Grade 3: Life Science Module: Unit 2

Lesson Sequence 2: Environment and an Organism's Traits

Lesson Sequence 2: Environment and an Organism's Traits

Overview

Total Time: 2.5 hours of instruction (divided into two sections)

In this lesson sequence, students learn about cause and effect relationships between an environment and an organism. Through a simulation and an original investigation, students learn that the traits of an organism and ultimately its survival are affected by the environment.

Lesson Sequence Focusing Question and Big Idea

How does an organism's environment affect that organism's traits?

- There is a cause and effect relationship between an organism's traits, like height or weight, and the environment it lives in. For example, an animal that is in an environment with plenty of food will grow to its optimal weight and therefore survive well. On the contrary, an organism that does not have its needs met, like a plant without enough water, may not be able to grow to its optimal height and therefore may not survive as well.

Long-Term Learning Addressed (Based on NGSS)

Construct an argument about the cause and effect relationship in which some traits, such as plant height or animal weight, are influenced by environment. (Based on NGSS 3-LS3-2)

This lesson sequence explicitly addresses:

Science and Engineering Practices:

- **Planning and Carrying Out an Investigation:** Collaboratively plan and conduct an investigation to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. *Students design an original experiment in which they investigate how the environment affects the growth of duckweed. Note: This Science and Engineering Practice is not explicitly aligned with* 3-LS3-2.
- **Engaging in Argument from Evidence:** Construct an argument with evidence. *Students construct an argument of the cause and effect relationship between an organism's expression of traits and its environment. Note: this is not explicitly linked with* 3-LS3-2.

Crosscutting Concepts:

- **Cause and Effect:** Students routinely identify and test causal relationships and use these relationships to explain change. *Through a bullfrog simulation and a student-led experiment with duckweed, students observe there is a cause and effect relationship between an organism's traits and its environment.*

Disciplinary Core Ideas:

- **LS3.A Inheritance of Traits:** Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. *Students observe how the bullfrog's inherited traits (e.g., size) are influenced by the environment.*

- **LS3.B Variation of Traits:** The environment also affects the traits that an organism develops. *Students observe that the environment affects the traits of duckweed and bullfrogs.*

Lesson Sequence Learning Targets

- I can play the Hungry Bullfrog game to explain the cause and effect relationship between a frog obtaining enough food and its ability to survive well in an environment.
- I can develop an experiment to test the cause and effect relationship between the environment and a plant's traits.

Ongoing Assessment

- Student science notebook: Environment and an Organism's Traits entry
- Scientists Meeting: Building Understanding

Agenda

Total Time: 2.5 hours of instruction

Section 1

1. **Opening**
   A. Reviewing Learning from Unit 1 (10 minutes)
   B. Constructing a Habitat Anchor Chart (15 minutes)
2. **Using Models**
   A. Hungry Bullfrog Simulation (20 minutes)
3. **Engaging in Argument**
   A. Frog and the Environment Argument (40 minutes)
   Optional Extension: Hungry Bullfrog Simulation: Round 2

Section 2

1. **Planning and Carrying Out an Investigation**
   A. Scientists Meeting: Planning an Investigation (30 minutes)
   B. Setting Up the Duckweed Experiment (20 Minutes)
2. **Evaluating Information**
   A. Scientists Meeting: Building Understanding (15 minutes)

Teaching Notes

Purpose of lesson sequence and alignment with NGSS standards:

- In this sequence, students learn how the environment can influence the traits of an organism, like weight and height (a Disciplinary Core Idea). They learn that even though traits are inherited, they are also influenced by the environment. Therefore, the environment and the traits of an organism are in a cause and effect relationship (a Crosscutting Concept).

