

LESSON

# Inherited Traits

 Overview

In this lesson, students will:

- Explain that living things inherit many characteristics from their parents.
- Demonstrate that traits vary in a group of similar organisms.

**THE CHALLENGE**

Design a spinner that shows inherited traits for a litter of puppies.

 Lesson Tags

**GRADE LEVEL:**

Elementary (grade 3)

**SUBJECTS:**

Science, technology, engineering, art

**DIFFICULTY:**

Beginner

**DURATION:**

45 minutes

**PREREQUISITE KNOWLEDGE:**

- littleBits basics
- Basic understanding of how genetic information is passed to offspring

## Supplies



### Bits:

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

### Tools Used:

- Markers/drawing materials
- Tape/glue
- Scissors

### Other Materials:

- 2 sheets of paper
- 1 die
- Optional: Decorating materials (stickers, glitter, pipe cleaners etc.)



## 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 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

**3-LS-3-1** Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.



## Vocabulary

Traits  
Organism

Inherit  
Offspring

Prototype  
Variation



## Resources

### ATTACHMENTS

[Inherited Traits: Student Handout](#)

### 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 (10 mins)

Create (20 mins)

Play (5 mins)

Remix (5 mins)

Close (5 mins)



## Instructional Steps

### Step 1: SETUP

**DURATION:** 10 minutes (prior to class)

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This lesson can be done individually or in small groups (23 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, DC motor, battery and cable, wheel, 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 it 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.

Consider "Designating Jobs" within student groups. Some possible roles to consider are Materials Technician, Artist/Scribe, Builder, and Presenter.

The lesson introduction asks students to identify traits they have inherited from either of their parents, which may be a potentially sensitive subject for students who are adopted, have a blended family, or do not live with their biological parents. Depending on your students, you may wish to adapt this section in response to any sensitivities.

#### NOTES

- You should use a classroom timer or [digital timer](#) to help keep students on track.



### Step 2: INTRODUCE

**DURATION:** 10 minutes

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#### Discussion

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

1. Ask students to think about some of their physical characteristics, such as eye color, hair color, or the shape of their nose. Then, set the stage for the challenge by asking students, "Who else in your family shares these features?" Encourage students to discuss familial resemblance, especially traits that come from either one of their parents. Review what it means to have an "inherited trait."
2. **Writing Box #1:** Sketch a picture of one (or both) of your parents and label any traits that you have inherited. Keep in mind that some traits may come from grandparents, or even great-grandparents!

## INHERITED TRAITS

3. Discuss: “Imagine that I was born into a family with three children, and we have the same parents. Why don’t I look exactly the same as my siblings?” Students should begin to articulate that while offspring of the same parents have similar inherited traits, they can also have differences which are called variations.
4. Explain that we know that offspring usually look a little like their mother and a little like their father.

### Introduce the Challenge

Explain that they’ll use littleBits and the littleBits Invention Cycle to create an invention that can show these different variations. We’re going to imagine that we are dog owners and we’ll use a traits spinner to show what our litter of puppies might look like using 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.



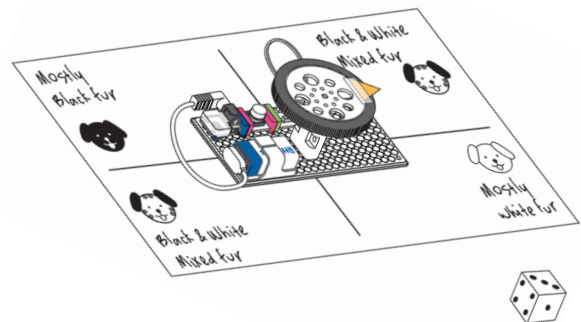
## Step 3: CREATE

**DURATION:** 20 minutes

Students will follow the instructions in the [student handout](#) to build their spinners.

### 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), so they can self-pace.





## Step 4: PLAY

**DURATION:** 5 minutes

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### Test your invention!

What will your litter of puppies look like? Roll the die. Press and hold the button for that many seconds, and then let go of the button.

**Writing Box #2:** Each person in the group takes a turn rolling the die and pressing the button. Record the fur color for all six puppies.



## Step 5: REMIX

**DURATION:** 5 minutes

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If any students struggled with their invention, allow a few minutes to adjust the circuit or materials so they can record their findings.

Encourage each group calculate the fraction of puppies that have all black fur, white fur and mixed black and white fur and record the answers in their handout.

**Writing Box #3:** Why did we use a die? In what way does this make our model more accurate? How could our model be improved?



## Step 6: SHARE

**DURATION:** 5 minutes

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Prompt students to extend, record, and explore their creations.

1. Ask each student group to share their puppy litter results, identifying the fraction of puppies that have black fur, white fur, or a mix of both. For example, how many of the 6 puppies are mostly white? Students may answer 2 out of 6, and may even notice that's one-third. Discuss: "What do you notice about our litters of puppies?"

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- a. Answers might include: Even though each group had the same parent dogs, the litters had variation. This is because offspring inherit some traits from the mother and some traits from the father.
2. **Writing Box #4:** Offspring inherit more than just their looks from their parents. A trait can also determine the way an organism survives or behaves. For example: A fish is born with gills so it can breathe underwater. Besides fur color, imagine some other traits that your puppies inherited from their parents. Sketch and label your ideas.



### Step 7: CLOSE

DURATION: 5 mins

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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.
- *Tip: Before this lesson, practice having students clean up Bits in a low-stress [interactive model](#). Have students highlight best practices they see as they clean up.*



### Step 8: EXTENSIONS

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Consider the following discussion and invention extension questions:

- Try using different inputs in your circuit. How does that change the way the spinner moves? Does it change your predictions?
- Could you use a different motion Bit as a spinner? Experiment and find out!
- Use your spinner design to create a board game about life cycles and traits, perhaps of other animals such as fish, birds, or a favorite pet!