



# JUMP FOR THE MOON

*A NASA Train Like an Astronaut Mission Handout – Educator Guide*

## Learning Objectives

Students will

- perform jump training with a rope, both while stationary and moving, to increase bone strength and to improve heart and other muscle endurance.
- record observations about improvements in stationary and moving jump training during this physical experience in the Mission Journal.

## Introduction

On Earth, humans experience the effects of gravity pulling on the human body which applies a constant force, or loading effect. This constant force is essential for building the healthy, strong bones we need on Earth. The force can be increased and bones can be made stronger by doing regular weight bearing physical activities such as jumping, walking, running or dancing. This is especially important when humans are young because this is when the skeleton is most responsive to exercise loading. Regular exercise done during youth will compensate for the expected bone loss that occurs as we grow older.

In addition to good nutrition, astronauts need to ensure their bones are strong enough to endure their assigned mission by undergoing physical training. Once in space, bones in the lower torso and legs are most affected by the reduced gravity environment. It is these bones that are more likely to suffer bone loss. NASA engineers must work to “artificially load” crew members by providing a harness for them to wear that straps them to the treadmills when the astronauts are exercising. When they return to Earth, they continue to exercise and eat properly in an effort to build up their bone strength. They have their bone mineral density (BMD) tested up to three years after they return from their mission to ensure their bones are as strong and healthy as they were before their mission.

Bone strength, along with other components of fitness (such as cardiovascular endurance and muscular endurance) can be improved just by jumping – or jumping rope. Use the information below to help administer the Train Like an Astronaut Mission Handout and help your students **train like an astronaut**.

## Administration

Follow the outlined procedure in the Jump for the Moon Mission Handout. The duration of this physical activity can vary, but will average **15-25 minutes**. In order for students to perform at their maximum potential, positive reinforcement should be used throughout the activity.

## Location

This physical activity should be conducted on a flat, dry surface with room to travel.

*This activity may be done on rainy days inside without the jump rope.*

## Set-up

Students should maintain an arms length distance from each other.

## Equipment

- Mission Journal and pencil
- jump rope (one per student)
- watch or stopwatch

Optional equipment:

- heart rate monitor

*For physical activity, students should wear loose-fitting clothing that permits freedom of movement.*

## Safety

- The traveled surface should be smooth, flat, and dry as students will be placing their hands on the floor.
- Proper distance between students will ensure safety for hands and feet and will help prevent collisions.
- Proper hydration is important before, during, and after any physical activity.
- Be aware of the signs of overheating.
- A warm-up/stretching and cool-down period is always recommended.

*For information regarding warm-up/stretching and cool-down activities, reference the Train Like an Astronaut (ages 6-17) from the President's Council on Physical Fitness and Sports at <http://www.presidentschallenge.org/pdf/getfit.pdf>.*

## Monitoring/Assessment

Ask the Mission Question before students begin the physical activity. Have students use descriptors to verbally communicate their answers.

Use the following open-ended questions **before, during, and after** practicing the physical activity to help students make observations about their own physical fitness level and their progress in this physical activity:

- How do you feel?
- How long did you jump without stopping?
- How does staying stationary feel different from moving?
- What happened to your heart rate?
- Did you sweat?
- How do you think this activity might help your bone strength?
- Why might maintaining bone strength be a challenge for astronauts in space?
- What muscles do you feel you are working while jumping rope?

The most appropriate answers would include:

- Upper body
  - shoulders
  - front/back of upper arms and lower arms
- Lower body
  - lower back
  - buttocks
  - front/back of upper legs and lower legs
- Core
  - abs/back (for stabilization)

Some quantitative data for this physical activity may include:

- rate of perceived exertion (on a scale of 1-10)
- distance traveled
- length of rest period
- respirations (breaths per minute)
- heart rate (beats per minute)

Some qualitative data for this physical activity may include:

- identifying amount of sweat or thirstiness
- identifying soreness in body parts
- identifying shakiness or muscle cramping

## **Collecting and Recording Data**

Students should record observations about their physical experience with jump training in their Mission Journal before and after the physical activity. They should also record their physical activity goals and enter qualitative data for drawing conclusions.