- In Section 1, students participate in a Hungry Bullfrog Simulation in which they explore how the availability of food in an environment affects the growth of a bullfrog. In the bullfrog simulation, students act as a bullfrog that is (and sometimes isn't) getting its needs met for food, water, shelter, and space. They then construct an argument (a Science and Engineering Practice) about the cause and effect relationship between an environment and the expression of traits.
- In Section 2, students plan and carry out an original investigation (a Science and Engineering Practice) to explore the cause and effect relationship between the environment and duckweed growth. In the duckweed investigation, students design an investigation to determine optimal growing conditions for duckweed. They initially go on a visual "paddle of a pond" to explore all the different places duckweed could grow. They then identify an experimental (testable) question, design an experiment to test a variable (shady/sunny, deep water/shallow water, salt/fresh water, with other plants/by itself etc.), and conduct their experiment to collect data and determine the influence of the variable on duckweed. At the conclusion of this investigation (about five days later), they use the data to construct an explanation in Lesson Sequence 4 about the relationship between traits, such as height and weight, and how the organism's needs are met in its environment.

How it builds on previous work in the Life Science Module:

- This lesson builds upon the learning from Unit 1 about inheritance and variation of traits by introducing the idea that there is a cause and effect relationship that affects the inherited traits. Students begin to understand: 1) A given environment can influence the traits expressed by an organism, like the weight of a bullfrog or the growth rate of duckweed; and 2) this influence on inherited traits can affect the organism's ability to survive.

How it connects to the CCSS Standards and EL Education's Language Arts Grade 3 Module 2:

- Students use the Back-to-Back and Face-to-Face protocol in Language Arts Grade 3 Module 2.
- The student arguments in Section 1 provide students with an opportunity to practice argument writing (CCSS ELA W.3.1).
- The Scientists Meeting in Section 2 provides students with the opportunity to practice their speaking and listening skills while collaborating in whole group discussions (CCSS ELA SL.3.1).

Possible student misconceptions:

- Students may think that organisms determine their own traits and, therefore, determine their own survival. Traits are inherited from parents, and sometimes those traits allow an organism to survive well. If an organism survives well, it will reproduce and therefore pass on the traits better adapted for survival to offspring. While teaching the lesson, consider asking: "Did the animal or plant choose its own traits? What did you learn in Unit 1 about traits?" and clarifying that traits are inherited through surviving and reproducing.
- Students may think that the environment and a habitat are the same thing or that these words can be used perfectly interchangeably. This misconception should be addressed when the concept of habitat is introduced in Section 1. A habitat is the area where a specific

organism lives, whereas the environment refers to a larger space that does not necessarily have specific organisms inhabiting it. A habitat provides resources for one species, while an environment could provide the resources for many species and could eventually become many habitats. Therefore, the environment contains habitats but a habitat does not contain the environment, and the environment can change the functioning of a habitat but a habitat does not change the environment.

Possible broader connections:

- Connect to students' lives by exploring how human traits are influenced by the environment—for example, students have likely learned that proper nutrition is important to help them grow "big and strong." Ask students to consider what might happen to their adult height if they did not have proper nutrition as children. What might happen to their teeth if they eat too many sweets?
- Connect to other sciences by thinking like a scientist about the cause and effect relationships all around us. Think of the cause and effect relationship between the Sun and the Earth, producers and consumers, force and motion.

Areas where students may need additional support:

- Students may need additional support constructing an argument. Use students' work with constructing an explanation from Unit 1, Lesson Sequences 4, 5, and 6 to scaffold instruction and consider creating intentional grouping for the Back-to-Back and Face-to-Face protocol in Section 1. Provide students with examples of arguments. Have students identify the claim, evidence, reasoning, and evaluation of evidence. Discuss what makes some arguments stronger than others.

Down the road:

- Students will use the frog and the environment argument constructed at the end of the Section 1 as a resource for the performance task in Lesson Sequence 5. Clearly mark the argument to make it easier for students to find at that time. Consider using a highlighter or sticky notes.
- Students will analyze the results from the duckweed experiment in Lesson Sequence 4. Plan on allowing the duckweed to grow for at least five days between setting up the experiment and analyzing the results. As with any living thing, duckweed may take more or fewer days to respond to the variables than predicted here. Monitor the growth so that students will see differences when analyzing the results. Consider setting up the experiment at the beginning of the week and analyzing the results with students after a weekend.

