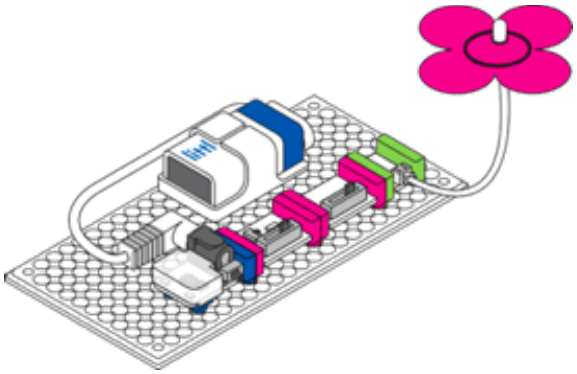
littleBits education

LESSON

Plant Adaptations



Overview

In this lesson, students will:

- Investigate specialized plant structures and describe their roles in food production, support, water and nutrient transport, and reproduction.
- Engineer a model of a plant structure and explain how it supports growth and survival.

THE CHALLENGE

Create a model of a new plant species that has specialized structures to help it survive!

Lesson Tags

PLANT ADAPTATIONS

GRADE LEVEL:

Elementary (grade 4)

SUBJECTS:

Science, technology, engineering, art

DIFFICULTY:

Beginner

DURATION:

60 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic understanding of plant structures and adaptations

Supplies

Bits:

- STEAM Student Set (power, light sensor, pulse, long LED, battery and cable, battery clip, and mounting board)

Other Materials:

- Construction paper
- If remixing the plant model, provide assorted materials, like pipe cleaners, felt, paper tubes etc.

Tools Used:

- Pen/pencil
- Marker
- Scissors
- Tape
- Light source: from phone or flashlight

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: Suggest, or make design changes to, their inventions to improve its' function.

SHARE: (Optional: Share the remixed inventions with the class.)

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

Adaptation	Species	Carnivore
Specialization	Structure	

Resources

ATTACHMENTS

Plant Adaptations: Student Handout

SUPPORTING LINKS

NASA Climate Kids: Plants and Animals

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 (45 mins)

Prep + Setup

Intro (15 mins)

Create (20 mins)

Play (5 mins)

Remix (15 mins)

Share (optional)

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, light sensor, pulse, long LED, battery and cable, battery clip, 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.

NOTES

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

Step 2: INTRODUCE

DURATION: 15 minutes

Discussion

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

1. Set the stage: “When you stop and think about it, plants are really super! All plants have the same basic structures, like roots and stems, but some plants have also developed their own unique structures that are essential for the plant’s survival. These specialized structures can help with food production, water and nutrient transport, plant support, and even reproduction.”
2. **Writing Box #1:** What are some challenges that a plant might encounter in its environment, that can lead the plant to develop a specialized structure over time?
    a. Students will explore a list of specialized plant structures and describe how each structure helps the plant survive Some examples include: Thick leaves that swell to store water (lack of precipitation); stems that wrap around objects (strong winds); petals that close up at night (cold temperatures); thorns and prickles (need protection from predators); long roots that grow deep into the ground (loose soil).
3. **Writing Box #2:** Imagine that you are a botanist who has discovered a new carnivorous plant species that eats insects through its flowers. This plant shares its habitat with an aggressive insect species that likes to feed on the plant’s leaves at night. What challenge might this present to the survival of plants in this area?
    a. Potential Answer: Plants need their leaves for photosynthesis, which produces food for the plant. If insects eat too much of the leaves, the plant will die.
4. **Writing Box #3:** Think about the challenge your plant is facing. Which plant structures could be specialized to help the plant survive?
    a. Potential Answer: Our plant could have some type of luminescence or light that attracts the insects away from its leaves and into the center of its flowers, where it can trap and eat them.
5. Since the insects feed at night, we’re going to engineer a plant that responds to light. It will have a flashing light that comes on when it is dark outside to attract the pesky insects into its trap.

Introduce the Challenge

Explain that they’ll use littleBits and the littleBits InventionCycle to create a model of a new plant species that has specialized structures to help it survive. The activity will be broken up into the following steps:

CREATE: Build your invention following the directions given.

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

REMIX: Consider ways to improve your plant, then try it out!

SHARE: (Optional: Share your remixed inventions.)

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

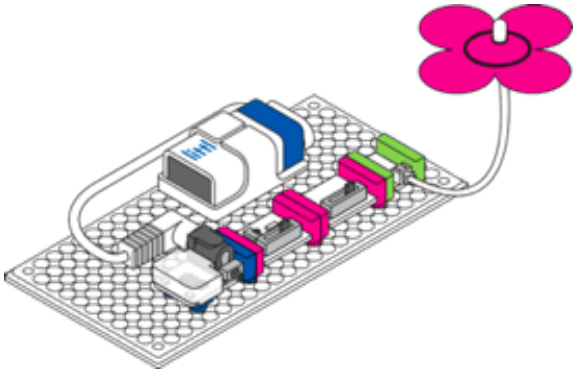
Step 3: CREATE

DURATION: 20 minutes

Students will follow the instructions in the student handout to build their plant model. Note that for step #14, students can also model "nighttime" by using their finger to cover up the light sensor. Then lift their finger off the sensor to demonstrate "daytime."

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!

Now let's see how well your plant protects itself against insects at night! Place your invention in a dark area and shine your flashlight at the light sensor. Now turn off the flashlight for a few seconds, and turn it on again. How does your plant respond?

Step 5: REMIX

DURATION: 15 mins

Writing Box #4: How might you improve your design? What changes would you make to better protect the plant? Have students write and/or sketch their ideas, then experiment with bringing their ideas to life.

Step 6: SHARE

DURATION: optional

If time, allow groups to share their remixed invention and design choices.

Step 7: CLOSE

DURATION: 5 mins

Students should take apart their inventions and put away the Bits according to the diagram on theback 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:

- Learn where technology meets nature! Create a littleBits invention that interacts with a real plant while it is growing. For example, you might engineer an automatic watering machine or experiment with growing conditions under different colored lights.