CLEAN ENERGY BRIGHT FUTURES
A Program of BEF

LESSON PLAN

Solar SPRK+

Lesson 6: Solar SPRK+ Final Challenge and Presentation

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DESCRIPTION
In this lesson, students will navigate through a maze using their SPRK+ in order to reach the solar charging station. Students will redesign their chariot in order to meet the needs of this new maze in order to carry their solar panels to the charging station, providing energy for their rover to continue working. Following the completion of this maze challenge, students will present their work in a final project analyzing their engineering design process and what they learned about solar energy and mars rovers.

GRADE LEVEL(S)
6, 7, 8

SUBJECT AREA(S)
Engineering design; computer programming; Mars rovers, photovoltaics

ACTIVITY LENGTH
5-10 hours

LEARNING GOAL(S)

1. Students will combine SPRK+ programming with the construction of a compatible chariot in order to guide their SPRK+ "Mars rover" to carry solar panels to a charging station.
2. Students will present a final project to the class that summarizes their knowledge about the scientific background knowledge tied to this project as well as their design and testing process.

STANDARDS REMINDERS

- While students work on various phases of engineering design, they will need to be tracking these phases in an engineering notebook in order to discuss their process and communicate their results clearly in the end. Their final project should function as an assessment of their understandings of the process overall.

REQUIRED MATERIALS

HANDOUTS/PAPER MATERIALS

- Student engineering notebooks for tracking progress
- Project Overview sheet

CLASSROOM MATERIALS

- Light source (e.g. 250 Watt halogen work light)
- Constructed maze
    - Maze ruler tape and protractor (these come with SPRK+ ball)
    - Assortment of guides and simulated problems one might find on Mars (ramps, bridges, etc).

ACTIVITY MATERIALS (GROUPS OF 3-4)

- Sphero SPRK+
- (Micro-USB to double alligator clip test cable
- Solar Panels for charging Sphero
- (1) SPRK+-compatible device (any Bluetooth Low Energy device, such as iOS and Android devices, Chromebooks, and Kindle Fire. Search google "What device is Sphero SPRK+ compatible with?" for more details from sphero.com
- Sphero Chariot, as built/designed by group

LESSON PROGRESSION

PLANNING AND PREP

Build and set up the maze for students. Make sure to include a variety of angles for SPRK+'s to maneuver around. Additionally, make sure that the width of the maze is constructed according to insight from previous chariot designs and discuss this constraint with students beforehand.

LESSON SEQUENCE

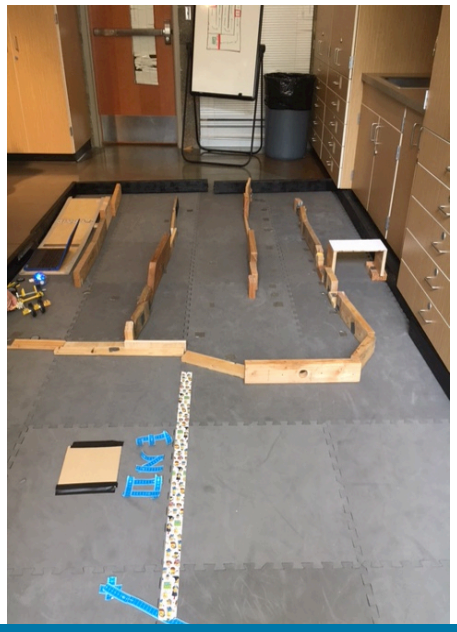

Figure 1. Maze

INTRO

- During this lesson, students will be required to combine the knowledge they have acquired in coding, engineering design, and photovoltaics into one larger project that asks them to navigate a complicated maze with their SPRK+, carry the solar panels needed to charge their rover, and connect to the charger once reaching the station.
- After completing the maze project, students will present their final projects to the class as a final assessment.

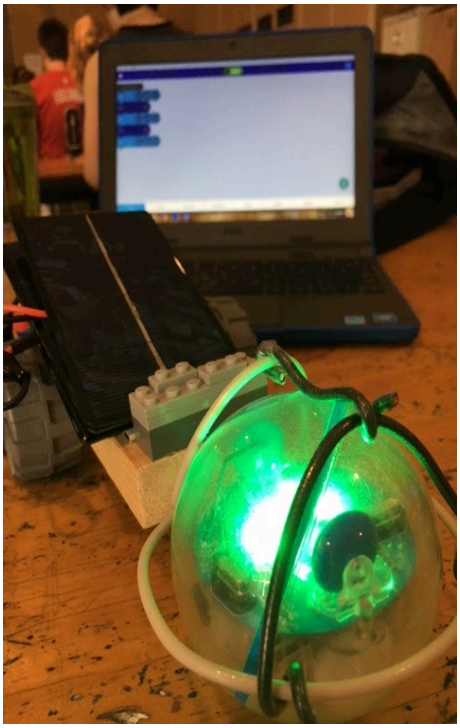

Figure 2. Sphero with Chariot and Computer Code.

MAZE CHALLENGE

- For this challenge, students can follow the same procedures of the engineering design cycle as above, either modifying their original design to meet new needs or start from scratch upon seeing the obstacle course.
- Students should complete the coding process first, making it through the obstacle course, then add on the chariot component and adjust direction and speed accordingly.
- In their engineering notebooks, a section can be included where they track their design and results for each run in order to keep records of what is successful.

PROJECT PRESENTATIONS

- Students should be given the “Solar Rover Project Overview” sheet in order to get a sense of the required content for their presentations. For definitions and science content, make sure that students have records of vocabulary and processes in their notes so that they can elaborate on using online research. If they are trying to start online to find their definitions, they will find very non-student-friendly terms and explanations.
- Use the project score sheet and numbers that work with your schools grading style to determine the total points awarded to each group.

ASSESSMENT AND EXTENSIONS

FORMATIVE ASSESSMENT

The teacher will track student progress in their engineering notebooks. Students will be informally assessed in how detailed their notes and findings are for different stages of the engineering design process and how well they are incorporating these findings into later designs.

SUMMATIVE ASSESSMENT

The final project presentation, in conjunction with observations of their completion of the maze, will serve as a final assessment for the unit.

LESSON EXTENSIONS

Students can continue to complete different and more challenging mazes with their Spheros. Another tactic could be to have students create their own mazes to challenge other teams, having them determine successful coding strategies during this project before handing it over to a different team.

Beyond the presentation outlined here, there could additionally be more of a focus on careers associated with programming and software engineering beyond aerospace. Students could work on a new section of their presentation or an entirely different presentation could be assigned that focuses on this. One method of approaching this from a design perspective could be through the creation of a plan for an app or functioning app using Scratch and presenting the idea to “investors.”