MISSION X: MISSION HANDOUT

YOUR MISSION: The Speed of Light

You will perform a time reaction activity using a ruler to practice your hand-eye reaction time and improve your concentration. You will collect, record, and analyze data during the skill-based experience on your Mission Journal.

Reacting quickly and having good concentration can be very important in life. A quick hand-eye reaction time can allow you to catch something in mid-fall. When you learn and/or practice a new skill, such as catching a ball, crossing the street, riding a bicycle, or someday driving a car, you are working on your concentration and your ability to react.

MISSION QUESTION: How can you perform a test and improve your concentration and hand-eye reaction time?

MISSION ASSIGNMENT: Hand-eye Reaction Training

You will complete this mission with a partner.
One will be the crew member the other the trainer.

- ○ You will sit or stand directly across from each other. Your teacher will give you specific instructions.
- ○ The crew member will do the following:
  - ▭ Extend your dominant arm out in front of your body.
  - ▭ Make a fist with your hand, thumb side up.
  - ▭ Point your thumb and index finger forward, keeping them about 2 cm apart.
  - ▭ Use your index finger and thumb to catch the ruler immediately after it has been released by the trainer.
- ○ The trainer will do the following:
  - ▭ Hold the ruler between the outstretched index finger and thumb of the crew member's dominant hand.
    - ○ Line the top of the crew member's thumb level with the zero centimeter line on the ruler.
  - ▭ Without warning, release the ruler letting it fall between the crew member's thumb and index finger. When the crew member catches the ruler, determine the distance between the bottom of the ruler and the top of the crew member's thumb.
- ○ Record the measurement in centimeters in the Mission Journal.
- ○ Repeat and record for a total of ten times.
- ○ Switch roles and repeat the procedure above for a total of ten trials.
  - ▭ Measure each time score using the Distance and Time chart. Note: There are 1,000 milliseconds (ms) in 1 second.
  - ▭ Record your best time in the Mission Journal.

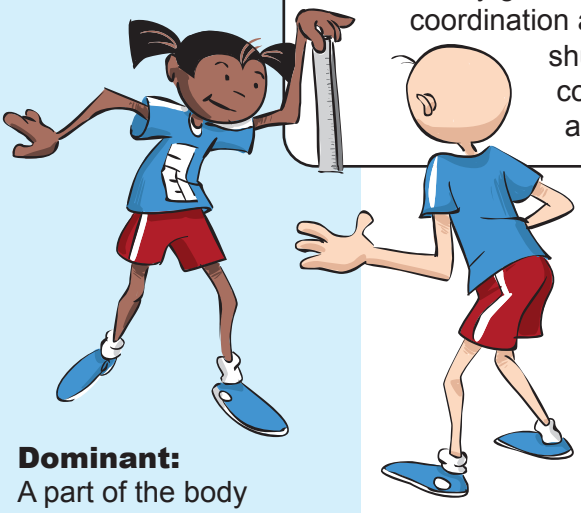
○ Record observations before and after this skill-based experience in your Mission Journal.

Follow these instructions to train like an astronaut.

With practice and concentration you can improve your hand-eye coordination which will increase your reaction time. This will prepare you to react when something unexpected happens. This is especially important if you can prevent an accident.

It's a Space Fact:

In preparation for space travel, astronauts invest many hours with NASA ASCR's and instructors to practice their hand-eye reaction time. Operating the robotic arm on the International Space Station (ISS) or landing the space shuttle requires crew members to have quick reaction times. Crew members must also be prepared for environmental hazards such as lighting and solar winds which could have a negative impact on reaction times. Fatigue, physical stamina and noise levels can also have a detrimental effect on an astronaut's reaction time. One responsibility of space shuttle pilots is to safely land the shuttle at the end of the mission. Pilots must practice landing techniques before they go into space. They use simulators on Earth to improve hand-eye coordination and sharpen concentration skills. Experience has shown that shuttle pilots with better hand-eye coordination and sharper concentration skills have more success landing the shuttle after a 12 to 14 day mission.



