A Patch to Match Every Mission

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Grade Level	6
Duration	3+ class periods

Adapted in part from:*NASA* & STEM in 30's *Design Your Own Mission Patch* as a culminating activity

National Standards	AZ Standards	Arizona Social Science Standards
GEOGRAPHY **Element 1: The World in Spatial Terms** 1. How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information **Element 2: Places and Regions** 4. The physical and human characteristics of places	**ELA** **Reading** **Integration of Knowledge and Ideas** 6.RI.7 Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue. **SCIENCE:** **Physical Science** 6.P2U1.4 Develop and use a model to predict how forces act on objects at a distance. **MATHEMATICS (optional)** **Ratios of Proportional Relationships** 6.RP.A.3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.	**GEOGRAPHY** **The use of geographic representations and tools helps individuals understand their world.** 6.G1.1 Use and construct maps, graphs, and other representations to explain relationships between locations of places and regions. Key concepts include major landforms and water bodies, countries, cities, ecosystems, climate, languages, religion, economic systems, governmental systems, population patterns, disease, trade routes, and settlement patterns

SIOP Elements

Preparation Adapting content Linking to background **Linking to past learning** Strategies used	**Scaffolding** **Modeling** Guided practice Independent practice **Comprehensible input**	**Grouping Option** Whole class Small groups **Partners** Independent
Integrating Processes **Reading** **Writing** **Speaking** **Listening**	**Application** **Hands on** **Meaningful** **Linked to objectives** **Promotes engagement**	**Assessment** **Individual** **Group** **Written** **Oral**

ARIZONA GEOGRAPHIC ALLIANCE

A Patch to Match Every Mission

Arizona English Language Proficiency Standards

Stage IV
Basic
Reading
Standard 4: 6.RI.4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.
B-4: answering who, what, where, when, why, which and how questions about text.
B-7: connecting information and events in text to life experiences and to related text and sources (text-to-self, text-to-text).
B-8: summarizing the main idea and supporting details from text.
B-14: drawing conclusions from information implied or inferred in a literary selection. B-23: locating information in print and electronic reference sources (e.g., encyclopedia, atlas, almanac, dictionary, thesaurus, periodicals, website, and textbooks) periodicals for a specific purpose.
Speaking and Listening
Standard 1 B-8: responding to questions and statements in an academic discussion by using key vocabulary in complete sentences. (If you're looking
6.R.I.1 Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text. (To justify their cause and effect connections).
6.W.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

Overview

Our youngest students to still believe that they can do anything, and schools can foster this belief by showing them examples of how extraordinary people and programs have reached what may have been thought by some to be “unreachable goals.”

Purpose

In this lesson, students will learn about gravity, microgravity, and various NASA missions. They will learn the importance of working as a team to complete a project just like the astronauts. This lesson contains adaptations for diverse learners (ELLs).

Key Vocabulary

gravity: the force of attraction that pulls things closer together
microgravity: when the pull of gravity is weak, things seem to be weightless
weightlessness: the sensatin you feel during freefall when no outside objects exert any force on you
orbit: the curved path taken by an object moving around another object
ISS: (International Space Station) a man-made liveable satellite
weight: how heavy an object is depends on its mass and force of gravity

Materials

- A copy of *Mousetronaut* by Mark Kelly or ability to show online version of story such as https://storytimefromspace.com/mousetronaut-2/ (8 min) or choose another relevant title:there are many available at https://storytimefromspace.com
- Moustronaut Predictions worksheet
- Projection device and computer
- Freefall worksheet
- Microgravity Math & the Moon worksheet and Answer Key
- NASA Mission Patch Match Pieces
- Designing a Mission Patch worksheet
- Scissors & Glue
- Colored Pencils
- Student devices if possible
- Cups, water, and receptacle to hold water
- Vocabulary Cards

Objectives

The student will be able to:

1. Describe the factual foundation for the Mousetronaut story.
2. Describe the levels of gravity and microgravity in low earth orbit and on the moon, calculating weight in both locations relative to mass on Earth.
3. Observe and perform freefall demo and explain components as example of low earth orbit weightlessness.
4. Explain various symbols on actual NASA mission patches.

