

Showing Evidence Unit Plan

Title: Space: The Future Frontier

Description: Humans have sought to understand the unknown since the beginning of time. In this unit, students research the costs and benefits of space exploration. They use the *Showing Evidence Tool* to organize claims and evidence to back their point of view concerning the justification of continued space exploration.

At a Glance

Grade Level: 6-8

Subject sort (for Web site index): Science, Language Arts

Subject: Earth Science

Topics: Space Exploration

Higher-Order Thinking Skills: Synthesis, Justification

Key Learnings: Evaluating Evidence, Cost-Benefit Analysis, Persuasive Writing

Time Needed: Three weeks, 45-60 minutes daily

Background: Utah, United States

Unit Summary

Students research the issue of space exploration by investigating specific space missions and the development of different space technologies. They then use the *Showing Evidence Tool* to synthesize their research and sort out the pros and cons of space exploration and create a product of their choice to support their presentation, supporting one side or the other. Students then participate in a debate over whether space exploration should continue and, if so, who should be responsible for funding.

Curriculum-Framing Questions

Essential Question

Why do we explore?

Unit Questions

How does space exploration benefit us?

Should space exploration continue to be funded? If so, how?

Content Questions

What are the main events that have affected space exploration?

What technological (electronic, communication, or digital) improvements have resulted from the exploration of space?

Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Space: The Future Frontier Unit Plan. These assessments help students and teachers set goals; monitor student progress;

provide feedback; assess thinking, processes, performances, products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Week 1

Build Background Knowledge

Discuss with students the question “Why do we explore?” Give students five minutes to write in their journals all they know about space exploration. Tell students that they may include specific missions, astronauts, outcomes of space exploration, and anything else that comes to mind, but emphasize that they should not stop writing during these five minutes. Ask students to look over their lists and share their ideas. Have them create a web or other graphic organizer to record their ideas. Ask students to consider what more they want to know about space exploration. They can record their thoughts in their journals. For homework, assign students to ask their parents what they know about space exploration and be prepared to share their responses with the class.

Pose the question: How does space exploration benefit us? Encourage students to share their ideas with the whole group. Divide students into small groups, and assign each group an approximately five-year period between the founding of the National Aeronautics and Space Administration (NASA) in 1958 and the present. Using all available classroom resources, each group researches space missions and milestones in national and international space exploration during their assigned time period. For each mission, students should include:

- Name of mission
- Goals of the mission (if an exploration of a planet, then give planet overview: size, composition, distance from the sun and earth, ability to support life)
- Country participating in the mission
- Estimated cost and how it was funded
- Successes and failures
- Contributions and effects (include ways knowledge gained from mission have been used on Earth)
- Type of technology used (telescope, rocket, satellite, etc.)

After the groups research and gather the above information, split them into jigsaw groups. Assemble one person from each five-year period into a new group. In these new groups, students each have three minutes to tell the other group members about the space exploration information they collected. After that, have the group create a timeline using spreadsheet software and give a presentation that addresses these two questions:

- What are the main events that have affected space exploration?
- What technological (electronic, communication, or digital) improvements have resulted from the exploration of space – how did this benefit us on earth?

Pass out and review the [timeline checklist](#) with students to help guide them through the activity. Assess student timelines focusing on their use of higher order thinking to address the above components.

Week 2

Introducing the Project

Present to students the following scenario:

As a member of a special task force you will be researching the future of space exploration. Your task is to weigh the pros and cons of spending billions of dollars on space exploration, and propose written recommendations to the President and his cabinet on whether he should cut back, maintain, or expand the U.S. space program. In addition, you will participate in a debate over the issue of whether space exploration should continue and, if so, who should be responsible for funding.

Talk to students about the fact that life beyond space is a topic that has undergone much debate. There are many questions they must think about such as: How much of the taxpayers' money is being spent on the space program? Could the money be better spent? Are the potential scientific benefits too marginal to justify the costs, or is this a wise investment in the future of mankind?