Dominant:
A part of the body that instinctively takes the lead over another.

Robotic arm:
A programmable, robot manipulator, that has functions similar to a human arm.

Fatigue:
A lack of energy.

Trials:
The act or process of trying and testing.

ASCR:
Astronaut Strength, Conditioning, and Rehabilitation Specialists; a fitness specialist that provides training pre- and post-flight for NASA astronauts.

Fitness Acceleration

- Squeeze a stress relief ball 15 times and then try the Speed of Light activity. Did this affect your time? Explain.
- Ride in an elevator while doing the ruler catch activity. Did this affect your reaction time? Explain.
- Do twenty jumping jacks and then try the Speed of Light activity. Did this affect your reaction time? Explain.

Think Safety!

Researchers and NASA ASCR's work with the astronauts by providing a safe environment to practice and master skills so astronuats are not injured. You must always practice safety!

- Sit or stand in a comfortable position during this activity.
- Use tools and equipment in the appropriate manner for this activity.
- Avoid obstacles, hazards, and uneven surfaces.
- Wear appropriate clothes and shoes that allow you to move freely and comfortably.

Mission Explorations:

- Practice a video or computer game that requires quick decision making.
- Participate in quick-moving sports such as volleyball, tennis, table-tennis, or racquetball.
- Visit an internet site approved by your teacher that has a reaction time test. Some involve changing lights, sounding buzzers, and even driving cars.

Status Check: Have you updated your Mission Journal?

Train Like an Astronaut: Adapted Physical Activity Strategies

Speed of Light

YOUR MISSION

You will perform a time reaction activity using a ruler to practice your hand-eye reaction time and improve your concentration. You will collect, record, and analyze data during the skill-based experience in your Mission Journal.

LINK TO SKILLS AND STANDARDS

APENS: 2.03.04.01

- Understand how certain types of disabilities may affect reaction time
- Modify activities to allow more or less processing time, as needed

Activity Specific Terms/Skills

Hand-eye coordination, fine-motor skills, communication, team work, reaction time

SPACE RELEVANCE

Reaction time can be improved with training. Operating the robotic arm on the International Space Station (ISS) or landing the space shuttle requires crew members to have quick reaction times. Crew members must also be prepared for environmental hazards such as lighting and solar winds which could have a negative impact on reaction times.

Space shuttle pilots used simulators on Earth to improve hand-eye coordination and sharpen concentration skills. Experience has shown that shuttle pilots with better hand-eye coordination and sharper concentration skills had more success landing the shuttle after a 12 to 14 day mission.

WARM-UP & PRACTICE

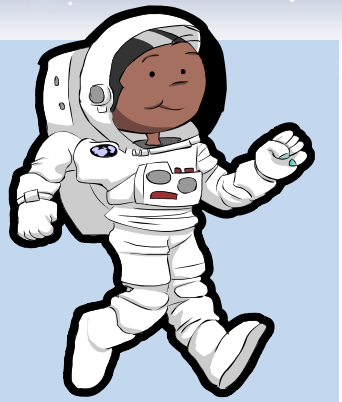
- Provide a stimulus to generate reactionary response
- Squeeze stress balls; squeeze and release hands
- Practice dropping or catching an object
- Wrist circles
- Catching a ball
- Play catch
- Passing a ball around
- Running to pick-up objects and bring back
- Touch each other's hands quickly
- Play rock, papers, scissors

SUGGESTED ADAPTED EQUIPMENT:

- POOL NOODLE
- YARD STICK
- TAP LIGHTS

Speed of Light

LET'S "TRAIN LIKE AN ASTRONAUT!"



Instructions for individual or group play: (Adjust steps and procedures as appropriate for participants)

You will complete this mission by yourself or with a leader.

