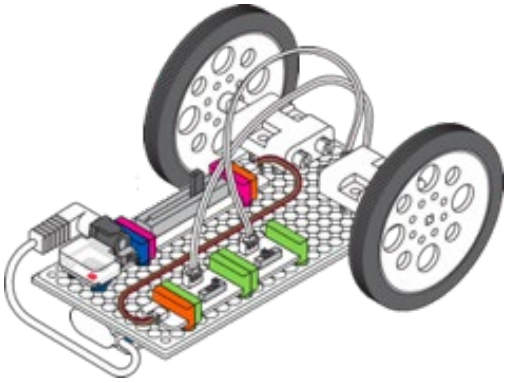
littleBits education

LESSON

Speed Racer



Overview

In this lesson, students will:

- Observe and measure the motion of a self-propelled vehicle.

THE CHALLENGE

Design and measure the speed of a self-propelled vehicle.

Lesson Tags

GRADE LEVEL:

Elementary (grade 3)

SUBJECTS:

Science, technology, engineering

DIFFICULTY:

Beginner

DURATION:

45 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic understanding of forces and motion

Supplies

Bits:

- STEAM Student Set (power, slide dimmer, wire, 2 DC motors, battery and cable, battery clip, 2 wheels, and mounting board)

Tools Used:

- Pen/pencil
- Meter Stick
- Stopwatch (or smartphone)
- Masking tape

Other Materials:

- Optional: craft and recycled material for car decoration

Description

LESSON OUTLINE:

INTRO: Introduce the lesson prompt and assess students' current knowledge.

CREATE: Groups of 2-3 students start to build their inventions.

PLAY: Students test their prototypes to make sure that it works and record their data.

REMIX: (If needed: Make changes to their inventions based on how testing went.)

SHARE: Students compile their findings and prepare to share.

ASSESSMENT STRATEGIES:

FORMATIVE ASSESSMENT: Circulate the classroom as students work, assessing their use of the Bits, teamwork, and any other relevant skills you wish to focuson. Depending on students' level of experience, you might look for students putting Bits together backwards (e.g. trying to force them together and not aligning the right sides and getting a magnetic snap), students not adding a power source etc.

SUMMATIVE ASSESSMENT Students should complete the student handout. You may choose whether this is an individual or group submission.

Standards

NGSS

3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Vocabulary

Motion
Speed
Direction
Average
Self-propelled
Position

Resources

ATTACHMENTS

Speed Racer: Student Handout

SUPPORTING LINKS

Understanding Motion

TIPS & TRICKS

#1: Keep an eye on the clock, and where students are at. Some students will want to spend too much time in the Create stage, and some students will try tospeed through it.

#2: We occasionally update our Bits and accessories, so some of the names and images included in the student handout may look different from those in your STEAM Student Set. Use your Invention Guide from within your Kit to support students with the parts that they have accessible to them. Use a rubber band or glue dots if you don't have a battery clip in your Kit. The invention will function the same!

PACING (45 mins)

Prep + Setup
Intro (10 mins)
Create (15 mins)
Play (10 mins)
Remix (optional)
Share (5 mins)
Close (5 mins)

Instructional Steps

Step 1: SETUP

DURATION: 10 minutes (prior to class)

This lesson can be done individually or in small groups (2-3 students). Each group will need one STEAM Student Set and a lesson handout. Set up a central location in the classroom for assorted materials and tools.

Each group will need a power Bit, slide dimmer, 2 DC motors, wire, battery and cable, battery clip, 2 wheels, and mounting board. If you don't have a battery clip in your kit, use tape, glue dots or elastic bands to secure the battery to the board. Younger students can start out with just these materials, so they aren't overwhelmed and don't try to add unnecessary Bits. Older/more confident students can have access to any Bits in their Kits.

Each group will need a large amount of floor space to test their vehicles, preferably without carpet and free from obstacles. Consider making arrangements for students to complete this challenge in a hallway, gym, or similar space.

NOTES

- You should use a classroom timer or digital timer to help keep students on track.

Step 2: INTRODUCE

DURATION: 10 minutes

Discussion

Elicit student responses to gauge understanding and warm-up for the activity.

