Exploring the Space Frontier 8-Step PBLP (Grades 7–12)

Objective: Students will explore the history, science, and future of human space flight, using a STEAMS (Science, Technology, Engineering, Arts, Mathematics, and Social Studies) approach. Through this project, students will develop innovative solutions, analyze historical milestones, and reflect on how space exploration impacts humanity on Earth and beyond.

Round Table

- **Opening Discussion:**
  - Why do we explore space?
  - How has space travel changed our understanding of Earth and human possibility?
  - What are some challenges astronauts face in space?
- **Purpose:** To engage students in critical thinking about human space flight—its significance, its challenges, and how it inspires scientific, social, and cultural advancement.

Reflection Point

- **Discussion Questions:**
  - How does space exploration impact life on Earth—economically, environmentally, or culturally?
- **Materials:**
  - Clips from documentaries such as *Apollo 11*, *The Mars Generation*, or NASA mission highlights
  - Excerpts from astronaut memoirs or speeches
  - Journal for reflections
  - Optional guest speakers: aerospace engineers, astronomy professors, or veterans of NASA programs

Knowledge Setting	
Science (S): Life in Space	❖ **Objective:** Understand the biological and environmental challenges of space travel. ❖ **Activity:** Investigate how the human body responds to microgravity, radiation, and isolation in space environments.
Technology (T): Innovations from Space Travel	❖ **Objective:** Understand how technologies developed for space are used on Earth. ❖ **Activity:** Research examples like GPS, water purification, and insulation materials.
Engineering (E): Designing for Space Survival	❖ **Objective:** Learn how spacecraft, suits, and systems are engineered for safety and functionality. ❖ **Activity:** Analyze blueprints and schematics for space habitats.
Arts (A): The Human Story of Space	❖ **Objective:** Reflect on how art, film, and literature capture space exploration. ❖ **Activity:** Create a poem or concept art inspired by space missions or imagined futures.
Mathematics (M): Mission Calculations & Trajectories	❖ **Objective:** Understand how math is used in planning space missions. ❖ **Activity:** Practice calculating orbital speeds, fuel ratios, or distances using simplified formulas and case studies.

Social Studies (SS): The Global History of Space Flight	❖ **Objective:** Trace the geopolitical and social impacts of human space exploration. ❖ **Activity:** Explore the Space Race, international cooperation through the ISS, and current global space agency partnerships.

Project Examples

Progress Map for Project Delivery	❖ **Week 1: Project Proposal** ● Students create a written proposal outlining the focus of their project and community benefit. ❖ **Week 2: Project Approval and Community Engagement Plan** ● Students submit their proposals and outline how their work will positively impact the community, ensuring alignment with the project's learning objectives and addressing real-world needs. ❖ **Week 3: Research Progress Update** ● Students conduct research and gather data related to their chosen focus area. ❖ **Week 4: Draft of Final Project** ● Students compile their findings into a draft report or presentation. ❖ **Week 5: Final Project Refinement and Approval for Implementation** ● Final feedback is provided, and the projects are presented at a community event involving local leaders and stakeholders.

Science (S): Health and Human Biology in Space	❖ **Project Example:** Research how studying astronauts' bodies in space has led to advancements in healthcare on Earth — such as bone density, muscle atrophy, or immune system insights. Create a report to hand off that explains how space biology benefits public health.
Technology (T): Spin-Off Innovations from NASA	❖ **Project Example:** Choose 3 everyday technologies that originated from space research (e.g., memory foam, water filters, infrared thermometers). Develop a poster, video, or infographic that tracks their origin, purpose in space, and how they're used today.
Engineering (E): Improving Life on Earth through Space Engineering	❖ **Project Example:** Study how the design of space suits, spacecraft, or satellites influenced design thinking on Earth (e.g., climate satellites, emergency shelters). Create a realistic improvement to an existing design that helps address an Earth-based issue (natural disasters, clean energy, etc.).
Arts (A): Cultural Reflections of Space Exploration	❖ **Project Example**: Explore how space travel has influenced visual arts, music, or storytelling (e.g., Afrofuturism, space race-era propaganda posters, films like *Hidden Figures*). Create an original artistic response (digital art, poetry, photography series, etc.) that reflects the human experience of space.

Mathematics (M): Tracking Space Mission Costs and Impact	❖ **Project Example**: Analyze the budget of a past or current space mission (e.g., Artemis, ISS, Apollo). Create a simple breakdown showing how funds were used and create a Venn diagram whether the return on investment benefited society (tech spin-offs, international cooperation, education, etc.).
Social Justice (SS): Global Cooperation in Space	❖ **Project Example**: Create a case study timeline on a landing page of the International Space Station or another international mission. Highlight how space programs foster diplomacy, peace, and shared scientific goals.

Community Involvement

- ❖ **Objective**: Combine all subject-based projects into a cohesive Space Innovation Suggestion Day, where students contribute ideas inspired by human space flight to address scientific, social, or cultural challenges on Earth.
- ❖ **Activity**: Host a “Space Innovation Day” Q&A Panel where invited space engineering professionals and community members provide constructive feedback on anonymous student projects.

Assessment

- ❖ **Objective**: Evaluate students’ understanding of how human space flight inspires innovation across scientific, social, and cultural contexts through an interdisciplinary STEAMS lens.
- ❖ **Methods**: Use rubrics that measure innovation, collaboration, problem-solving, community impact, and understanding of space-inspired solutions.

Feedback Loop

- **Activity**: Students reflect through a journal entry after receiving feedback from the Space Innovation Day Q&A Panel.
- **Journal Prompt**:
  - How did hearing from professionals or peers help shape your view of innovation and space exploration?
  - What connections did you discover between space technology and life on Earth?
  - How would you improve or expand your research skills based on what you learned?

Resume Integration

- Survey career interest in aerospace engineering, science communication, data analytics, design thinking, international cooperation, or creative industries influenced by space culture. Showcase projects on resumes, highlighting skills in research, innovation, and advocacy.

For more 8-Step Project-Based Lesson Plans check out our website at www.steamsinitiative.org

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