To acquire background knowledge for creating claims and to get students discussing the topic of space exploration, have students read the following articles: [Pros and Cons for Exploring Space*](#) and [Is Space Exploration Worth the Cost?*](#). Use these articles as the basis for a [Socratic Seminar*](#). The technique is derived from an ancient form of discourse—Socratic dialogue, where students seek deeper understanding of complex ideas through thoughtful discussion. After reading the articles, give students the prompt that will be used with the *Showing Evidence Tool*: Can we justify the cost of space exploration? Remind students they must be able to identify and refute possible counter arguments to their point of view.

Ask students to analyze their thoughts on their own by writing in their journals. This pre-writing activity should stimulate the critical thinking process prior to the discussion.

Distribute the [discussion rubric](#) and ask students to review before proceeding with the next activity. Group students in a circle and pose the question *Can we justify the cost of space exploration?* Elicit responses from students and have them support their positions by citing evidence from the articles. Encourage students to question one another's reasoning and ask each other follow-up questions. All subsequent questions in the seminar should be based on the students' ideas and contributions in response to the initial question. Ask students to use the [discussion rubric](#) to assess their skills during the Socratic discussion. Review these self-assessments and offer feedback as necessary.

Practice Using the Tool

Before proceeding with the next activity, click [here](#) to set up the Space project in your workspace. Introduce students to *Showing Evidence* by having students log into their *Showing Evidence* team space. Tell them they will be building on the dialogue they began on space exploration during the Socratic seminar.

- Direct students to create a claim based on the question *Can we justify the cost of space exploration?*
- Show students how to add, describe, and rate evidence. As a class, articulate the connections among the pieces of evidence, and how each piece works to support or weaken the claim.
- Discuss the idea of reliable evidence. Have students make a checklist of things that they might find out that would help them decide whether the evidence they are using is reliable. Some of the following questions could end up on this reliability checklist: What are the biases you see in this source? How current is the information? Is the author an authority on the subject? Is the author expressing fact or opinion? What is the author trying to convince us to

believe or do? Who is the intended audience? What is the purpose of the source? From the checklist create a class rubric to judge the quality of the evidence.

- Demonstrate how to link evidence to a claim to show that the evidence either strengthens or weakens the claim. Explain that when they bring the evidence over into the Claims Workspace, they need to make a judgment call. Now they are evaluating the evidence to see if it helps or hurts their claim. Sometimes a piece of evidence could even be used to support or oppose the same claim. It depends on how they interpret and discuss the evidence.
- Discuss how to determine the rating for the support or opposition of the claim. Explain that they're only evaluating how this one piece of evidence supports or opposes the claim. When making this rating, they are not to consider how reliable the source is or whether they think the evidence is true - that assessment was done in the earlier rating.
- Explain that a new claim can be added as more evidence is gathered.
- Tell students they will work in teams so they can discuss their developing ideas.
- Model how student teams will peer review each other's work.
- Discuss the comments feature, and agree on how it will be used.

Use the Tool

Assign each student team another team's work to review. Have students continue to research the topic and build their case. Check in frequently both in person and asynchronously during prep time to guide work. Students may conduct a [space exploration poll](#) to gather further evidence. Remind students that in order to be sure an argument is convincing, it is important to consider the opposing view. Require students to find evidence that weakens their claim in order to be prepared for any counterarguments that may come up in the debate. Use the Comments feature to give feedback, redirect effort, suggest new avenues of study, or ask for clarification about a team's thinking.

Remind students to review and comment on their assigned team's work. Discuss with the students the kind of comments they are expected to give and get additional ideas from the students. Explain they are expected to make a minimum of three comments. Direct them to use the [project rubric](#), reliability checklist and discussions they've had to help provide good feedback to the other team. Remind student teams that they should not make comments about whether they think the outcome is wrong or right, but instead base their comments on the quality of the argumentation.

Examine the Showing Evidence Activity

The *Showing Evidence Tool* space below represents one team's investigation in this project.

