Down to Earth Design Challenge Missions

Title - Mission Stellar Health: Train Like An Astronaut				
Grade Level: 6-8	**Duration:** 45-90 minutes	**Subject:** Life Science, Engineering Design	**STEM Practices:** Asking Questions and Defining Problems, Developing and Using Models	**NGSS Standards:** MS-PS2-4, MS-LS1-5, MS-ETS1-1, MS-ETS1-2

Activity Summary: Learners explore astronauts' challenges while staying fit and healthy in space. They'll learn about the technology on the ISS that allows the astronauts to exercise in microgravity conditions. Then, they'll explore how innovations on the ISS help doctors improve people's health on Earth. Learners will design a solution to help community members maintain bone, muscle, and/or lung function, connecting their solution to careers in health sciences.

Objectives:

- Define why astronauts need to exercise in space and the effects of microgravity on their bodies.
- Associate the importance of exercise in maintaining health, both on Earth and in space.
- Identify the health challenges caused by climate change and exercise limitations in affected communities.
- Examine ways that research in space can be used to improve health outcomes on Earth.
- Either
  - Design an indoor exercise routine inspired by astronaut workouts, incorporating safe and accessible elements.
  - Develop a simple prototype of exercise equipment using recycled materials for elderly people with breathing issues.

Essential Questions:

- Why do astronauts need to exercise in space, and how do they adapt to a zero-gravity environment?
- How does exercise in space benefit both astronauts and people on Earth?
- What are the health challenges associated with living in space, and how can we apply space-based exercise solutions to improve health on Earth?
- How can physical activity help combat health issues caused by climate change, particularly in vulnerable communities?

Enduring Understanding: Exercise is essential for maintaining physical and mental health in space and on Earth, and space research on health challenges like muscle and bone loss can inspire innovative solutions to improve well-being in communities affected by climate change.

Instructional Scope and Sequence						Assessment Strategy
Time	**Step**	**Tasks**	**What is the TEACHER doing?**	**What is the LEARNER doing?**	**Materials needed**	**Benchmark or Performance Expectation**
15 min (longer if desired)	**DEFINE**	**Identify the Problem**	Reviewing the resources provided in the SciFri lesson about exercise on the ISS and connections to Earth. Introducing the problem using real-world examples of health challenges caused by climate change and exercise limitations in affected communities.	Listening, asking questions, and noting key challenges related to exercise on the ISS and health in climate-impacted communities.	Presentation slides, articles, or case studies on health challenges due to climate change (heat waves, air quality).	Learners understand why physical exercise is important for space stations and on Earth. Learners understand how climate change affects physical activity and health.
		Needs & Constraints	Guiding discussion on resources and constraints in exercise solutions (e.g., limited equipment, small indoor spaces). Reviewing materials available.	Listing available materials, identifying limitations, and discussing constraints for developing indoor exercise solutions.	Whiteboard, markers, resources list.	Learners identify specific needs and constraints for the design solution.

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		Research	Providing resources, articles, and videos on astronaut exercise technology and community health needs. Guiding learners to create a KWL chart, if desired.	Conducting research on exercise solutions in space and how they can be applied on Earth.	Internet access, research materials, video clips on ISS exercise.	Learners gather relevant research on exercise solutions used in space and in climate-affected areas.
15 min (longer if desired)	**IMAGINE**	**Brainstorming**	Facilitating brainstorming, encouraging creativity, and ensuring all Learners contribute ideas. Providing examples or models for productive divergent thinking in groups (i.e. morph charts). Guiding discussion on the pros and cons of each solution.	Brainstorming potential exercise routines or equipment using available materials and applying space research principles. Collaborating to develop and assess multiple solutions.	Worksheet, paper, writing materials.	Learners generate multiple creative ideas.
15 min (longer if desired)	**DESIGN**	**Pick the Best Solution**	Guiding the evaluation process, helping Learners assess their options based on constraints and needs. Guiding convergent thinking process.	Debating and selecting the best solution based on feasibility and impact.	Worksheet, rubric	Learners select the best solution through a structured evaluation process.
		Develop / Plan Solution	Helping learners structure their plan and ensuring it includes all necessary components (e.g., materials, steps).	Drafting a detailed plan with steps, materials, and roles for creating the solution.	Worksheet, materials list	Learners develop a clear, actionable plan.
20 min (longer if desired)	**CREATE**	**Prototype / Model Solution**	Supervising the creation process, offering feedback, and ensuring safety.	Constructing a prototype using available materials (e.g., exercise equipment or routine)	Recycled materials, simple tools, household objects.	Learners create a functional prototype.
		Refine Protoype / Model	Providing constructive feedback and guiding improvement. The amount of time available for iteration may vary based on educational constraints.	Revising their prototype to enhance performance.	Prototype materials, rubric	Learners demonstrate iteration and improvement in their designs.
10 min	**EVALUATE**	**Test Solution**	Monitoring the testing process and assuring the safety of learners.	Testing the prototype with peers or family members, recording results.	Rubrics, timers or a clock, camera or phone with video	Learners complete testing and document their results.
5 min (longer if desired)	**IMPROVE**	**Reflection**	Guiding reflection through questions and prompts. Gallery walk and/or peer feedback.	Reflecting on successes, challenges, and what could be improved.	Worksheet	Learners critically reflect on their work and suggest improvements.
		Rationale	Encouraging learners to articulate reasons for their design decisions.	Writing or presenting rationale for their design and proposed changes.	Worksheet	Learners provide clear rationales for design changes.
10 min	**SHARE**	**Communicate solution**	Assisting learners in organizing their video, photos, or other media. Note: Perfection is the enemy of good here.	Creating a video or demonstration of their solution. Keep it simple.	Camera or phone with video, computer, Internet access	Learners create and deliver a clear solution.

Additional Resources:

Mission Stellar Health: Train Like An Astronaut

SciFri Exercise Like An Astronaut!

SciFri Exercise Like An Astronaut Workout

SciFri Mission Stellar Health Routine

Stellar Health Routine Rubric

SciFri Mission Stellar Health Equipment

Stellar Health Equipment Rubric