In advance:

- Collect local duckweed or order it online. (See Additional Resources on the Grade 3 Life Science Module Overview for possible vendors). You will need approximately 1 cup for the class. Dispose of locally collected duckweed only by putting it back into the local environment. Dispose of ordered duckweed by throwing it in the garbage after freezing it.
- Read each section and complete the Preparing to Teach: Self-Coaching Guide.
- Determine groups of two to four students for the Hungry Bullfrog Simulation, and triads or groups of four for the duckweed experiment.

- Prepare:
  - Dog pictures to display.
  - Hungry Bullfrog Simulation (see materials). Print and cut out the Hungry Bullfrog Simulation cards and consider laminating them for future use (see supporting materials).
  - Duckweed experiment (see materials).
  - Pond slideshow or print out photos from the Pond slideshow in color (see supporting materials).
- Review the Back-to-Back and Face-to-Face protocol. See Classroom Protocols pack on Curriculum.ELeducation.org.
- Post: Lesson sequence focusing question, lesson sequence learning targets, Concepts Scientists Think About anchor chart, Planning a Frog Pond anchor chart, Habitat anchor chart, Scientists Do These Things anchor chart, Norms of a Scientists Meeting anchor chart, and Unit 2 guiding questions.

Optional extensions:

- *Hungry Bullfrog Simulation, round 2:* Distribute the Long Tongue Inherited Trait cards to one student in each group and explain that this long tongue allows this student to eat two more (take two more tokens) each time he or she draws a "frog eats" card. As a debrief, ask: "What do you notice about the effect the inherited trait of a long tongue had on the bullfrog's weight?"

Vocabulary

habitat: the natural home of an organism where its needs for food, water, shelter, and space are met
environment: the surroundings in which organisms live; can contain many habitats
trait: a characteristic of an organism
organism: a living thing, like a plant or animal
data: collected facts, observations, and details
variable: a thing that is changed in an investigation
relationship: the way two or more objects or living things interact

Materials

General Materials

- ☑ Concepts Scientists Think About anchor chart (begun in Unit 1, Lesson Sequence 2; added to in Section 1; see supporting materials)
- ☑ Dog pictures (one set to display)
- ☑ Planning a Frog Pond anchor chart (begun in Lesson Sequence 1; added to in Section 1; see supporting materials)
- ☑ Student science notebook (from Unit 1, Lesson Sequence 1; one per student)
  - Environment and an Organism's Traits Entry (page 32 of student science notebook)
- ☑ Habitat anchor chart (new; co-created with students during Section 1; see supporting materials)

- ☑ Scientists Do These Things anchor chart (begun in Unit 1, Lesson Sequence 2)
- ☑ Norms of a Scientists Meeting anchor chart (begun in Unit 1, Lesson Sequence 1)
- ☑ *Bullfrog at Magnolia Circle* (book; one to display)
- ☑ Pond slideshow (one to display)
- ☑ Unit 2 guiding questions (from Lesson Sequence 1; one to display)

Science-Specific Materials (gathered by the teacher)

- ☑ Hungry Bullfrog Simulation:
  - Hungry Bullfrog Simulation Student Directions (one per group)
  - Hungry Bullfrog Simulation Teacher Directions (for teacher reference)
  - Sack for collecting, such as a children's sock or small bag (one per student)
  - Tokens, such as larger dried beans or marbles (one bowl full per group)
  - Scale (two per class)
  - Hungry Bullfrog Simulation cards (one set per group)
  - Long Tongue Inherited Trait cards (optional; one card per group)
- ☑ Duckweed Investigation:
  - Duckweed plants (at least nine plants per group)
  - Small, clear cups, like Dixie cups (three cups per testing group or student and three cups for teacher experiment)
  - Distilled water (enough to fill every Dixie cup halfway)
  - Trays (depending on size; enough to hold the cups)
  - Various materials for testing (determined by students)
  - Permanent marker (one per group)
  - Ice cube (one per day for teacher experiment)
- ☑ Teacher science notebook (from Unit 1, Lesson Sequence 1; for teacher reference)

