Sphero Rover

Overview:
In this activity, students will learn the basics of how to connect, aim, drive and block code the Sphero BOLT robot. Youth will then practice coding and problem solving to code their robot to complete a sample Mars mission.

Goals:
- Learn how to connect to the Sphero BOLT
- Learn how to aim the Sphero BOLT
- Learn how to drive the Sphero BOLT
- Learn how to use block coding to code the Sphero BOLT.

Time Required: 2-3 hours

Materials:

For each student (or pair of students):
- Sphero BOLT Robot
- iPad or other compatible device
- Ruler, meterstick, or measuring tape
- Sphero Heading Protractors (for Mars Mission activity)

Background:

The Sphero Bolt is a programmable robot that can be used with children of all ages and skill levels. While coding is a primary focus, Sphero can be used to teach STEM, problem solving, storytelling, and other topics across the curriculum and project areas. Sphero's online library provides a variety of educational activities, curriculum and support.

The BOLT Power Pack comes with an educator guide that provides valuable information on setup and care of your robots, along with some sample lessons. There is also a glossary and list/description of the different blocks.

There are 4 different program types you can use to operate the BOLT – Drive, Draw, Blocks, and Text.

First, is the Drive function. This allows you to drive the robot like a remote-control car, no coding necessary.

With the Draw program you draw a path on the screen for your BOLT to travel. You can change the colors and speed of the robot by clicking on the tools on the bottom left of the screen.

The Blocks program allows you to use drag and drop block coding to design a program for your robot. This lets you have more control and write more complex programs.

Finally, the Text option allows advanced coders to use JavaScript to write their code.

Procedures:

Connect Robot:

Begin by connecting your robot to the Sphero Edu app on your device.
1. Open the Sphero Edu app and ensure that Bluetooth is enabled.
2. Tap the "Connect Robot" icon at the top right of your screen.
3. Select your robot type.
4. Hold your robot next to the device and select it to connect. If you are using multiple robots, look for the robot with the strongest bluetooth signal.
   Tip: If you are connecting with a group, connect one at a time, otherwise you may not know which BOLT you connected to. Once you have connected, change the color of your robot to help you keep track of it!
   Troubleshooting: If a Sphero cannot be detected move your device closer to the robots. If you are unable to connect, close the app, then reopen it and try again.

Aim Robot:

Now that your Sphero robot is connected to Sphero Edu, let's practice aiming. All Sphero robots need to be "aimed" and oriented relative to your position, so that forward for the robot and you are the same direction.
1. Place your robot on the floor or a flat surface.
2. In the Sphero Edu app, select "Drive".
3. Tap the "Aim" button.
4. Drag the aim ring until your robot's blue "taillight" is pointing directly at you.
   Tip: "Aim Often" is a good mantra with these robots. Make sure to aim each time before starting to run your program.

Drive Robot:

Your Sphero robot should now be aimed and connected to the Sphero Edu app. From the drive screen, you can drive your robot.
- Drag the blue circle inside the gray circle to drive your robot and control its direction.
- The blue circle on the vertical line controls the speed.
- Change your Sphero robot's color by dragging the white circle around the color wheel.

Practice aiming and driving your robot by moving it from one side of the room to the other and back again.

Block Coding:

1. **Select the new program button** in the right sidebar (plus sign in the lower right).
2. Name your program, choose **Blocks** as your program type, and choose **BOLT** as your robot.

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3. Select **Create** to open the Block Canvas.
4. Take a look around and find the following:
    - The drive and aim buttons
    - The block library
    - The Roll Block (the first movement block says: roll 0 at 0 speed for 0s)
5. Blocks are divided into color-coded sections. Blue is movement, green blocks control lights, and red plays sounds. Other colors indicate operators, sensors, variables and functions – these all come in for more complex codes.
6. The Roll Block has three inputs:
    - **Speed**: how fast your robot will roll, 0-255
    - **Heading**: the direction your robot will roll, 0-359, in degrees
    - **Duration**: the amount of time that your robot will roll, in seconds
7. To build your program:
    - Click on the Roll Block and drag it up to connect to the On Start Program block in the canvas. Click on the 0s to add values. Continue clicking, dragging, and customizing blocks to build your program.
    - How far does you BOLT roll at a chosen speed in 2 seconds?
    - What speed and time should you use to get your Sphero to travel 1 foot (30cm)
    - Use this information to help you in the next activity.

Program a Square:

1. Right click or long press on the **roll block** and select **duplicate**.
2. Repeat until you have four total **roll blocks**.
3. Snap them together underneath **on start program**.
4. **Adjust the inputs** to make your BOLT roll in a square.
5. Select **Start** to test your program.
6. Test and revise until BOLT makes all four sides of the square.
    - *What values did you use for the heading inputs?*
    - *Did your BOLT roll in a square? Why or why not?*
    Hint: You do not have to change any of the speed or duration inputs!
7. Extensions: Add Delay Blocks between each Roll Block. How does this affect your program?
8. Extensions: Use the Light Blocks to change the colors of your BOLT, experiment with the animation matrix.
9. Extensions: Add sounds to your program. *Note:* the sounds will come from the device NOT the BOLT.
10. Extensions: Can you make BOLT:
    - Play a different sound at every corner?
    - Play a sound while rolling?
    - Show a different color for each side of the square?
    - Count and show the number of sides will rolling?
    - Drive a square with sides that are exactly 2 feet?
    - Repeat the square 3 times using the Loop Block?

Sphero's Mission to Mars
1. Complete the Sphero's Mission to Mars activity.
2. It takes anywhere from 5-20 minutes for a signal to get from Earth to Mars (depending on planet positions). For this reason, the spacecraft at Mars need to operate autonomously.
3. Have students draw a picture of the obstacle course in their mission notebooks. Encourage them to label the checkpoints, measure the distances between them, and write down the headings needed to travel between checkpoints.
4. Encourage students to build their best code, test and then refine. Try to avoid "trial and error" coding.
5. Use the Exit Program block (purple) to end or stop the program once you have reached the final checkpoint.
6. Wrap up by having students define terms in their glossary.

Common problems / Additional guidance:

This lesson can be broken up into 2-3 sessions as needed. For example, you could start by practicing connecting, aiming, and driving the robots. Set up a maze for them to drive through. The next session you can start block coding, and program the square. Finally, use the Mars Mission for the 3rd and final session.

Using the app:

Having students create an account will let them save their work to the cloud. Students do not need to sign in or create an account to use the app (quick start). However, they will not be able to save work to the cloud (you can save it on the device)

Programming:

Programming not working as planned? Insert a Delay Block, set the time for 1s. This often helps the robot transition from one block of code to another.

There are often multiple ways to program the same challenge. There is not necessarily a "right" way. If the BOLT does what you want, you wrote the code correctly!

Touching and holding on a block will let you open up the Block Help with a description of how this block can be used.

Once you start the program, you can stop it again at any time by clicking on the Stop button at the top center (same button, it changes from start to stop)

Adapted from the following lessons:
- Introduction to Sphero Edu: https://edu.sphero.com/cwists/preview/52597x
- BOLT Blocks 1: Roll Block Squares: https://edu.sphero.com/cwists/preview/1671-blocks-1-loopsx

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