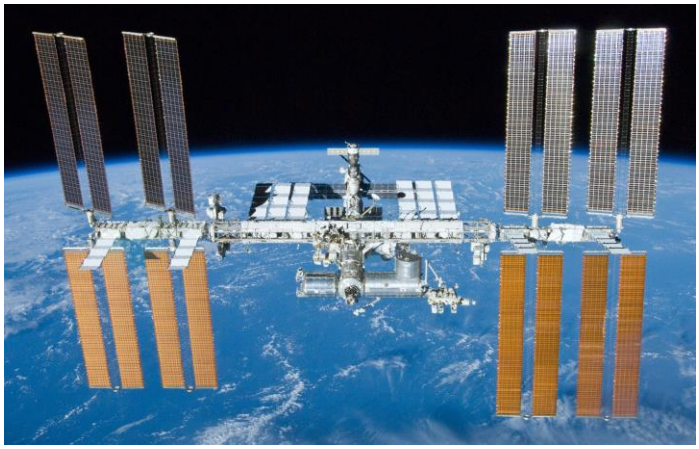
Microgravity Research Proposal Project

Subject Area(s) Science and Technology

Associated Unit Space Exploration

Lesson Title Microgravity Research Project Proposal

Image 1



ADA Description: The International Space Station

Source/Rights: Picture courtesy of Wikipedia.com

Caption: The International Space Station orbiting the Earth

Grade Level 11-12

Lesson #

Lesson Dependency

Time Required **3-5 days**

Summary

Students will be asked to read current research reviews about microgravity and experiments conducted on the International Space Station. Using this information, students will write a proposal for research to be conducted on the International Space Station to further research in microgravity.

Engineering Connection

Engineering involves problem solving and often the creation of functional materials. Students will be asked to use their problem solving skills to propose and create possible procedures for further experimentation in microgravity with the goal of either improving life on earth or furthering the cause of long term space exploration.

Engineering Category

1. Relating science and/or math concept(s) to engineering

Keywords

microgravity, research, citation, scientific process

Educational Standards

State STEM Standard Florida: Science [2008] Nature of Science (9-12) Standard 1: The Practice of Science • Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science, and do the following:

1.pose questions about the natural world,

2.conduct systematic observations,

3.examine books and other sources of information to see what is already known,

4.review what is known in light of empirical evidence,

5.plan investigations,

6.use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs),

7.pose answers, explanations, or descriptions of events,

8.generate explanations that explicate or describe natural phenomena (inferences),

9.use appropriate evidence and reasoning to justify these explanations to others,

10.communicate results of scientific investigations, and

11. evaluate the merits of the explanations produced by others.

ITEEA Standard Technology [2000] Design (K-12) • Standard 10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

NGSS Standard Science [2013] Science and Engineering Practices (9-12) Constructing Explanations and Designing Solutions • Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Pre-Requisite Knowledge

Teachers should have a basic understanding of methods used in scientific research.

Students should have prior knowledge of the scientific process.

Learning Objectives

After this lesson, students should be able to:

- **Students will be able to describe current research in microgravity by participating in a group activity and sharing their results with the class. This will give students the background knowledge needed to choose a research project topic.**
- **Students will be able to work with partners to read a published research paper on the microgravity topic they are most interested in. This will give students the information they need to propose further experimentation in microgravity.**
- **Students will utilize media center resources to construct a rough proposal for research to be conducted in microgravity. Students will gain skills in the development of scientific research as well as in source citation.**

Introduction / Motivation (5E – Engage)

https://www.nasa.gov/mission_pages/station/research/videos/index.html

Hook students with a current video about research being conducted on the ISS. Choose any current video that has to do with the scientific research process (new ones are put out on a regular basis).

Lesson Background & Concepts for Teachers (5E – Explain)

Teacher should find 3-6 current research papers about research work being conducted in microgravity. Many schools have legal access to these papers. NASA.gov is also a good resource for material. Teachers should use these papers as background and they will be used by the students. Teachers should either be able to teach students the process of MLA/APA citation or utilize media center personnel to be able to teach the students how to properly cite resources.

Students should be walked through the process a step at a time. For teachers who have the time more than 2 days could be spent putting the actual paper together in the media center (perhaps using peer review). My intention for this lesson is that students will have some prior experience with research papers so while this will be a different format they will be able to use the resources available to them in school to complete the in-school work during the 4 days of allotted class time.