Section 1: Opening

A. Reviewing Learning from Unit 1 (10 minutes)

- Gather students together in a circle [1].
- Direct their attention to the posted lesson sequence learning targets and read them aloud:

  "I can play the Hungry Bullfrog game to explain the cause and effect relationship between a frog obtaining enough food and its ability to survive well in an environment."

  "I can develop an experiment to test the cause and effect relationship between the environment and a plant's traits."
- Underline *cause and effect relationship* in both learning targets and ask:

  "What does the word* relationship *mean here?" (A relationship is the way two things, including living things, interact. In this lesson, we are looking for a cause and effect relationship of a bullfrog and its habitat and of a plant called duckweed and its habitat.)
- Direct students' attention to the posted **Concepts Scientists Think About anchor chart**, and focus them on the "Cause and Effect" column.

- Using a total participation technique, invite responses from the group:

  "Based on the learning targets, what cause and effect relationships are we going to be learning about?" (There is a cause and effect relationship between the frog obtaining enough food and surviving well. There is a cause and effect relationship between the duckweed and how well it grows.)

- Tell students that when scientists think about cause and effect, they conduct an experiment to test and explain how changes happen. Add "identify and test relationships in order to explain change" to the Concepts Scientists Think About anchor chart.
- Using a total participation technique, invite responses from the group:

  "What have you learned about traits from Unit 1?" (We have learned about inheritance, variation, and the relationship between variation and survival/ability to reproduce).

- Display the **dog pictures**.
- Using the dog pictures, explain that there is a relationship between the way traits are expressed, or seen, because of the environment. Say: "Let's think about two puppies who are siblings but they both go to live in different homes. In one home, a puppy is fed too much food and lots of scraps from the table. In another home, the puppy is given just the right amount of food."
- Using a total participation technique, invite responses from the group:

  "How has its environment influenced its trait of weight?" (The environment with more food has the effect of a fatter puppy; the environment with less food has the effect of a skinnier puppy.)

  "But even if the dog is put on a strict diet, it will not look like the dog in Picture 3. Why not?" (Because it is a different dog that inherited different traits from its parents. An environment can't change an organism's traits, but it can influence them.)

- Direct students' attention to the posted **Planning a Frog Pond anchor chart.** Remind students that the goal of the unit is to build a frog pond and that in order to do that, they must understand the relationship between a frog and its surroundings, or the environment it's in [(2)].
- Tell students that they need to study the environment to understand how different parts of the surroundings affect how healthy the habitat is and how well the frog gets its needs met, specifically the food, water, shelter, and space. To do this, they will play a simulation and set up an investigation today.
- Tell students that they will use the information from the Hungry Bullfrog Simulation and Duckweed Investigation as evidence to explain that an environment can influence the traits of an organism. Therefore, the environment they are designing, the frog pond, will positively influence the traits and the survival of a frog.
- Add "2. Collect Evidence: How do we know our frog pond designs will meet the survival needs of frogs?" to the Planning a Frog Pond anchor chart.

Preparing to Teach: Self-Coaching Guide

1. What group norms will I emphasize?
2. It's okay if students use *habitat* and *environment* interchangeably at this point. They will become more familiar with the differences later in the unit.

