Pluto's Not a Planet: *Discussion Guide*

Overview

When the International Astronomical Union (IAU) met on August 24, 2006, astronomers voted to reclassify Pluto from a planet to a dwarf planet. Explore the new definition of a planet and the downsizing of the solar system to eight "true" planets — changes that have sparked public debate as well as new understandings of the evolving nature of science. Learn too why Pluto has been at the center of controversy ever since it was first recognized in 1930. As technology advanced, Pluto's position in the scientific community declined.

Classroom Activities

1. Show the "Is Pluto a Planet?" segment from the *TLC Elementary School: The Story of the Solar System* video.

    - **Discussion**: Well before the 2006 vote, the validity of Pluto's planethood was being questioned. Ask: What made scientists question Pluto's planethood? What viewpoints in the debate does this video present?

    - **Chart**: Ask students to complete a chart with three columns: How Pluto Differs From the Inner Planets, How Pluto Differs From the Outer Planets, and How Pluto Differs From Asteroids. (Define asteroids as small planets orbiting the sun.) Make sure that students consider size, orbit, and composition. Based on the chart, ask students to draw conclusions.

    - **Simulation:** Hold a mock IAU congress to simulate debate of the original proposal for recognition of 12 planets, adding Ceres, Xena, and Charon, three large bodies orbiting the sun. Also have students simulate the vote on the revised proposal to demote Pluto to dwarf planet status. At the 2006 IAU meeting, astronomers redefined a planet as follows:
        - It has enough mass to become round.
        - It orbits around a sun.
        - It has control of its own orbit.

      Discuss: How and why did the definition of a planet change? Why doesn't Pluto fit the new definition? (Its orbit is intertwined with that of its moon, Charon.) What does the current redefinition of planets show about the solar system? About science?

- **Reading News:** Have students clip newspaper and magazine articles about Pluto's demotion and the surrounding debate, and create a classroom bulletin board on the subject. Discuss news coverage of the event.

2. Show the "Pluto" segment from the video *A Spin Around the Solar System: The Small Pieces: Asteroids, Comets, and Pluto*. (Access to unitedstreaming is required.)

    - **K-W-L Chart:** Before viewing the video, have students create charts with three columns about Pluto: What I Know, What I Want to Know, and What I Learned. Encourage them to fill in the chart as they watch the movie.

    - **Debate:** Have students summarize information from the video about the Kuiper Belt, the broad band of icy asteroids in the far regions of the solar system, and debate whether the many large orbiting bodies of the Kuiper Belt should be considered planets.

    - **Photography:** Show photos of Pluto from the Hubble Space Telescope on the NASA Web site, http://www.nasa.gov/home/, and have students list its characteristics (cold, shadowy, icy, etc.). Ask why so little is known about Pluto. Make sure students understand that only the strongest telescopes can view it because it is very small and distant.

    - **Visual Aid**: Show students a visual depicting Pluto's oval orbit and its involvement with Neptune and other celestial bodies in the Kuiper Belt, including its own moon, Charon. Discuss why Pluto's orbit disqualifies it from the current definition of a planet. (An example of a visual aid may be accessed at www.nasm.si.edu/ceps/etp/pluto/pluto_orbit.html.)

    - **Glossary:** Have students make a glossary defining terms from the video including the following: *planet*, *solar system*, *elliptical*, *orbit*, *moon*, *comet*, *Kuiper Belt*, *asteroid*, *inner planets*, and *outer planets*.

    - **Discussion:** Ask students: Why do definitions of the solar system change? How are scientists' views of the solar system changing? Is the solar system changing, or is scientists' ability to understand it changing? Do you think the definition of *planet* will change again?

3. Show the "Uranus, Neptune, and Pluto" segment from the video *The Solar System: Our Neighbors in Space*. (Access to unitedstreaming is required.)

    - **Polling:** Take a poll of students on whether or not Pluto should be considered a planet, and encourage students to poll other students and adults outside of class and compile the results.

- **Posters:** Encourage students to design attractive and persuasive posters either for or against Pluto being called a planet.

- **Diagramming**: Have students diagram the new solar system, with eight planets as well as the dwarf planets Pluto and Ceres.

- **Brainstorming: Mnemonic Device:** Have students brainstorm to create a new mnemonic device for remembering the names of the eight planets. They may know earlier mnemonics for the nine planets, such as "My Very Educated Mother Just Served Us Nine Pickles."

- **Researching Web Sites:** Have students investigate more about Pluto and see whether the following Web sites have up-to-date information about Pluto:
  - www.nsta.org
  - www.nasa.gov
  - http://quest.arc.nasa.gov
  - www.seds.org
  - www.sln.org

- **Letter Writing**: Ask students: If Pluto is no longer a planet, is it important to learn about it? Tell students about the New Horizons spacecraft investigating Pluto, which was launched in January 2006 and is expected to reach Pluto in 2015. Have groups of students draft letters to their representative in congress, supporting or opposing continuation of the program.

4. Show the "In Search of Planet X: Lowell and Tombaugh" segment from the video *The Outer Solar System: Pluto*. (Access to unitedstreaming is required.)

   - **History:** Summarize the history of the discovery of Pluto. Ask: Do you think Pluto should have been designated a planet? Demoted earlier? Why?

   - **Case Study:** Provide the facts about the discovery of UB313, nicknamed Xena, which is an orbiting body larger than Pluto. Tell students that Michael Brown, a Caltech astronomer, observed Xena in 2005. Brown said, "I may go down in history as the guy who killed Pluto." Discuss the role of Xena in Pluto's downfall.

   - **Timeline:** Have students arrange these events in chronological order to show the rise and fall of Pluto:
     - 1930 – Pluto is discovered by Clyde Tombaugh and designated a planet.
     - 2006 – International Astronomical Union votes to oust Pluto as a planet.

- 2003 – Orbiting object larger than Pluto is discovered: UB313, or Xena.
- 1908 – Percival Lowell begins search for the ninth planet, Planet X.
- 1990 – Hubble Space Telescope is launched, making distant bodies more visible.
- 1801 – Dwarf planet Ceres is discovered by Giuseppe Piazzi.
- 1978 – Pluto's satellite, Charon, is discovered by James Christy.

- **Mythology:** Invite students to research the naming of Pluto and Charon, as well as myths about Pluto, the Greek god of the underworld, and Charon, the ferryman to the underworld.

- **Career Exploration**: Invite students to use career Web sites to explore astronomy as a career, finding out about astronomers' roles, goals, places of employment, education, and career outlook. Have students think of questions they would like to ask an astronomer and send these as letters or e-mail messages.

- **Biography:** Assign students to read a biographical article about Percival Lowell, Clyde Tombaugh, V. M. Slipher, or Michael Brown and report on the scientist's life and his work related to Pluto.

- **Predicting:** Encourage students to imagine what will happen to scientists' view of the solar system in coming years. Have students write headlines for newspapers in the year 2030.

Academic Standards

Mid-continent Research for Education and Learning (McREL)
McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit http://www.mcrel.org/compendium/browse.asp.

Students develop abilities related to the following national standards:

- Historical Understanding
  - Understands and knows how to analyze chronological relationships and patterns
  - Understands the historical perspective

- Language Arts
  - Uses reading skills and strategies to understand and interpret a variety of informational texts
  - Uses viewing skills and strategies to understand and interpret visual media

- Science
  - Understands the content and structure of the universe
  - Understands the nature of scientific knowledge

National Science Education Standards
For national science education standards that address teaching, content, and assessment, visit www.nap.edu/html/nses.

This lesson plan addresses the following national standards:

- Earth and Space Science
- Science and Technology
- Science as Inquiry