotor: Awareness and mastery of the body

Connection to the curricula

- ✓ How do the structures of the Universe contribute to its sustainability?

Orienting & Asking Questions

Orienting: Provide Contact with the content and/or provoke curiosity

1 st Lesson: 45 Minutes

In this lesson we will be looking 2 short videos:
https://www.youtube.com/watch?v=O8tzXj1S30s (NASA's James Webb Space Telescope LIVE Tracking New Pictures of Unseen Universe)

https://serol.lco.global/videos/ (The life and times of stars)

and exploring the organization of celestial bodies by locating the Earth in the Universe.
https://solarsystem.nasa.gov/ (a simulated view of our solar system)

2 nd Lesson: 90 Minutes

In this lesson we will be looking 2 short videos:

https://www.nasa.gov/content/discoveries-hubbles-universe-videos (Intergalactic Elegance: Hubble´s Universe)

https://www.jpl.nasa.gov/edu/learn/project/make-a-scale-solar-system/ (Solar System, size and distance)

and exploring *Stellarium* software, *Salsa J* software and *Portal LCO: 1-* recognize the importance of using telescopes in the study of astronomy; 2- became a cosmic explorer creating a scale model of the Solar System.

3rd Lesson: 90 Minutes

Interpreting information about the light waves and their spread, looking 2 short videos
https://science.nasa.gov/ems/09_visiblelight (Visible light)

https://lco.global/spacebook/light/what-is-light/ (What is Light?)

and studying the light reflection with a very simple activity.

4th Lesson: 45 Minutes

In this lesson we will be looking about NASA mission, the Earth Surface Mineral Dust Source Investigation (EMIT), and 2 short videos:

https://www.nasa.gov/press-release/nasa-spacex-launch-climate-science-research-more-to-space-station (NASA, SpaceX Launch Climate Science Research, More to Space Station)

https://serol.lco.global/videos/
(Serol`s cosmic adventures: Tracking asteroids and comets)

https://www.youtube.com/watch?v=toIks87vY_w (A veil of grit from Saara, Portugal, 16-03-2022)

Understanding the necessity of contributing to the sustainability of our planet and the Universe.

Define Goals and/or questions from current knowledge

1 st Lesson:

- Understand the organization of celestial bodies in the Universe.

2nd Lesson:

- Explaining the instruments used in the historical evolution of knowledge of the Universe;
- Interpreting the meaning of the distance units appropriate to the different scales of the Universe, specifically ua and a.l.;
- Exploring *Stellarium* software, *Salsa J* software and Portal LCO to observe the stars and the solar system.
- Creating a scale model of the Solar System.

3rd Lesson:

- Interpreting information about the light waves and their spread;
- Concluding, through experimental activities, that light may suffer reflection (specular and diffuse), checking the laws of reflection.

4th Lesson:

- Recognize the importance of the Earth Surface Mineral Dust Source Investigation (EMIT), developed by NASA.
- Understand the Big Climate Impacts, known as mineral dust or desert dust, it can influence weather: A veil of grit from Saara blanketing some Portuguese cities while also absorbing and scattering sunlight.

Creating a scale model of the Solar System

Objectives:

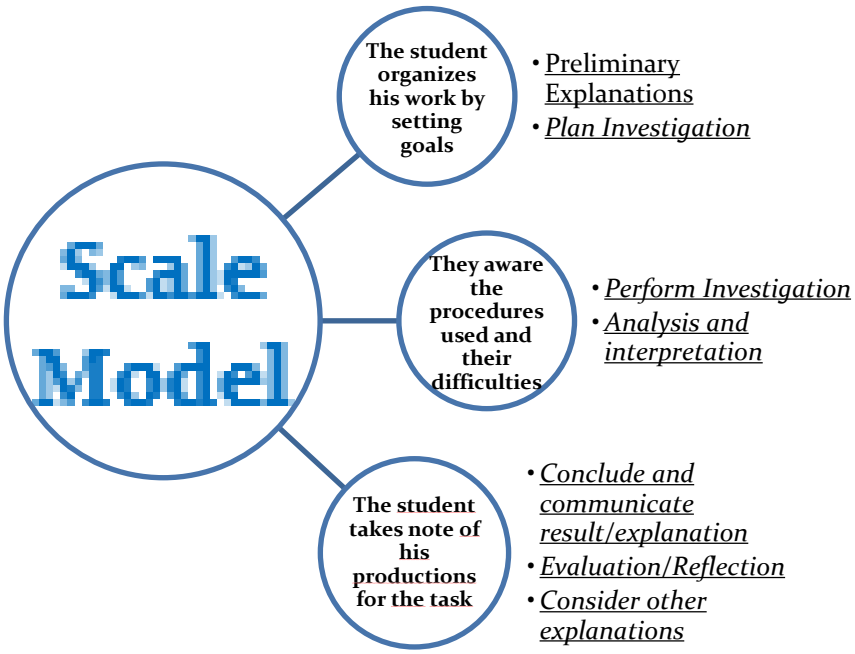
- ✓ Understand the necessity of using scales in construction of astronomical models;
- ✓ Gain a better understanding of the vast distances between planets in the outer solar system compared with those in the inner solar system;
- ✓ Recognize the importance of using models in the study of astronomy;

Hypothesis Generation and Design

Generation of Hypotheses or Preliminary Explanations

- If the planets of the solar system orbit the sun, then the distances between planets and the sun there are not the same, also the orbital radius.
- If the sun is so far away from some of them, then is exceedingly difficult send spacecraft to the planets.

Design/Model



Planning and Investigation

Plan Investigation

The student will:

- ✓ Use Stellarium software to determine the distance of each planet to the sun;
- ✓ Calculate the scale value for each Solar System object using a scale factor of 10 centimeters per astronomical unit (AU). 1 AU is equal to about 150 million kilometers;
- ✓ Construct a distance model of the solar system to scale, using colored beads as planets;
- ✓ Use the distances (in centimeters) that have calculated, measure the distance from the sun on the string to each planet;
- ✓ Gain a better idea of the vast distances between planets in the outer solar system compared with those in the inner solar system;
- ✓ Recognize the importance of using models in the study of astronomy;
- ✓ Recognize why is exceedingly difficult send spacecraft to the planets in the outer solar system.
- ✓ Imagine how the makeup of inner planets versus outer planets could be used to explaining the difficult send spacecraft to the planets.

Perform Investigation

Activity in small groups:

Students create a scale model of the solar system using beads and string. They aware the procedures used and their difficulties when they:

- ✓ Use Stellarium software to determine the distance of each planet to the sun;
- ✓ Calculate the scale value for each Solar System object using a scale factor of 10 centimeters per astronomical unit (AU). 1 AU is equal to about 150 million kilometers;
- ✓ Use the distances (in centimeters) that have calculated, measure the distance from the sun on the string to each planet;
- ✓ Recognize the importance of using models in the study of astronomy.

Analysis & Interpretation

Analysis and interpretation : Gather result from data

- ✓ The students observe the distances in the outer solar system are match big than those in the inner solar system, also the orbital radius.

Conclusion & Evaluation

Conclude and communicate result/explanation

- ✓ As a result, when we send spacecraft to planets like Jupiter, Saturn, Uranus, and Neptune, we end up having to traverse vast expanses of empty space to get there.

Evaluation/Reflection

- ✓ The students reflecting about the vantage of the construction of models in astronomy.
- ✓ The students discuss why so few spacecrafts have gone to the outer planets and beyond.

Consider other explanations

- ✓ Students imagine how the makeup of inner planets versus outer planets could be used to explaining the difficult send spacecraft to the planets.