B. Constructing a Habitat Anchor Chart (15 minutes)

- Direct students' attention to the lesson sequence focusing question and read it aloud:
  - "How does an organism's environment affect that organism's traits?"
- Invite students to open their **student science notebooks** to the **Environment and an Organism's Traits entry** and put their finger on the "Opening" section.
- Provide students with time to jot down their own ideas about the lesson sequence guiding question or learning targets under the "Opening" section [1].
- Tell students that the frog ponds that they are going to be designing will be the frog's *habitat*. Define as necessary (the home of an organism that provides for the needs of the organism). Clarify that the *environment* is a larger space and that the environment can contain many habitats. So, when the environment changes, it can change a habitat.
- Using a total participation technique, invite responses from the group [2]:

  "What are the things you need to survive?" (Responses will vary.)
- Invite students to share out. As students share, capture their ideas on the board. Point out that all their needs fit into three categories: food, water, and shelter or space.
- Clarify the difference between "want" and "need."
- Tell students that the plants and animals that they are studying also need clean air to survive, but the class is concentrating on these three categories.
- Direct students' attention to the **Habitat anchor chart** and say: "The environment, or natural surroundings of a plant or animal, where the organism gets its needs met is called a habitat. A habitat can be broken down into three different parts (point to anchor chart): food, water, and shelter or space."
- Have students practice sorting the needs that they listed for their own survival into the categories of food, water, and shelter or space.

Preparing to Teach: Self-Coaching Guide

1. Consider doing a picture walk of *Bullfrog at Magnolia Circle* to stimulate thinking of the parts of a frog habitat.
2. What do I anticipate my students will say? How can I encourage them to think of the three categories?

Section 1: Using Models

A. Hungry Bullfrog Simulation (20 minutes)

- Arrange students into pre-determined groups of two to four students [1].
- Post the question that students will be exploring through the simulation:
  - "Does the environment have an effect on a frog's trait of weight?"
- Post and read the **Hungry Bullfrog Simulation Student Directions**. Refer to **Hungry Bullfrog Simulation Teacher Directions (for teacher reference)** as necessary.
- Distribute the **Hungry Bullfrog Simulation materials** [2] [3].

- Remind students that as they play, they must record the cause and effect relationships described in the Hungry Bullfrog Simulation cards in their student science notebook in the table under the "Using Models" section. Model as necessary.
- Invite students to begin the simulation.
- As students complete the simulation, monitor time and rotate from group to group to clarify and check for understanding. If time permits, distribute the optional **Long Tongue Inherited Trait cards**.
- After 15 minutes, refocus whole group and tell students that now they will measure how much their bullfrog weighs [4].
- Allow students to weigh bullfrogs and record the weight in the student science notebook under "Using Models" where it says "Final Bullfrog Weight." Model as necessary.
- Have students set aside the materials from the simulation, stacking them neatly in the center of each table.
- Ask students to return to their seats.

Preparing to Teach: Self-Coaching Guide

1. How will I group students for the game?
2. How will I ensure that I have enough Hungry Bullfrog Simulation materials for all groups?
3. How will I distribute materials?
4. How will I set up scales to allow students to measure and record the weight of the "bullfrog" or sack?

Section 1: Engaging in Argument

A. Frog and the Environment Argument (40 minutes)

- Refocus whole class.
- Using a total participation technique, invite responses from the group:

  "Which part of the habitat—food, water, shelter or space—would you say the frog was interacting with during the game?" (Responses will vary. Shelter and food are likely.)

  "How was the Hungry Bullfrog Simulation similar to what happens in nature?" (Frogs eat animals and run away from animals.)

  "How is it different?" (Frogs don't keep getting bigger and bigger but use food to maintain a healthy weight.)
- Tell students that they will be constructing an argument based on their findings from the simulation and will use the table and the weight of the frog as evidence to support their claim [1].
- Direct students' attention to the posted **Scientist Do These Things anchor chart** and focus on the steps in the "Engaging in Argument" column under "Preparing for the Argument" on the Scientists Do These Things anchor chart:
  - Pose the question.
  - Identify evidence that answers the question.
  - Evaluate whether that evidence is good enough.