5. Work cooperatively to create, revise, and justify design choices for their own team patch.

Procedures

SESSION ONE

Engage:

1. Distribute the *Mousetronaut* Predictions worksheet to each student. Tell them that this story, according to Astronaut Mark Kelly, is based on a (partially) true story. Show the cover. Elicit from students that usually illustrations of animals in clothing indicates a work of fiction. Then ask students to think about what could be true in the story. Allow time to write down a prediction. There are no wrong answers. **(Preparation: Linking to past learning)**
2. Elicit from students whether they want to hear Scott Kelly read from the ISS https://storytimefromspace.com/mousetronaut-2/ or for you to read to them. Then play or read the story. **(Integrating Processes: Listening)**
3. At the end of the story, ask students to think again about what is true from the story. Allow time to write down answer(s). **(Scaffolding: Comprehensible Input)**
4. Discuss and evaluate ideas/answers together using Think-Pair-Share. Guide students to realize that: There were mice aboard the Space Shuttle Endeavor for experimental purposes; there was one mouse smaller than the rest, and that mouse demonstrated weightless by floating (freefalling) in his cage while the others held onto their cages. Read as needed from the *Afterword* in the text. **(Integrating Processes: Writing)**
5. Conduct a partner practice: Student A tells B one thing that was true. B repeats back what was true and adds one more thing & tells if true or false. A repeats the added part & adds one more if time allows. Students independently finish the exit ticket.**(Assessment: Individual/Written & Oral; Integrating Processes: Speaking; Grouping Option: Partners)**

SESSION TWO

Prior to the Lesson: Watch video at https://www.thenakedscientists.com/get-naked/experiments/weightless-water to visualize how the demonstration should be done and explained.

Explore:

1. Show students the pictures of Meteor "enjoying weightlessness." Ask what does it mean to be weightless? to feel weightless? Have you ever felt weightless (on a swing or a roller coaster ride)? Can your weight change that fast? Elicit student ideas about gravity/weight & tell students you will demonstrate the phenomenon of freefall. **(Application: Linked to Objectives)**
2. Take a prepunched plastic cup or a paper cup that you punch (in front of the students) with a pen to make a hole in the side. Holding your finger over the hole, fill the cup with water. Take your finger off of the hole and ask students to describe what they see. (The water is pouring out through the hole.) Ask why. (Gravity is pulling on the water.) **(Application: Meaningful)**
3. Again fill the cup & hold your finger over the hole. Ask them to predict: what will happen if you let go of the cup? Have them quick sketch in a science notebook or on a slate. (**Assessment: Individual/Written)**
4. Holding up the cup for all to see, drop the cup into sink or tub. (Consider filming this part of the lesson.) Repeat as necessary for students to see that the cup falls as a unit with the water inside and the water doesn't come out of the hole! **(Scaffolding: Modeling)**
5. Allow students to try out the demo in pairs. **(Application: Hands on)**
6. Distribute Freefall worksheet to explain cup/water behavior in freefall compared to the mousetronaut on the space shuttle. (Gravity is still acting on mousetronaut & shuttle, but system is moving in orbit at over 17,000 mph.) Have them draw model of Earth/ISS freefall. **(Assessment: Individual/Written)**
7. Show how astronauts can play basketball on the ISS by viewing the video at https://www.nasa.gov/audience/foreducators/microgravity/home/free_fall_ball.html & challenge students to play the online game. . **(Application: Promotes Engagement)**

SESSION THREE

Prior to the Session: Pre-cut NASA Mission Patch Match pieces. Be sure to keep an intact copy for the answer key.

