Solar System Explorer | Instructor Guide

Students explore an interactive model of the solar system to learn about features of interest.

Overview

In this interactive model of the solar system students can:

- Control time to understand how planets differ in the lengths of their days and years.
- Exaggerate the sizes of solar system objects to make them easier to view, while remaining aware that the exaggerated sizes are not to scale.
- Turn realistic lighting on and off
    - When on, they can observe how the Sun creates day and night on each object.
    - When off, they can explore features on both the daytime and nighttime sides more easily
- Compare size scales between each object and Earth.

Grade Level: 6-8

Suggested Time: One or two 50-minute class periods

Multimedia Resources

- Solar System Explorer WorldWide Telescope Interactive

Materials

- Activity sheet - Solar System Explorer Introduction and Scavenger Hunt
- Optional: Solar System Exploration Log sheet
- Optional: Solar System Terminology Reference

Lesson Plan

The following represents one manner in which the materials could be organized into a lesson.

Learning Objectives:

- SWBAT articulate and model what makes up our solar system:
    - Our Sun (a star) at the center
    - Planets orbiting the Sun
    - Moon(s) orbiting some planets
- SWBAT compare and contrast different properties of objects within our solar system.

Activity Outline:

1. **Engage** - suggested activities:
    a. Have a discussion about what makes up our solar system. Have students sketch what they think our solar system looks like and how the objects within it are arranged.
    b. In a think-pair-share, have students discuss what they know about the properties of solar system objects. Ask students to think in terms of **patterns**. What do our solar system objects have in common with each other, and in what ways are they different?

2. **Investigate**
    a. At their computers, have students work individually or in pairs on the web-based *Solar System Explorer* interactive. Give students a brief opportunity to freely explore the interactive before handing out the worksheet.
    b. Hand out a copy of the worksheet to each student. Before students complete the worksheet activities, draw their attention to the “Patterns” section on pg. 3. They should briefly scan through the questions, so they have them in mind as they complete the scavenger hunt.
    c. Hand out the Solar System Terminology Reference and the Solar System Exploration Log sheet for students to keep track of information as they explore.
    d. As students explore the solar system model by way of the scavenger hunt, they will familiarize themselves with the objects within our solar system and how they relate to each other.

For a 1-day lesson: Give students a 15-minute time limit and invite them to identify as many objects in the scavenger hunt as they can.

For a 2-day lesson: Give students until the end of the first class to try to answer all the scavenger hunt questions.

    e. After the time limit (*or for homework or at the start of day 2*), have students complete the worksheet questions on Patterns.

3. **Reflect**
    After students have had enough time to explore the interactive and attempt the worksheet questions, bring the class back together for a concluding discussion. Review responses to the Patterns worksheet questions. Additional discussion questions include:
    a. What is the difference between a planet and a moon? (planets orbit the Sun; moons orbit planets)
    b. What are different ways to classify planets? (Inner vs. outer planets; solid vs. gaseous surface)

   i. Which solar system objects shown in the interactive have a surface that you could stand on? Which ones don't? (Can stand on surface: Mercury, Venus, Earth, Earth's Moon, Mars, Jupiter's moons, Pluto. Can't stand on surface: Sun, Jupiter, Saturn, Uranus, Neptune)
   ii. Why was Pluto's classification changed from planet to dwarf planet? (In 2006, astronomers voted to define planets using the criteria listed on the terminology sheet. Pluto does not meet the 3rd requirement)

c. How would a day or a year on another planet in our solar system be different than a day or a year on Earth?
   i. Planets closer to the Sun have shorter years; planets farther away from the Sun have longer years.
   ii. Length of a day depends on rotation speeds, which don't vary by any sort of pattern.
      1. Some planets like Venus have very long days.
      2. Some planets rotate in the opposite direction from Earth (also Venus), which would make the Sun rise in the west and set in the east.
   iii. If students have already learned about Seasons on Earth, you could ask them to consider what seasons might be like on other planets. For example, Uranus rotates on its side, which leads to unusual seasonal patterns. During the northern summer, the north pole experiences 21 Earth-years of continuous sunlight, while the south pole is in darkness that whole time. During "equinoxes," the whole planet will be in daylight for half the day and darkness for the other half (which is also the case for equinoxes on Earth).

Standards

ESS1.B Earth and the Solar System
The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS- ESS1-3)

Associated performance expectation
MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), **surface features (such as volcanoes)**, and **orbital radius**. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

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