- Remind students that through the simulation, they were looking for how a habitat can influence an organism's traits by exploring the question: "Does the environment have an effect on a frog's trait of weight?"

  "What evidence did you collect through the simulation to help you argue that there is a cause and effect relationship here? (the weight of the frog and the things in the environment that made it go up and down)

  "Is this enough evidence? Did the frog's weight get affected by the environment?" (yes)

  "What other evidence would help the argument be stronger?" (real data outside of a simulation)

- Point out that students are now ready to make an argument. Read the steps for making an argument from the Scientists Do These Things anchor chart:
  - Make a claim.
  - Provide evidence and reasoning.
  - Explain why the evidence is good evidence and/or what could make it stronger.
- Ask students to notice and name the ways that an argument and an explanation are similar and different.
- Tell students they are ready to construct an argument about the cause and effect relationship between a frog getting food from its environment and its trait of weight. Tell them that before they write their argument, they are going to practice saying it orally using the Back-to-Back and Face-to-Face protocol. Remind them that they used this protocol in the Language Arts Grade 3 Module 2, and review as necessary. Refer to the Classroom Protocols pack on Curriculum.ELeducation.org for the full version of the protocol [2].
- Have students find a partner and stand back-to-back with each other, being respectful of space.
- Ask students the following question and give them 30 seconds to consider how they will respond:

  "First, make a claim. Does the environment have an effect on a frog's trait of weight?" (Yes, there is a cause and effect relationship between a frog obtaining enough food and its ability to gain enough weight to survive well in an environment.)

- Invite students to turn face-to-face to share their responses.
- Have students repeat this process with a new partner for the following questions:

  "What evidence supports your claim from the Hungry Bullfrog Simulation?" (Students should use the examples of from the table and the weight of the frog in their student science notebook.)

  "How does your evidence support your claim? Give your scientific reasoning." (Because there were many things in the environment chasing my frog, it lost a lot of weight. Therefore, the environment affected its trait.)

  "Do you have good evidence? What would make your argument stronger?"

- Invite students to return to their seats and write their own argument in the student science notebook under the "Constructing an Argument" section [3] [4].
- After 10 minutes, invite volunteers to share out [4].

Preparing to Teach: Self-Coaching Guide

1. Based on the explanations that students wrote for the summative assessment in Unit 1, what kind of support will they need for constructing this argument?
2. How familiar are my students with the Back-to-Back and Face-to-Face protocol?
3. Perhaps my students would benefit from a model oral argument. Something like: A frog's weight is affected by its environment. So, there is a cause and effect relationship between a frog getting enough food and its ability to gain weight to survive well in an environment. (This is the claim.) In the Hungry Bullfrog game, even though my frog was chased by a snake twice and I lost tokens, I was able to eat grasshoppers and mosquitos so I didn't lose too much weight. (This is my evidence.) My final bullfrog weight was 6.5 grams. (This is more evidence.) Therefore, the organisms in the environment, like the snake and mosquitos, affected the weight of my bullfrog. But because he was able to get enough food, he has a healthy weight and is surviving. (This is my reasoning.) I think this is good evidence that a frog's weight is affected by the environment. Additional evidence from outside the simulation would make my argument stronger.
4. I could also ask students to raise their hands as they hear the three parts of my (or a classmate's) explanation. Hold up one finger when you hear a claim, hold two fingers when you hear evidence, hold up three fingers when you hear the reasoning, and hold up four fingers when you hear evaluation of evidence.