Elaborate and Evaluate:

1. Explain how space exploration/science is an extreme team endeavor. Project and explain how every team, for every mission, has designed their own mission patch. Show how there are several features commonly found on such patches: They usually show the name of the mission, the team members, and other significant goals and objectives are represented by symbols. **(Scaffolding: Modeling)**
2. Distribute NASA Mission Patch Match pieces--one set per 2 students. Tell students to examine the patches and their symbols and read over the mission descriptions to see if they can match

mission to patch. Allow time for students to sort & match. **(Integrated Processes: Reading; Grouping Option: Partners)**

3. Now have students look at the symbols for geographic information: https://pubs.usgs.gov/gip/TopographicMapSymbols/topomapsymbols.pdf
    - Landforms
    - Bodies in the solar system
    - Modes of transportation
    - Natural resources of Earth and space
    - Origins of language
    - Evidence of migration/movement
    - Direction (latitude/longitude, compass rose
    - Symbols of nations **(Scaffolding: Modeling)**
4. Distribute Designing a Mission Patch worksheet. Model the development of a team patch by using a relevant example. (Teachers as Commander, Pilot, and Mission Specialists. Symbols for school initiative, mascot, buildings, location, etc.) **(Scaffolding: Modeling)**
5. Explain the expectations for a team patch and allow time for each component. **(Scaffolding: Comprehensible input)**
6. If desired, show online patch making website for inspiration. **(Scaffolding: Comprehensible input)** http://disney.go.com/vacations/missionspace/missionpatch.html

SESSION FOUR (Optional)

1. Project the Rocket Launch Challenge found at https://www.sciencelearn.org.nz/embeds/132-rocket-launch-challenge. Have several students select the attributes for launching and see how well the rocket fares or have students use their hand held devices and launch the rocket.
2. Distribute Microgravity Math & the Moon worksheet and go over the example(s) given. Remind students to use the appropriate unit of measurement, and encourage practice with metrics as the measurement standard for the international science community.
3. Conclude the session by reading relevant selections online (or printable) with vocabulary supports. **(Integrating Processes: Reading/Listening/Writing)**

    https://www.readworks.org/article/From-the-Earth-to-Outer-Space/41e56718-fc5f-4362-91cf-d16626f80bf5#!articleTab:content/

    https://www.readworks.org/article/What-Is-the-International-Space-Station/aab52e87-0a98-45d9-abfb-ecc3018ec0f6#!articleTab:content/

Assessment

Reading and Geography
The Designing a Mission Patch can be graded using the points given in the checklist. Mastery will be considered a score of 80 points or higher. **(Assessment: Group/Written)**

Mathematics (optional)
The Microgravity Math & the Moon worksheet can be graded. Mastery will be considereed a score of 8 points or higher. **(Assessment: Individual/Written)**

Science
The Freefall worksheet can be graded for a correct drawing of what is happening. Mastery will be considered a score of 8 points or higher. **(Assessment: Individual/Written)**

Extensions

Track the ISS online or by app
https://spotthestation.nasa.gov/tracking_map.cfm

Online NASA kid-friendly resource
https://spaceplace.nasa.gov/menu/parents-and-educators/

Additional suggested children's literature for your class library:

- *Gravity* by Jason Chin
- *Max Goes to the Space Station: A Science Adventure with Max the Dog* by Jeffrey Bennett (as well as the other titles in the series)
- *The Man who went to the Far Side of the Moon: The Story of Apollo 11 Astronaut Michael Collins* by Beau Uusma Schyffert
- *Reaching for the Moon* by Buzz Aldrin

Sources

https://www.npr.org/2019/07/19/743076259/how-a-10-year-old-boy-helped-apollo-11-return-to-earth
NASA & STEM in 30's *Design Your Own Mission Patch*
https://www.youtube.com/watch?v=u6zHQ_GOoXc
https://airandspace.si.edu/sites/default/files/media-assets/12%20Mission%20Patches.pdf
https://www.abemblem.com/serves/astronauts/
AB Emblems has carried on the tradition of producing all NASA patches.
https://history.nasa.gov/mission_patches.html
https://www.ariss.org/current-iss-crew.html