Planetary Paths

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Students' natural interest in our solar system makes an interdisciplinary unit on the topic all the more rewarding. The following activities allow you to construct your own path to teaching the solar system. Not only can science teachers get involved, but language arts, social studies, art, music, and other teachers can also be a part of the activities and lessons. This collection of ideas should spark an interest in astronomy in any middle school classroom.

Language arts connections

Planetary Travel Brochures

Divide the class into groups of three or four students. Have each group randomly select a slip of paper on which the name of one of the planets is written. Tell groups that they have been hired to design travel brochures and posters for their planet. Remind the groups to think about the kinds of activities that they like to do while on vacation. They should describe activities that feature an important characteristic of the planet—for example, high jumping on the Moon. The brochures should be informative as well as attractive. Be sure to provide brochures and booklets from local travel agencies to serve as models.

Planetary Literature

Ask students to restate in their own words the facts on each planet given in selections from Beyond the *Blue Horizon:* Myths and *Legends of the* Sun, Moon, Stars, *and Planets.*[1] Students should compile a list of adjectives used to describe each planet and then draw the planet using their list of adjectives and details from the passages.

Planetary Tales

Have students research planet- related mythology. Many people are familiar with the Greek and Roman myths; however, Egyptian, Native American, Japanese, and Chinese mythology are not commonly known. After the research findings have been read and shared, go over the purposes of legends and ask students to discuss what the legends mean and what the myths try to explain. Have students write and illustrate their own tales about one of the planets and post them in the classroom. *Beyond the Blue* Horizon is an excellent resource for this activity. However, preview the legends selected for classroom use, as some contain mature themes.

Planetary Discovery

Have students write a diary entry as a person who discovered one of the planets. You may ask students to research and write about a historical figure or write a fictional account.

Planet to Planet

Have students use a Venn diagram to compare and contrast two or more planets.[2] Students do well with this activity because they work with provided information instead of just memorizing facts about the planets.

Mystery Planet

Ask students to examine bits of broken and naturally weathered rocks, pebbles, twigs, bones, fossils, and other artifacts placed in small, resealable bags.[3] The bags represent collections of materials from mystery planets. Students should describe the physical properties of the objects and infer the pre-history of the items by writing about how natural forces may have created current conditions. Once students have described the items in one bag, have them describe the mystery planet. For instance, fossils would indicate a planet with life, and pumice would indicate a planet where volcanic activity has occurred. This activity develops skills in observing, sorting, classifying, inferring, and hypothesizing.

Language arts

Have students write a five-paragraph paper in which they give three reasons why they would like to live on a particular planet.

Social studies connections

A Little Bit of History

Have students find out when Uranus, Neptune, and Pluto were discovered and who discovered them. Have them use reference sources to find out how each planet acquired its name and symbol. What do the symbols mean and why were they chosen? (Table 1 on page 14 includes this information for Mercury, Mars, and Pluto.)

Celestial Flag Hunt

Identify countries with flags that include celestial symbols. For instance, the flags of Tunisia, Pakistan, and Turkey include stars and the Moon.

Science connections

Relative Sizes

Collect round objects of different sizes, including a beach ball, Ping- Pong ball, softball, volleyball, tennis ball, golf ball, baseball, marble, seamstress straight pin, and a flathead straight pin. Have students select appropriate objects to represent the planets based on the relative sizes of the planets (shown in Figure 1).

Relative Distances

Have students create a mini-solar system outdoors with the objects from the previous activity. Each "planet" should be positioned a certain number of paces away from the Sun. Have one student make all of the paces so that the distances are consistent. The relative distances, converted into paces, are shown in Figure 1. Or you may use the length of a given student's body to mark the distance of each planet from the Sun. This is a fun way of making the measurements more personal—finding out the distances in, say, "Eddies" or "Julies" instead of meters. Each planet's relative number of student body lengths from the Sun is also given in Figure 1.