Section 2: Planning and Carrying Out an Investigation

A. Scientists Meeting: Planning an Investigation (30 minutes)

- Ask students to bring their student science notebooks and gather for a Scientists Meeting.
- Direct students' attention to the **Norms of a Scientists Meeting anchor chart.**
- Using a total participation technique, invite responses from the group:

  "What are the norms of a Scientists Meeting?" (take turns talking, build on one another's ideas, disagree respectfully, ask questions to clarify information)
- Remind students that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher.
- Tell students the goal of this meeting is to plan an investigation and that planning and carrying out investigations is something that scientists do. An investigation will help students answer the question: How does an organism's environment affect that organism's traits? And this particular investigation will help them learn more about how the environment affects duckweed [1].
- Show students the frog sitting in the duckweed in *Bullfrog at Magnolia Circle* on pages 6 and 7. Show them the real **duckweed plants**. As you show students the duckweed, remind them that one trait they have already talked about is how big an organism can get (like the Hungry Bullfrog). This is also a trait that plants have.
- Ask:

  "How can the environment cause duckweed to grow well?" or "How can the environment cause duckweed to not grow well at all?" (If the environment provides a good habitat for the duckweed—the necessary food, water, and space that the duckweed needs—it will survive well.)

- Invite students to share out.
- Refocus whole group and say: "Before you begin the experiment to see under what conditions duckweed grows well, you have to understand all the different types of places duckweed could grow. To get a better understanding, we will be looking at different places duckweed could grow in a pond. After every slide, we will stop and discuss the different parts of the environment that may be affecting how the duckweed grows."
- Invite students to open their student science notebooks to the "Planning an Investigation" section in the Environment and an Organism's Traits entry.
- Tell students that they will now view a slideshow, and at the end of each slide, they will record some conditions or characteristics of the environment that may affect how the duckweed grows [(2)].
- Guide students through the **Pond slideshow.**
- After students view each slide, invite them to record the characteristics of the environment that may affect how the duckweed grows in their student science notebook.
- After finishing the slideshow, tell students they will use this list of characteristics of the environment to plan an investigation.
- Tell students that they will plan an investigation around the following question: "Under what conditions in a pond does duckweed grow well?"
- Tell students this is a good question to investigate because they can design some trials, or tests, to see how duckweed grows under different conditions.
- Model how to select the variable to be tested by thinking aloud. Say [(3)]:

  "I am going to show you how to create a good scientific experiment. The first step in planning your experiment is choosing only one condition to test. Scientists call this condition a* variable. *I noticed that pond water can be different temperatures. So, I am going to test the variable of water temperature, and I am going to write that down in my notebook."

- Ask:

  "What variables might be changed in a duckweed's environment?" (amount of sunlight, amount of water, type or quality of water, amount of other material in water)

- As students share, capture their ideas on the board.
- Model how to set up the investigation by determining what materials are needed and recording them in the **teacher science notebook**. Say:

  "In a scientific experiment, I need to have one test as a* control, *which means we won't change anything in that cup."

  "I also need to do multiple tests, so I am going to set up two more tests—two more cups with duckweed in them."

  "I am testing the variable of cold water. How can I do that? Oh, I know what I can do! I can put an ice cube in the two test cups every day. I need to write down the materials I need in my notebook."

- Model and show students your thinking as you set up the experiment [(4)]:
  - Label each cup: control, Test 1 and Test 2.
  - Pour distilled water halfway up into each of the cups. As you pour, explain that it is important that everything remain constant, or the same, except for the one thing you are testing, the variable.

  - Place three duckweed plants in each cup. Remind students that you are keeping the number of duckweed plants the same, too.

- Ask:

  "Why might paying attention to variables and the other conditions, like the things keeping constant, be important?" (Only one thing can be tested at a time because otherwise you wouldn't know what actually made the duckweed grow or not grow the best.)

- Ask students to return to their seats [5].

Preparing to Teach: Self-Coaching Guide

1. What experience do my students have with original investigations?
2. How can I get my students to a real pond?
3. What will be the best place in my classroom to model the process of setting up an investigation?
4. Would a posted class checklist or visual be helpful to my students?
5. Do I have all student materials ready?