Week 3

Create Persuasive Product

From their research findings, instruct students to create a persuasive product that reflects their recommendations to the President and his cabinet. Allow students to choose the medium they want to use for publishing their work. Some suggestions for student products are: written essay, [brochure](#), newsletter, or [electronic slideshow](#). Make sure students address the following questions:

- How does space exploration benefit us?
- What are the costs involved with space exploration?
- Should space exploration continue to be funded? If so, who should fund the exploration?

Assess students' persuasive products using the [project rubric](#). Distribute the rubric before students begin writing and go over the criteria so they know what is expected of them.

Set aside a day for students to present their findings to the President and his cabinet. Encourage audience members to take notes and generate questions to ask the teams after each presentation. As a final activity, facilitate a debate and encourage students to defend their reasoning using justification from research. End the final activity with a comprehensive debriefing session discussing the initial question *Why do we explore?* Give students the opportunity to express any relevant observations they may wish to make. Assess students' ability to orally synthesize their learning during the debate and debriefing using anecdotal notes.

Prerequisite Skills

- Experience with multimedia publishing and word processing software
- Familiarity with persuasive writing
- Basic understanding of bias and reliability when researching on the Internet

Differentiated Instruction

Resource Student

- Give additional assistance, extra work time, and task modifications as needed. Allow the student to use compensatory skills to complete assignments, such as oral presentation instead of final written essay.

Gifted Student

- Students can extend their understanding of space exploration by developing a presentation with recommendations on whether and how humans will be able to adapt to space travel.

English Language Learner

- Develop a glossary for students with vocabulary words related to the unit and help English Language Learners define the words throughout the unit.

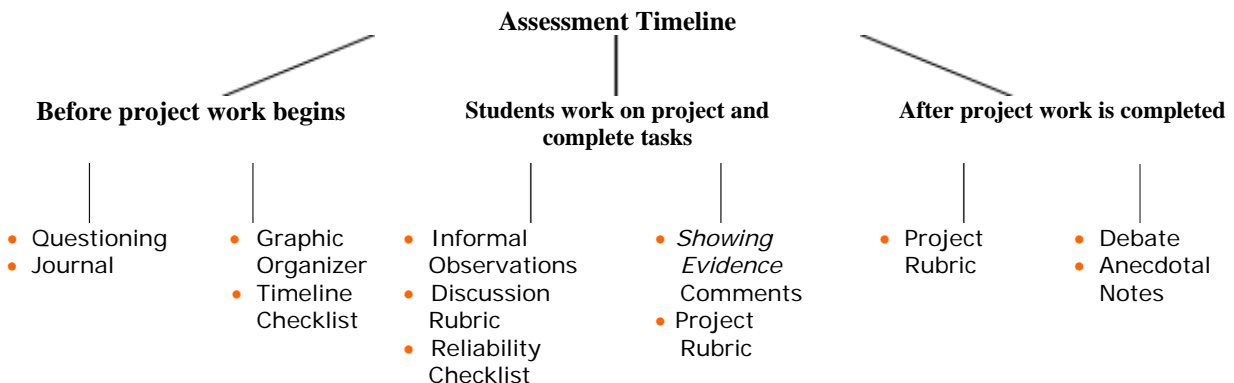
Credits

Karren Perry is a sixth-grade teacher and technology facilitator in Salt Lake City, Utah. She participated in the Intel® Teach Program which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED (highlight box)

The following [sections](#) are listed in the Things You Need highlight box (Assessment, Standards, Resources, PDF) and are linked to pages that contain that section's content.

Assessment Plan



Assess students through journal responses, informal observation while they participate in different activities, and feedback provided by students and teacher while using the *Showing Evidence Tool*. Use the [timeline checklist](#), [discussion rubric](#), reliability checklist, and [project rubric](#) to help students monitor their progress and understand the expectations throughout the project. Assess the final projects using the [project rubric](#).