Create-a-Crater

Simulate crater formation on the planets by dropping objects into a container of sand or flour covered with a light dusting of cocoa or paprika. Vary the size of the objects and the height, angle, and speed at which they are dropped. Have students compare the results from each test and discuss how this activity resembles what really happens on the terrestrial planets. This activity simulates the impact and angle at which meteors strike the Earth and other planets. Discuss new the size and shape of craters help scientists determine the size of objects that created them, as well as the speed and angle at which objects hit the Earth and other planets.

Math connections

Scale Models

Have students create their own scales showing the relative sizes and distances of the planets.

Measuring the Model

Take students outside to the model of the solar system created previously and have them measure the distances in meters from the Sun to each planet. They could also measure the distances between the planets.

Graphing Practice

Ask students to graph the number of moons of each planet.

A Weighty Subject
Have students calculate their weight on each planet by multiplying their weight on Earth by the force of gravity on each planet relative to that of Earth (shown in Table 1 for Mercury, Mars, and Pluto). The students' weight on each planet can then be graphed. Since some students may be sensitive about their weight, you may want to let one value, such as 40 kilograms, represent the weight of each student.

Soda Gravity
Have students place pennies in empty soda cans to represent the feel of a full can of soda on other planets. Use the following amounts—Mercury: 38 pennies, Venus: 101 pennies, Earth: one full can of soda, Mars: 38 pennies, Jupiter: 293 pennies, Saturn: 119 pennies, Uranus: 102 pennies, Neptune: 133 pennies, and Pluto: 0 pennies.

Planet Angles
Have students construct a quadrant using a protractor, tape, drinking straw, and washer. Use it to measure the angles of the planets in the sky above the horizon.

Art connections

More Models
Have students make accurately- sized clay models of the planets. Students can then paint their planets with the accurate colors.

Alien Invasion?
Ask students to draw a picture of a creature that could live on another planet. The conditions of the chosen planet should he considered
when designing the creature. The students can then make their creatures out of clay and write a descriptive paragraph about their creature's characteristics.

Planetary Bookmarks
Have students research and create their own planetary bookmarks modeled after those in Table 1.

Music connections

Even music teachers can join the fun with such songs as "Venus in Blue Jeans," by Jimmy Clanton, "Venus," by Frankie Avalon, "Third Rock from the Sun," by Joe Diffie, and "Earth Angel," by The Penguins. Gustav Holst's symphony *The* Planets includes pieces that represent every planet except Earth and Pluto. The music evokes images of the Roman mythological namesakes of the planets. These images could then be contrasted with the actual environments of the planets. Encourage students to enlist the help of their parents and grandparents in suggesting astronomy-related songs. Compile a class collection of astronomy music.

Assessment

Although most of these activities can be used as assessments with proper documentation and guidelines, here's a culminating activity that ties in everything students have learned about the solar system. Students create their own model of the solar system with their acquired knowledge of the relative sizes, distances, and other characteristics of the planets. Students use the relative sizes of the planets, a compass, and a ruler to draw each planet. They then color, cur out, and glue each planet onto a six-meter strip of black paper at the correct relative distance from the Sun.

Acknowledgment

Many of the activities in this article were developed by ITEACH (Idaho Teachers Excited About Cruisin' the Heavens) participants and staff. ITEACH is an NSF- funded teacher enhancement project on middle school astronomy education across the curriculum.

References

1. Krupp, E. 1993. *Beyond the blue* horizon: Myths *and legends* of the Sun, Moon, stars, and planets. New York: HarperCollins.
2. Dodge, B. et al. 1994. Out of *this world.* Fresno, Calif.: AIMS Education Foundation. 3. Mystery planet materials and activity directions can he purchased from Lou
Finsand, Spectrum House USA, 1502 West 19th St., Cedar Falls, IA 50613; (319) 2668377.

Resources

- *Dance of the planets.* ARC Science Stimulations, P.O. Box 1955, Loveland, CO 80539. (303) 667-1168.
- The *great solar system rescue.*1992. Watertown, Mass.: Tom Snyder Productions. (800) 342-0236.
- Maton, A. et al. 1994. Exploring *the* universe: Activity book. Englewood Cliffs, N.J.: Prentice Hall.
- *Voyager I1.* Carina Software, 12919 Alcosta Blvd. 07, San Ramon, CA 94583. (410) 355-1268.