One person will be the crew member and the other the trainer. You will sit or stand directly across from each other. Progress towards two players independently playing.

The crew member will do the following:

- Extend your dominant arm out in front of your body.
- Make a fist with your hand, thumb side up.
- Point your thumb and index finger forward, keeping them about 2 cm apart.
- Use your index finger and thumb to catch the ruler immediately after it has been released by the trainer.

The trainer will do the following:

- Hold the ruler between the outstretched index finger and thumb of the crew member's dominant hand.
- Line the top of the crew member's thumb level with the zero centimeter line on the ruler.
- Without warning, release the ruler letting it fall between the crew member's thumb and index finger. When the crew member catches the ruler, determine the distance between the bottom of the ruler and the top of the crew member's thumb.

Record the measurement in centimeters in your Mission Journal.
Repeat and record for a total of ten times.
Switch roles and repeat the procedure above for a total of ten trials.

TRY THIS! *Some ideas for Adapted Activity*

- Use a full-hand grip
- Perform while seated or supported against a wall
- Choose a yard stick or longer item
- Select brightly colored objects, or ones with wide stripes to visibly measure reaction speed
- Try a slower moving object such as a plastic bag
- Instead of catching the item, have participant drop an item (like a ruler or noodle) at the same time as instructor
- Pool noodle instead of yard stick
- Tap light or sound emitting device

THE SPEED OF LIGHT

Learning Objectives

Students will:

- perform a time reaction activity using a ruler to practice your concentration and improve your hand-eye reaction time; and
- record observations about improvements in this skill-based experience in the Mission Journal.

Introduction

Have you ever played a quick moving sport such as basketball, tennis, or racquetball? As in most sports, these physical activities require you to be quick on your feet and stay focused. Thinking quickly about your next move takes a lot of practice and dedication to improve your game.

Each time you practice a sport or engage in physical activity, you are improving your reaction time. Reaction time is how fast you can respond to a stimulus. A stimulus can be a noise or something you feel or see. Astronauts practice their mission duties on Earth to improve reaction time and concentration and be prepared for their mission

NASA has a variety of environments where astronauts train for their missions. They often simulate unforeseen situations and events to help the astronauts practice reaction time and concentration in space. Astronauts preparing for Extra-Vehicular Activities (EVAs) or robotic arm operations test their skills in the Virtual Reality Laboratory (VR) at Johnson Space Center (JSC). In a virtual reality microgravity environment, astronauts, wearing special gloves, video display helmets, chest packs, and controllers, learn how to orient themselves in outer space. In space, up and down are not recognized and even a minor tweaks with a thruster can send someone spinning off into space. In the VR Lab, astronauts can safely practice dangerous events such as self-rescue techniques during an EVA. Practicing their reaction time here on Earth will help the EVA astronauts have successful EVAs in space.

The Jake Garn Training Center at the Johnson Space Center is a training facility where astronauts prepare for space shuttle operations. A motion-based trainer simulates the vibrations, noise, and views that the astronauts experience during a space shuttle launch or landing. The Jake Garn facility also houses a functional space station simulator, which familiarizes astronauts with the laboratory systems of the International Space Station (ISS). Space shuttle and ISS trainers and instructors in this facility introduce the astronauts to various situations that they may face during their missions. Space shuttle pilots know the importance of reaction time and concentration, because they are required to land the space shuttle safely. Pilots practice on Earth in space shuttle simulators for many hours. They are presented various landing situations and they must practice to be able to land the space shuttle successfully. Therefore, astronauts must depend on their reaction time and concentration in order to have a successful shuttle landing.

Administration

Follow the outlined procedure in The Speed of Light Mission Handout. The duration of this physical activity can vary, but will average **10-15** minutes per class. 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. It could be done in the classroom with limited distractions.

