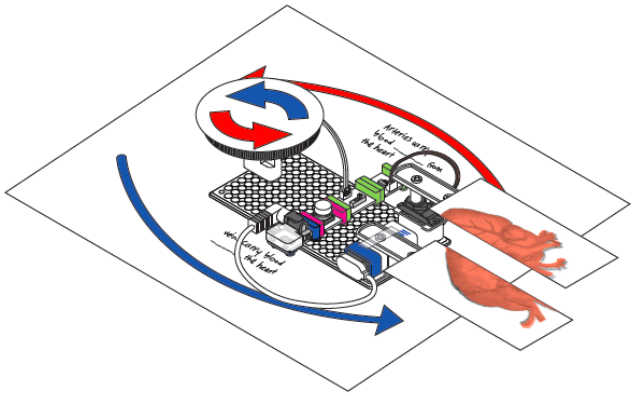
littleBits education

LESSON

Heart Beats



Overview

In this lesson, students will:

- Identify the journey of oxygenated and deoxygenated blood throughout the body as it circulates through the heart.
- Articulate that the heart squeezes blood with each beat.
- Address misconceptions about the heart, including its shape and what a heart beat is.

THE CHALLENGE

Design a littleBits model of the circulatory system to demonstrate the movement of blood with each heart squeeze.

Lesson Tags

littleBits education

HEART BEATS

GRADE LEVEL:

Elementary (grade 4)

SUBJECTS:

Science, technology, engineering, art

DIFFICULTY:

Beginner

DURATION:

60 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic understanding of the circulatory system

Supplies

Bits:

- STEAM Student Set (power, button, servo, DC motor, battery and cable, battery clip, wheel, 2 mechanical arms and mounting board)

Tools Used:

- Pen/pencil
- Blue and red markers/crayons
- Scissors
- Tape

Other Materials:

- 1 per class for demo: pitcher or large bowl of water + kitchen sponge

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.

REMIX: (Optional: Make modifications to the invention.)

SHARE: Use the model to connect students' heart beats to what is happening inside their bodies.

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 focus on. 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

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Vocabulary

Circulatory System
Heart beat
Oxygenated
Deoxygenated

Resources

ATTACHMENTS

Heart Beats: Student Handout

SUPPORTING LINKS

Mocomi's Illustrated Video of the Heart

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 to speed 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 (60 mins)

Prep + Setup
Intro (10 mins)
Create (25 mins)
Play (5 mins)
Remix (optional)
Share (15 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, button, servo, DC motor, battery and cable, battery clip, wheel, 2 mechanical arms 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.

For the demo in the introduction, fill a pitcher or large bowl with water and place it next to a dry sponge at the front of the class.

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. **Writing Box #1:** Ask students, “In what way is the heart like a sponge?” Allow students time to write their responses. Then, elicit their answers in a “popcorn” fashion, allowing students to informally “pop” out ideas.
2. Demo: Dip the sponge in the water while squeezing, and allow the sponge to fill with water. Then, hold the sponge out of the water for students to see. Ask them, “How can I get all the water out of this sponge?” Guide students to articulate that you should squeeze the sponge. Do this a few times to establish a rhythm, demonstrating that with each squeeze, water comes out from the sponge.
3. Ask students again, “In what way is this sponge behaving like a heart?” Students may vocalize that our heart “squeezes” blood to our bodies. Guide them through the discussion to articulate that we know that each time our heart squeezes blood–it’s our heartbeat!
4. Solidify the idea that with each heartbeat, our hearts fill with blood, both oxygenated and deoxygenated, and squeeze the blood in need of oxygen to the lungs, while squeezing the oxygenated blood to the body. If students need to visualize this cycle, consider showing them Mocomi’s Illustrated Video of the Heart (link in Supporting Materials).
5. **Writing Box #2:** Allow students time to draw a model of this cycle. Ask groups to share out their models, gently correcting any misconceptions.

