Astronomy Education:The Planets of the Solar system

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Abstract

The present work is addressed to the teachers and introduces the teaching of "The Planets of our Solar System" in Greek Lyceum with recent innovative methods.

1 Introduction

In order to give a solution to all these questions round the teaching of Science and especially of Astronomy, we have planned educational material addressed to the teachers which refers to the learning process of the subject " The Planets of the Solar System" in the Greek Lyceum. In this project the structure, the objectives and what is included in the educational material are described.

2 Educational material

Including: 1. Educational guide for the teacher. 2. Information about the planets. 3. Activities done by the students with the teacher supervising 4. Proposals for using modern educational material (slides, videotapes, cd rom's, internet, books). This work ends with the answers to the review questions and a series of slides showing the subject.

In the **educational guide** there is an introduction to the modern teaching methods and essential instruction about the use of material is given. It is proposed the classical general strategies of the problem solving and the project method as well as the part strategies of concept mapping, brainstormig, discussion and library research. The strategies are formed according to the part objectives and are fitted individually or in conjunction in or der to help the student giving their best. The teacher uses the material on his own judgment according to the curiculum the level and the number of the students.

Essential information refer to planets Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Poseidon, Pluto and their satellites. You can find information about their morphology, their atmosphere and their interior structure. There is a different unit for every planet in which you can also find photographs and tables with the main physical features. At the end of every unit there are some Key words, Questions and exercises like "Fill in the blanks" and "Right or Wrong". These exercises are used at the beginning or at the end of the lesson in order correct answers to be given to frequent misconceptions.

The activities **focus** to the understanding of the astronomical subjects, the active participation, the familiarization with the optical instruments, the cooperation, the developing of a critical attitude, self confidence and social understanding. They also focus to the familiarization with the research environment, the communication with scientist and researchers, the contact with the nature and modern technologies.

3 Activities

The activities are divided into four parts:

I. Revision questions
like "Choose the right" and "Thought questions" like
1. Which planet is surrounded by thick atmosphere rich in CO2? a) Mars b) Venus c) Pluto d) Jupiter.
2. Which is the biggest satellite of the solar system? a) Titan b) Ganymedes c) Triton d) Europe.
and
1. Why Mars has seasons?
2. Why is difficult to study Pluto's surface?

II. Observing the planets
It is preferable to observe the night sky from the country away from the cities lights. Also reduce the chances of being cloudiness. Select an observing site that has a clear view of the horizon. Consult an astronomical magazine or internet to determine every planet toward the constellations on the sky map. You can observe the planets or photograph them. (Indispensable materials: telescope, photo camera, sensitive films astronomical magazine, sky maps or planisphere, binoculars.)
With naked eye: observe the planets at the night sky every season. You can see Venus before sunrise or after sunset. Determine Mars's location among the constellations and draw a picture of what you see. Try to find Jupiter and Saturn too.
With high-powered binoculars: the observations are more affective. You can probably see Uranus and Neptune.
With telescope: observe repeatedly Venus through her phases and make a drawing of its appearance. Observe Jupiter and the galilean moons. Observe the zones and the red spot. Observe Saturn. Can you see the rings?

III. Projects
Student projects are suggested in which define the object, the resources, as well as the process of implementation. The main idea of some of these projects is described below.
1. Planets and space trips.
The educator forms students into groups, one group for each planet. Groups gather information about the space trips that occurred in the past or scheduled for the planet they intend to go. Students present their work and discuss it. After that projects are processed all together in order to be presented in the school paper and to be the subject of a speech in the rest of the school students.
2. Astronomical sources research.
Students form two groups. The first group gathers planet photographs while the second gets information and reports about the major planet characteristics. This work is given to students in order to update their astronomy record.
3. Astronomy, art, music.
Students that work on cameras, take pictures from books and magazines. Some others choose music themes or even compose their own. Both work groups join their material to create a multimedia presentation. Furthermore some planet paintings can be made to decorate the classroom.
4. Astronomy and Greek mythology.
Students form groups and gather information about the naming of each planet. The work is presented to the class and to the school paper. The research can be expanded to foreign culture history.
5. Astronomy and Astrology.
Some students get information relative to the planets position around the sun and the constellations of zodiac, paying major attention to the social substance of this issue.

6. Planets and school paper.
Students keep an astronomical school paper article in a permanent basis.
7. From the Earth to the Planets.
Students form groups in order to categorize a set of multi-theme photographs. The photographs concern earth-showing photos taken from earth, as well as from space, and Moon or Planets photos. The groups join this visual planet study in order to come into some conclusions about the planet characteristics. In advance the educator challenges the students perceptiveness in major morphological planet site identification, during a slide show in the class.

IV. Educational excursions
Students can visit Greek Astronomical Institutes in Athens, Thessaloniki , Crete, Ioannina, Kefalonia, and Patras and accomplish sky observations.
In many Greek towns such as Athens, Volos, Salonica, Katerini, Corfu, Patras, Rhodes, Florina, Chalkis amateur groups organize astronomical events, useful for the needs of this course.

4 Resources for Educators

Useful sites
NASA On-line Resources for Educators
http://www.hq.nasa.gov/education
Web Sites for Instructors of Introductory Astronomy Courses
http://www.aspsky.org/htm/astro/insites.html
The Astronomical Society of the Pacific
http://www.aspsky.org/
Astroweb: Astronomy/Astrophysics on the Internet
http://www.stsci.edu/astroweb/astronomy.html
European Astronomical Society
http://www.iap.fr/eas/
International Astronomical Union
http://www.intastun.org/
The Planetary Society
http://planetary.org/
NASA
http://www.nasa.gov/
Sky and Telescope
http://www.skypub.com/
Hubble Sites
http://hubble.stsci.edu/
Magellan Mission to Venus
http://www.pdsimage.jpl.nasa.gov/PDS/public/magellan/magellan.html
Planetary Photo Journal
http://photojournal.jpl.nasa.gov
Views of the Solar System (Calvin Hamilton/Los Alamos)
http://bang.lanl.gov/solarsys

Cd-roms ,Videos, Books
Encyclopaedia Brittanica, (http://britannica shop.britannica.co.uk)
Lamprakis Research Foundation, (http://www.lrf.gr)
MMI Corporation, (http//members.aol.com/mmicorp)
Sky Publishing Co, (http://skypub.com)
There are interesting books addressed to the students (they refer in the project). You can also find in the newspapers and magazines interesting simplified articles about the solar system which can be the start of a relative file.

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