Figure 1. Planet data

Planet	Relative diameter	Relative distance from Sun	Distances in paces	Distances in student lengths
Sun	1.4 m			
Mercury	0.6 cm	6 cm	12	0.33
Venus	1.2 cm	11 cm	22	0.75
Earth	1.3 cm	15 cm	30	1
Mars	0.7 cm	23 cm	46	1.5
Jupiter	14.3 cm	78 cm	156	5
Saturn	12.1 cm*	143 cm	286	9
Uranus	5.0 cm*	287 cm	575	19
Neptune	4.7 cm*	450 cm	901	30
Pluto	0.5 cm	590 cm	1180	40

*Not including rings

Table 1. Planetary bookmarks

Mercury	Mars	Pluto
Revolution period: 88 days (0.24 yrs.)	**Revolution period:** 687 days (1.9 yrs.)	**Revolution period:** 248 yrs.
Equatorial diameter: 4,880 km	**Equatorial diameter:** 6,794 km	**Equatorial diameter:** 2,300 km
Relative gravitational force (Earth = 1.0): 0.38	**Relative gravitational force (Earth = 1.0):** 0.38	**Relative gravitational force (Earth = 1.0):** 0.03
Planet composition: rock and metal, a large iron core	**Planet composition:** rock and metal	**Planet composition:** low-density snowball of frozen gas and rock
Atmosphere: little; chiefly helium, hydrogen, and sodium	**Atmosphere:** carbon dioxide at 1/10 that of Earth's	**Atmosphere:** thin and cold; mainly nitrogen and methane
Rings: none	**Rings:** none	**Rings:** none
Special features: greatest surface temperature extremes, reflects less light than any other planet, presents phases to skygazers	**Special features:** polar ice caps expand in winter, shrink in summer. Redness due to iron oxide. Largest volcano, Mt. Olympus, is three times higher than Mt. Everest	**Special features:** Circles Sun in continual darkness. Eccentricity of orbit periodically carries it inside Neptune's orbit (most recently, from 1979–1999)
Discovery: unknown	**Discovery:** unknown	**Discovery:** Percival Lowell predicted its existence in 1905; first seen by Clyde W. Tombaugh in 1930
Distance from Sun: 57.9 million km	**Distance from Sun:** 227.9 million km	**Distance from Sun:** 5,900 million km
Rotation period: 58.6 days	**Rotation period:** 24 hrs. 37 min. 22 s	**Rotation period:** 6 days 9 hrs.
Surface temperature: 430° C in day to −185° C at night, equatorial	**Surface temperature:** −173° C in winter at poles to 10° C at equator	**Surface temperature:** −223° C
Surface type: Covered with ancient craters. Crust of light silicate rocks	**Surface type:** two terrains—craters with eroded rims; large, smooth basins	**Surface type:** plentiful methane frost
Satellites/moons: none	**Satellites/moons:** 2; Phobos, Diemos	**Satellites/moons:** 1, Charon
Origin of name: messenger of the Roman gods	**Origin of name:** Roman god of war (for its redness)	**Origin of name:** Roman god of the underworld
Symbol and meaning: Messenger's symbol. Fastest-orbiting planet; appears in sky very close to Sun	**Symbol and meaning:** Shield and spear, universal symbol for man	**Symbol and meaning:** PL are the first two letters in the planet's name; also the initials of Percival Lowell
Exploration: Mariner 10 (1974, 1975) photographed about 1/2 of surface	**Exploration:** Mariner 4 (1965). Mariner 6 and 7 (1969). Mariner 9, Mars 2 and 3 (1971). Mars 5, 6, and 7 (1974). Viking 1 and 2 (1976). Global Surveyor (1997). Pathfinder (1997).	**Exploration:** by telescope, camera, and the Hubble Space Telescope
Geographical features: smooth plains in northern polar regions; long, high ridges, scarps, due to planet shrinking as it cooled	**Geographical features:** evidence of volcanoes, meteor collisions, marsquakes, even water erosion. Dust storms common	**Geographical features:** a celestial snowball