Introduce the Challenge

Explain that they’ll use littleBits and the littleBits Invention Cycle to create an interactive model of the circulatory system to demonstrate how our heart beats. The activity will be broken up into the following steps:

CREATE: Build your model following the directions given.

PLAY: Test your circuit to see how well it works.

REMIX: (Optional: Make any modifications to fix or improve the model.)

SHARE: Use the model to connect your heart beats to what is happening inside your bodies.

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

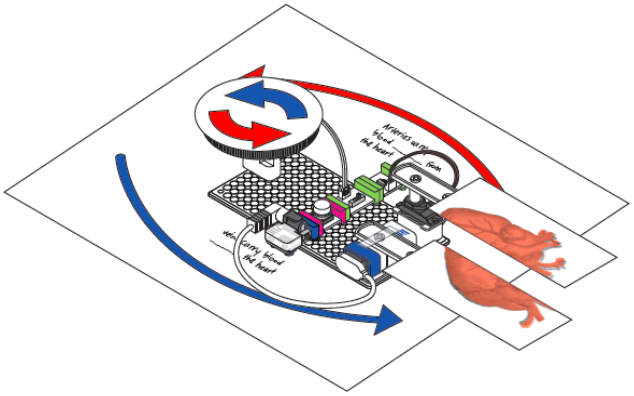
Step 3: CREATE

DURATION: 25 minutes

Students will follow the instructions and diagrams in the student handout to build their heart model.

NOTES

- If students need a little extra help getting started, 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 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: 5 minutes

Test your invention!

Turn on the power button and press the button quickly to see that the DC motor rotates slightly, while the "heart" beats open and closed. Turn to a partner and take turns explaining how your model helps show how the heart moves blood through our body.

Step 5: REMIX

DURATION: Optional

Make sure all students have a properly functioning model before moving onto the next phase.

Step 6: SHARE

DURATION: 15 mins

Prompt students to record and explore their models.

1. **Writing Box #3:** Ask each group member to place their two fingers on the side of their neck to feel their pulse. Tell the room to be quiet as you time them for 15 seconds. Ask everyone to silently

record how many times their heart beats in those 15 seconds.

2. Ask the groups how we can figure out our heart beats per minute. Guide students to understand that there are 60 seconds in a minute, and there are four groups of 15 seconds in 60. Allow students time to multiply their Column B number by four and write it down. This is their "resting" heart rate.
3. Give students a few minutes to demonstrate normal heart rates with their model. They may discover that, unlike our hearts, our model is imperfect and can't pump as efficiently as our muscles.
4. Explain that our heart is an efficient muscle that can beat faster if we need more oxygen. Ask students what could make us need more oxygen.
    a. Students may answer running, jumping, dancing, climbing, or playing at recess.
    b. If time permits, have students do 15 jumping jacks, followed by another 15 seconds of counting their heart rate. This will help them see their heart rate elevate.
5. Explain that it's normal for our heart rates to rise when we exercise. When a resting heart rate is very high, without exercise, this is called "tachycardia," and usually indicates problems within the heart.
6. Take a moment to establish a normal heart rate on your circulatory system by pressing the button smoothly and slowly. Then, symbolize a quicker heart beat by pressing the button rapidly. Groups will notice that the arms can't open and shut fast enough, just as our heart can't efficiently pump blood if it goes too quickly.
7. Wrap up with a class brainstorm: What are some ways we can take care of our hearts?
    a. Students might contribute that we should eat a good diet to stay healthy; that we should get exercise, because our heart is a muscle that needs "working out"; that we should get plenty of sleep to allow our heart time to rest.

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.

Step 8: EXTENSIONS

Consider the following invention or discussion prompts:

- Ask students how we could "automate" our "heart beat" to symbolize the fact that our hearts never stop working? Students may suggest we trade the button Bit for the pulse Bit.
- Challenge two groups to join together to demonstrate both pulmonary circulation (the heart pumping deoxygenated blood to the lungs) and systemic circulation (the heart pumping oxygenated blood to the body).