Targeted Content Standards and Benchmarks

Utah State Standards

Science

Standard 1

Describe new areas of scientific and technological activity that have been generated by space research and exploration.

Standard 3

Students will understand the relationship and attributes of objects in the solar system.

Language Arts/Media

Standard 1

Oral Language: Students develop language for the purpose of effectively communicating through listening, speaking, viewing, and presenting.

Standard 3

Students locate resources and access information within resources.

Standard 4

Students engage and extract information.

Student Objectives

Students will be able to:

- Evaluate and select information resources that are understandable, available, relevant, current, valid, and authoritative.
- Classify information based on fact and opinion.
- Select and evaluate information resources for objectivity (for example., information that does not show prejudice, stereotyping, bias, and propaganda).
- Identify key events in the development of space exploration.
- Understand the relationship and attributes of objects in the solar system.
- Describe new areas of scientific and technological activity that have been generated by space research and exploration.
- Demonstrate an understanding of the costs, benefits, and challenges of space exploration.

Materials and Resources:

Printed Materials

- Literature on space from the school and public library

Internet Resources

- National Aeronautics and Space Administration (NASA)
www.nasa.gov/externalflash/Vision/main.html*
Educational resources on all aspects of space studies
- BBC Science and Nature
www.bbc.co.uk/science/space/exploration/index.shtml*
Collection of space articles including a timeline of events that shaped space travel
- Space Generation Advisory Council
www.spacegeneration.org/
Discussions on the history and future of space exploration
- The White House
www.whitehouse.gov/news/releases/2004/01/20040114-3.html*
Remarks by the President on United States space policy
- Space.com
www.space.com/news/nsf_space_poll_000620.html*
Article detailing a study which shows public support of a Mars trip

- Space Daily
www.spacedaily.com/news/oped-04b.html*
Newspaper article discussing whether space exploration is worth the cost
- America's Debate
www.americasdebate.com/forums/index.php?s=058866005c4066088f37a54a8647d528&showtopic=910&st=0&#entry11087*
Collection of posts discussing the benefits of space exploration
- BBC News
http://news.bbc.co.uk/1/hi/talking_point/2718035.stm*
Comments discussing the issue of space exploration
- Space Today Online
www.spacetoday.org/Astronauts/SpaceTourists.html*
Article discussing space tourism
- Space Future
www.spacefuture.com/archive/benefits_of_commercial_passenger_space_travel_for_society.shtml*
Discussion of the benefits of commercial passenger space travel
- MSN Encarta
http://encarta.msn.com/encyclopedia_761556756_5/Space_Exploration.html*
Article discussing the history and future of space exploration
- National Space Society
http://chapters.nss.org/letters/archives/2004/02/space_program_b.html*
Letter to the editor detailing the benefits of space exploration
- The Society of Performers, Artists, Athletes, and Celebrities for Space Exploration, Inc.
www.stars4space.org/Benefits.html*
Article describing the technological benefits gained from space exploration
- International Space Station
www.shuttlepresskit.com/ISS_OVR*
Overview of the International Space Station
- Space Today Online
www.spacetoday.org/Rockets/X_Prize.html*
Article discussing the Ansari X Prize and the privatization of space exploration
- NASA Space place
<http://spaceplace.jpl.nasa.gov/en/kids>*
Collection of games, animations, projects, and facts about Earth, space, and technology
- Science Friday Kids' Connection
www.sciencefriday.com/kids/sfkc20030207-1.html*
Includes an audio clip discussing the future of space exploration after Columbia
- BBC Newsround
http://news.bbc.co.uk/cbbcnews/hi/teachers/citizenship_11_14/subject_areas/scientific_development/newsid_3397000/3397051.stm*
Learning resources focusing on the space exploration debate
- ThinkQuest
www.thinkquest.org/library/cat_show.html?cat_id=169*
Various Webquests on space exploration

Other Resources

- Invite speakers who work in professions related to space exploration

Technology – Hardware

- Internet connection for independent research and tool use

Technology – Software

- Multimedia software to create final presentations