- Monitor student progress throughout the physical activity by asking open-ended questions.
- Time should be allotted for the students to record observations about their experience in their Mission Journal before and after the physical activity.
- Graph the data collected in the Mission Journal on the graph paper provided, letting students interpret the data individually. Share graphs with the group.

## **Progression**

- Increase the time to one minute and then to two minutes.
- Increase the number of jumps per time period.
- Jump on one foot or with both feet together.
- Go from jumping twice per rotation to jumping one time per rotation.
- Rest periods may be shortened and additional variations may be added.

Students should practice the Mission Handout physical activity several times before progressing or trying the related Mission Explorations.

## **National Standards**

National Physical Education Standards:

- Standard 1: Demonstrates competency in motor skills and movement patterns needed to perform a variety of physical activities.
- Standard 2: Demonstrates understanding of movement concepts, principles, strategies, and tactics as they apply to the learning and performance of physical activities.
- Standard 3: Participates regularly in physical activity.
- Standard 4: Achieves and maintains a health-enhancing level of physical fitness.
- Standard 5: Exhibits responsible personal and social behavior that respects self and others in physical activity settings
- Standard 6: Values physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

National Health Education Standards (NHES) Second Edition (2006):

- Standard 1: Students will comprehend concepts related to health promotion and disease prevention to enhance health.
  - o 1.5.1 Describe the relationship between healthy behaviors and personal health.
- Standard 4: Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
  - o 4.5.1. Demonstrate effective verbal and non-verbal communication skills to enhance

- health.
- Standard 5: Students will demonstrate the ability to use decision-making skills to enhance health.
  - o 5.5.4 Predict the potential outcomes of each option when making a health-related decision.
  - o 5.5.6 Describe the outcomes of a health-related decision.
- Standard 6: Students will demonstrate the ability to use goal-setting skills to enhance health.
  - o 6.5.1 Set a personal health goal and track progress toward its achievement.
- Standard 7: Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.
  - o 7.5.2 Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.
- Standard 8: Students will demonstrate the ability to advocate for personal, family and community health.
  - o 8.5.1 Express opinions and give accurate information about health issues.

### **National Initiatives and Other Policies**

Supports the *Local Wellness Policy*, Section 204 of the Child Nutrition and WIC Reauthorization Act of 2004 and may be a valuable resource for your Student Health Advisory Council in implementing nutrition education and physical activity.

### **Resources**

For more information about space exploration, visit [www.nasa.gov](http://www.nasa.gov).

To learn about exercise used during past and future space flight missions, visit <http://hacd/jsc.nasa.gov/projects/ecp.cfm>.

Access fitness-related information and resources at [www.fitness.gov](http://www.fitness.gov).

View programs on health and fitness:

Scifiles™ The Case of the Physical Fitness Challenge  
<http://www.knowitall.org/nasa/scifiles/index.html>.

NASA Connect™ Good Stress: Building Better Bones and Muscles  
<http://www.knowitall.org/nasa/connect/index.html>.

For guidelines for fluid replacement and exercise:

National Athletic Trainer's Association (NATA)

- Fluid Replacement for Athletes (Position Statement)  
<http://www.nata.org/statements/position/fluidreplacement.pdf>

For information on warm-up and cool-down stretches, visit:

American Heart Association (AHA)

- Warm-up and Cool-down Stretches  
<http://americanheart.org/presenter.jhtml?identifier=3039236>

For information about rate of perceived exertion (RPE), visit:

Centers for Disease Control and Prevention (CDC)

- Perceived Exertion  
[http://www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived\\_exertion.htm](http://www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived_exertion.htm)

For guidelines on heart rate and exercise, visit:

Centers for Disease Control and Prevention (CDC)

- Target Heart Rate and Estimated Maximum Heart Rate  
[http://www.cdc.gov/nccdphp/dnpa/physical/measuring/target\\_heart\\_rate.htm](http://www.cdc.gov/nccdphp/dnpa/physical/measuring/target_heart_rate.htm)

American Heart Association (AHA)

- Target Heart Rates  
<http://www.americanheart.org/presenter.jhtml?identifier=4736>

## **Credits and Career Links**

Lesson development by the NASA Johnson Space Center Human Research Program Education and Outreach team with thanks to the subject matter experts who contributed their time and knowledge to this project.

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