1. Set the stage for the challenge: "Imagine a race car track during a race. Now picture one red race car that surges ahead of the pack. What are some ways that this car's motion can be measured and described?"
    a. Answers include: We could describe the relative motion of the car (for example, 12 meters in front of the green car), direction (moving forward), or we can measure the speed that the car is moving.

2. Review with students that motion can be described using an object's position and direction. Any time an object's position changes, motion has occurred.
3. **Writing Box #1**: Sketch yourself riding in a car. What is something that might affect the motion of the car? How might you be able to tell if the car speed changes?
4. Discussion: Ask students to briefly share out their responses. Students might say that the driver can affect motion by turning the car, and that we might feel the motion by our body moving to the side, or even our hair moving differently if we're in a convertible car!

Introduce the Challenge

Explain that they'll use littleBits and the littleBits Invention Cycle to engineer our own moving race. Then we'll test our cars to see how fast they can go! The activity will be brokenup into the following steps:

CREATE: Build your invention following the directions given.

PLAY: Test your circuit and invention to see how well it works and record your data.

REMIX: (If needed: Make changes to your inventions based on how testing went.)

SHARE: Compile your results and reflections to share with the class.

Divide the class into groups of 2-3 and have them set up their workstations.

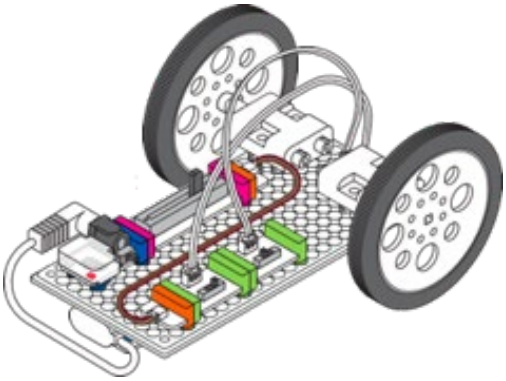
Step 3: CREATE

DURATION: 15 minutes

Students will follow the instructions in the student handout to build their race cars.

NOTES

- If this is your first lesson with littleBIts or your students need a little extra help getting started, have students reference the Bit Index in their STEAM Student Set Invention Guide or the littleBits website to learn how specific Bits work.
- The Create phase may take more or less than the allotted time, depending on the group and students' familiarity with littleBits. You may want to give students guidance on what they should do after assembling their circuit (e.g. move on to the Play phase to test their circuit), so they can self-pace.



Step 4: PLAY

DURATION: 10 minutes

Test your invention!

Turn on and test your circuit! Move the slide dimmer to change the speed of your car. Your car should move in a straight line. If it's spinning in a circle or moving backwards, double check that your DC motor settings match step #5 in your student handout.

Let's Measure the Speed of our Race Car!

Each group should have a meter stick, stopwatch and masking tape.

Writing Box #2: Make a plan to measure how fast your race car is moving. Make sure to use all of the materials in your plan. How will you know how fast your race car is traveling?

Writing Box #3: Have each person in the group take a turn testing the race car. Record the time, distance, and speed of your race car each time.

Encourage students to have speedy trials, i.e. 10 seconds each.

Step 5: REMIX

DURATION: Optional

If any students struggled with their invention, allow a few minutes to adjust the circuit or materials so they can move onto the data collection.

Step 6: SHARE

DURATION: 5 minutes

Ask each student group to share their testing results, identifying the method they used to calculate speed as well. What units did students use to measure distance, time and speed? If you'd like to do a class average, have each group to provide their top speed. Then, calculate the "Class Average Top Speed" on the board, showing students your math process.

Writing Box #4: Did you get the same results each time you tested your race car? If not, why do you think the results were different? Hint: How did position and direction affect your speed?

Step 7: CLOSE

DURATION: 5 mins

Students should take apart their inventions and put away the Bits according to the diagram on the back of the Invention Guide. Students should clean up their workspace and return any usable materials/tools.

NOTES

- Remember that Bits aren't made out of titanium, so a calm and productive clean-up closing section is important to keep Bits safe.

Step 8: EXTENSIONS

Consider the following invention extensions:

- Use recycled materials and art supplies to give your race car a body or form. Give it some character!
- Engineer a remote race car that you could control with a flashlight! Students may replace the button with the light sensor Bit.
- Mix it up! Change one Bit in your race car design (for example, add the slide dimmer or the pulse Bit). Make a prediction about how this might change the motion of your race car, and then repeat the speed trials.