Set-up

- If sitting, position two chairs directly across from each other. One chair for each student in a team of two.
- Give each student their mission handout either on a clip board or have them sit close to a desk to place their mission handout on while they are engaged in the activity.
- Print or display a copy of the Distance and Time Chart. (Appendix A)

Equipment

- Mission Journal and pencil
- Metric rulers – wood, hard plastic, or metal

Safety

- Sit or stand in a comfortable position during the activity
- Use tools and equipment in the appropriate manner for this activity.
- Avoid obstacles, hazards, and uneven surfaces.
- Wear appropriate clothes and shoes that allow you to move freely and comfortably.

Monitoring/Assessment

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

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

- Are your trial scores improving as you are practicing?
- Was your first and last trial different? If they were, what do you think played a factor in making both trials different?
- If your reaction time did not increase, what can you do to make your reaction time faster?

Some quantitative data for this physical activity may include:

- changes in trial scores
- how many trials were performed over the course of the class

Some qualitative data for this physical activity may include:

- environmental factors
- student fatigue level
- identifying soreness in body parts

Collect, Record, and Analyze Data

Students should record observations about their skill-based experience in their Mission Journal before and after the activity. They should also record their skill-based goals and enter qualitative data for drawing conclusions.

- Monitor student progress throughout the skill-based 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 skill-based activity.
- Graph the data collected in the Mission Journal on the graph paper provided, letting students analyze the data individually. Share graphs with the group.
- Find a mean, median, and mode of your reaction times.

  Apply mathematics! Convert the centimeters to millimeters.
  http://www.onlineconversion.com/length_common.htm

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

Fitness Acceleration

- Squeeze a stress relief ball 30 seconds and then try the Speed of Light activity. Did this affect your reaction time? Explain.
- Ride in an elevator while doing the ruler catch activity. Did this affect your reaction time? Explain.
- Do twenty jumping jacks, and then try the Speed of Light activity. Did this affect your reaction time? Explain.

Mission Explorations

- Practice a video or computer game that requires quick decision making.
- Participate in quick-moving sports such as volleyball, tennis, table-tennis, or racquetball.
- Visit an internet site approved by your teacher that has a reaction time test. Some involve changing lights, sounding buzzers, and even driving cars.

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:

- Standard 1: Students will comprehend concepts related to health promotion and disease prevention to enhance health.
    - 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.
    - 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.
    - 5.5.4 Predict the potential outcomes of each option when making a health related decision.
    - 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.
    - 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.
    - 7.5.2 Demonstrate a variety of healthy practices and behaviors to maintain or improve personal health.

National Science Education Standards:
Standard F: Science in Personal and Social Perspectives

- Personal health (K-8)

Standard B: As a result of the activities in grades K-4, all students should develop an understanding of:

- Properties of objects and materials
- Position and motion of objects

National Initiative

Local Wellness Policy, Section 204 of the Child Nutrition and WIC Reauthorization Act of 2004 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.

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

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

NASA Connect™ The Right Ration of Rest: Proportional Reasoning:
http://www.knowitall.org/nasa/connect/index.html

NASA Connect™ Better Health From Space to Earth
http://www.knowitall.org/nasa/connect/index.html

Credits and Career Links

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

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http://www.wylelabs.com/services/medicaloperations/ascr.html

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Appendix A

Distance	Time
5 cm (2 in)	100 ms (0.10 sec)
7.5 cm (3 in)	120 ms (0.12 sec.)
10 cm(4 in)	140 ms (0.14 sec)
12.5 cm(5 in)	160 ms(0.16 sec)
15 cm(6 in.)	180 ms (0.18 sec)
17.5 cm(7 in)	190ms (0.19sec)
20 cm (8 in)	200 ms (0.20 sec)
22.75 cm (9 in)	220ms(0. 22 sec)
25.5 cm (10 in)	230 ms (0.23 sec)
27.5 cm (11 in)	240 ms (0.24 sec)
30.5 cm. (12 in.)	250 ms. (0.25 sec.)