Vocabulary / Definitions

Word	Definition
microgravity	a condition in space in which only minuscule forces are experienced, virtual absence of gravity; *broadly* : a condition of weightlessness
All other	Students will create a list of new vocabulary words on day 2 of the lesson plan – this is individual because it depends on the research paper they are working with.

Associated Activities (5E – Explore)

- **(1 day) Students will be able to describe current research in microgravity by participating in a group activity and sharing their results with the class. This will give students the background knowledge needed to choose a research project topic.**
    - Bell work: Survey Monkey pre-assessment.
    - Students will view a brief video filmed on the ISS (these update on a regular basis, so the actual video will vary).
    - Students will break up into 3-6 groups and be given a chance to work with their peers to read and learn about one area of research in microgravity. Students will then work with their groups to create a short presentation including a visual aid. Students will then take notes on other groups presentations.
    - Wrap up: Students will come up with at least 2 ideas for possible further research in microgravity. Note sheet to be graded and given back to students on the next class day.

- **(1 day) Students will be able to work with partners to read a published research paper on the microgravity topic they are most interested in. This will give students the information they need to propose further experimentation in microgravity.**
    - Bell work: Students will use yesterday's notes to decide which topic area they are most interested in. Students will then be paired with another student who has a similar topic. Students will work together to read a current research paper on their topic (preferably a review, but this is up to the teacher).
    - Students will produce individual OR group Cornell Notes which must include any needed vocabulary definitions. Student partners can support one another but must write separate summaries even if they decide to do group notes. Summaries will be graded and handed back the next day.
- **(2 days) Students will utilize media center resources to construct a rough proposal for research to be conducted in microgravity. Students will gain skills in the development of scientific research as well as in source citation.**
    - Bell work: Students will use the previous days' work to choose a preliminary topic for their research proposal (this can be changed and/or refined as they work).
    - Students will use media center time to write up their research project proposal and to create a 5 resource annotated bibliography (either APA or MLA format). Proposals will include: Title, Overview/Abstract of proposal, brief "literature" review, possible materials needed, at least one experiment with a protocol, and a summary paragraph explaining why this research would further our scientific understanding of microgravity.
    - Students will have 2 media center days as well as 3 more "homework" days before they turn in their final paper.
        - ***On the day the project is due: Survey Monkey post-assessment.***
- **(Possible Extension, 3-4 days) Students will present their research proposal to the class as if they were trying to convince NASA to conduct their experiment(s) on the International Space Station.**

Lesson Closure

Assessment (5E – Evaluate)

Pre-Lesson Assessment

- *Pre-assessment to determine student prior knowledge and track learning gains.*
    - https://www.surveymonkey.com/r/ZDRRWJD
    - Students can use their devices to complete the survey online OR request a paper copy that the teacher can manually use. **They should only answer #1-5 as #6-10 are the post-assessment questions.**

Post-Introduction Assessment

- *Post-assessment to determine student learning gains. Compared to pre-assessment results.*
    - https://www.surveymonkey.com/r/ZDRRWJD
    - Students can use their devices to complete the survey online OR request a paper copy that the teacher can manually use. **They should only answer #6-10 as #1-5 are the pre-assessment questions.**

Lesson Summary Assessment

Students will complete a research proposal paper along with an annotated bibliography.

Homework
-Students will have 3 days outside of class time to complete their projects.

Lesson Extension Activities (5E – Extension)

- (Possible Extension, 3-4 days) Students will present their research proposal to the class as if they were trying to convince NASA to conduct their experiment(s) on the International Space Station.
- Extension for non-seniors: any returning students can use this experience to participate in the Kennedy Space Center's Student Astronaut Challenge. Part of the Student Astronaut Challenge is a competition where the students have to propose research for the International Space Station when given a specific scenario.

  http://www.astronautchallenge.com/index.php?option=com_content&view=article&id=49&Itemid=57

Additional Multimedia Support

References

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Attachments: Worksheet

Contributors

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Research in Microgravity: Notes

Name: _____ Date: _____ Pd: _____ _____ / 20

Topic	Description	Examples of Current Research + Possible Future Research

(2 pts) Brainstorm: Using what you have learned today come up with at least 2 possible ideas for what you'd like to see being researched in a microgravity environment like the International Space Station.