STAR net Hands-on

Tested & Approved STEM Activities

Curiosity Rover's Adventure on Mars

Facilitation Guide

STAR net
Science-Technology Activities & Resources For Libraries

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Curiosity Rover's Adventure on Mars

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Credit: Space Science Institute/NCIL

Overview

Patrons code a programmable toy vehicle, such as the Code & Go Robot Mouse, to travel to different waypoints on a 4′ x 5′ vinyl map of Mars, while learning about NASA's Curiosity Rover and its mission to Mars.

Activity Time

20-40 minutes

Intended Audience

Families or other mixed-age groups, including children as young as 4 years old *with assistance from an older child, teen, or adult*
School-aged children ages 6 and up
Tweens

Type of Program

- ☑ **Facilitated hands-on experience**
- ☑ **Station, presented in combination with related activities**
- ☐ Passive program (if instructions are provided at the start of the course)
- ☐ Demonstration by facilitator

What's The Point?

- **NASA scientists use rovers and other robotic explorers to study other worlds that humans can't travel to safely.**
- **These rovers are operated remotely. NASA programs the rovers to complete tasks by sending them step-by-step instructions from Earth.**
- **Since Mars is our closest neighbor, it is a good candidate for exploring and potentially finding microscopic life.**

Facilitator Note:
This activity helps patrons to build computational thinking skills by creating algorithms (series of instructions on how to accomplish a task) for the programmable toy vehicle.

Materials

For each group of 1-3 participants:

- ☐ Coding educational product to use as a "rover," such as the Code & Go Robot Mouse, the Bee-Bot Robot, Coding Critters, or Sphero Robots.
- ☐ 4' x 5' vinyl Mars map (up to three groups can use the same map at a time). How to order
- ☐ "Curiosity Rover's Adventure to Mars" printouts, printed in color and laminated for re-use. Download here
- ☐ 1 copy of the "Mission Plan" map per group, printed in color on letter-size paper. Download here

Preparation

Before the Activity:

- ☐ Order the 4' x 5' vinyl Mars map (order more than one if you are anticipating doing this activity with more than 9 participants).
- ☐ Print and laminate the "Curiosity Rover's Adventure to Mars" printouts.
- ☐ Print and laminate "Mission Plan" maps (one map per group).
- ☐ Make sure the robotic toy vehicle is turned on and the batteries are charged.

Activity Set Up:

- ☐ Lay out the 4' x 5' vinyl Mars map(s) on the floor.
- ☐ Display the first two printouts near the top of the map for instructions.
- ☐ Optional: You may choose to display the printouts #3-6 near the top of the map for additional background information.
- ☐ Group the remaining printouts in order of Waypoints and leave them in stacks nearby for participants to examine (on a table or on the floor around the 4' x 5' vinyl map).

Passive Program:
This activity works great as a passive program! Simply arrange the activity as described above, leave out some robotic toy vehicles (e.g. Code & Go Robot Mouse, Sphero, etc.) and allow patrons to explore on their own!

Facilitated Activity

1. Share ideas and knowledge.

- Introduce yourself. Help the participants learn each other's names (if they don't already) through an icebreaker activity.

- Optional videos to show:
  - Mars in a Minute: How do Rovers Drive on Mars?: demonstrates how engineers on Earth send computer commands to Curiosity Rover to tell it where to go and what to do.
  - Leave the Driving to Autonav: showcases new technology in which the rover can navigate on its own, without people programming every move.
  - Mars in a Minute: Why is Curiosity Looking for Organics?: explains Curiosity's main purpose, which is to find evidence that Mars could have previously had small life forms called microbes.

- Pass around the first two printouts and discuss the following questions:
  - What is a rover? Who can tell me the names of rovers they know of?
  - Why do we use rovers to explore Mars? What are some things they might be looking for?

- ***Optional***: Pass around the printouts #3-6 to discuss additional background information.

2. Mars Mission!

1. Divide participants into teams of 1-3 people.

2. Give each group a "Mission Plan" map and a robotic toy vehicle (e.g. Code & Go Robot Mouse, Sphero, etc.). Explain that they will be programming the toy vehicle to travel to each of Curiosity's six waypoints, with one additional "wheel check" stop, using the "Mission Plan" map as a guide. When they arrive at each waypoint, they may find the corresponding waypoint printout to get a close-up look of the area.

3. Allow 5 minutes for the participants to become familiar with how to use the programmable robot toy (instructions for use should be included in original packaging).

4. When they're ready, the participants can now start programming the robot toys to get to each waypoint.

Facilitating Large Groups:
If you have more than one programmable robot toy, then several groups can be "exploring" Mars at the same time starting at different waypoints. Participants can work in teams and take turns making the code, programming the robotic toy, and reading the waypoint information.

Facilitated Activity (continued)

3. Conclude

Draw on the participants' observations and reflections, and discuss the following questions:

- What was difficult about getting to each of the waypoints?
- What techniques helped you be successful in programming the mouse?
- What is beneficial about programming a robot to move rather than drive in real time (like a remote-controlled car)?

Extension:
Consider exploring Curiosity's current location on Mars using STAR Net's activity: Tour the Moon or Mars with Google Earth.

Background Information

NASA's Curiosity Rover landed on Mars on August 5, 2012 to search for evidence that Mars could have once been habitable for microscopic life forms. It uses highly advanced scientific tools to collect air, soil, and rock samples in order to find proof that water once existed on the planet and for signs of organic material that could indicate life once existed on Mars.

The rover is operated remotely from Earth. Sending signals from Earth to Mars can take between 13 minutes and 24 minutes. Because of the time delay, NASA scientists must send the rover multiple instructions at a time. However, in case the instructions put the rover in danger, they are equipped with an artificial intelligence that allows them to cancel a command so they don't accidentally fall off a cliff or get damaged.

NASA sends rovers to Mars because it is safer and less expensive than sending humans, but the discoveries made by the rovers will help prepare astronauts to explore Mars in the future!

Next Generation Science Standards

Science and Engineering Practices
- Using Mathematics and Computational Thinking
- Obtaining, Evaluating, and Communicating Information
- Constructing Explanations and Designing Solutions

Disciplinary Core Ideas
- ETS1.A: Defining and Delimiting Engineering Problems
- ETS1.B: Developing Possible Solutions
- ETS1.C: Optimizing the Design Solution
- 3-5-ETS1-2: Engineering Design
- MS-ETS1-3: Engineering Design

Crosscutting Concepts
- Patterns
- Structure and Function
- Interdependence of Science, Engineering, and Technology
- Influence of Science, Engineering, and Technology on Society and the Natural World

Computer Science Teachers Assoc. Standards

- 1B-AP-08: Compare and refine multiple algorithms for the same task and determine which is the most appropriate
- 1B-AP-10: Create programs that include sequences, events, loops, and conditionals
- 1B-AP-11: Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process
- 1B-AP-12: Modify, remix, or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features
- 1B-AP-15: Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended
- 1B-AP-16: Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development
- 3B-AP-11: Evaluate algorithms in terms of their efficiency, correctness, and clarity