B. Setting Up the Duckweed Experiment (20 minutes)

- Tell students that now they will set up their own investigations.
- Arrange students into pre-determined groups of four.
- Ask students to work as a group to answer the questions in the Designing Our Experiment section of their student science notebook. They should each write the answers [1].
- Tell students to raise their hand once they have finished their plan in their student science notebook, so you can approve it.
- Distribute the **Duckweed Investigation materials** to groups whose plans have been approved.
- Invite groups to set up their experiments. Remind students to label the three cups first with their name and control, Test 1 and Test 2. Every cup should be exactly the same. It should be half full with three plants in each cup. Encourage students to refer to the directions in their student science notebook as they work.
- Refocus whole group and say:

  "In order for us to be able to determine the effect that the environment has on duckweed, we first need to record observations about the plant now before we make any changes."

- Model for students how to do this by thinking aloud as you record data about your duckweed from each cup on a table in your teacher science notebook, including the temperature.
- Invite students to do the same for their three tests in their student science notebook in the Duckweed data table.
- Circulate to clarify and check for understanding.
- Model for students how to change the environmental conditions in their cups by placing an ice cube in Test Cup 1 and Test Cup 2 of your experiment.
- Allow students to make changes to Test Cup 1 and Test Cup 2.

- Ask students to place the three cups on the tray to be collected.
- Collect trays and place in a safe location. Tell students they will return to see the results of their experiment in Lesson Sequence 4.
- Give students specific positive feedback on their experimental designs. (Example: "I saw groups thinking hard to only change one thing, or variable.")
- Using a total participation technique, invite responses from the group:

"What did you learn about good experimental design in today's lesson sequence?" (choose only one variable, keep everything else constant or the same, do multiple tests)

Preparing to Teach: Self-Coaching Guide

1. How can I work with individual groups? Could I set up stations and have some independent work that my students could do at this time?

Section 2: Evaluating Information

A. Scientists Meeting: Building Understanding (20 minutes)

- Ask students to bring their student science notebooks and gather for a Scientists Meeting.
- Referring to the Norms of a Scientists Meeting anchor chart, remind students of the norms of this kind of meeting [1].
- Tell students the goal of this meeting is to build understanding of the cause and effect relationship between an organism's traits and its environment or habitat.
- Invite students to open their science notebooks to the Environment and an Organism's Traits entry in the "Opening" section.
- Direct students' attention to the posted **Unit 2 guiding questions** and select a volunteer to read it aloud:
  - "What are necessary parts of a frog habitat, and how do they interact to support the survival of frogs throughout their life cycle? How can we build that (in the schoolyard or in the community or a local park)?"
- Help students build understanding about an organism and its environment. Start by repeating the phrase "how do they interact to support the survival of frogs."
- Ask:

"You've learned a lot in this lesson sequence about how an environment or a habitat can affect an organism. What did you learn about the relationship between an environment and an organism?" (The environment can affect the traits of an organism.)

"How was the bullfrog in the simulation affected by its environment?" (It gained or lost weight.)

"How do you think the duckweed will be affected by the changes to the environment?" (It will grow well or not well.)

"What are some other examples of how an organism's traits can be affected by the environment it lives in?" (An organism might grow taller, depending on its environment.)

"Could an environment or a habitat affect the weight of an organism so much that the organism might not survive?" (Yes. If a frog is so weak that it can't run away from predators, it might die.)

"What are some other ways a habitat might affect survival? What if the frog didn't have anywhere to hide from predators? What would happen?" (It would die.)

"Can you invent a rule for the relationship between an organism and its environment?" (Responses will vary. There is a cause and effect relationship between an environment and the traits of an organism. There is a cause and effect relationship between an environment and the survival of an organism.)

- Remind students to use the information in their science notebooks as evidence as they participate in the conversation [(2)].
- Ask:

  "What information has the class collected to help answer the unit guiding questions? (Hungry Bullfrog Simulation and Duckweed Investigation—even though there are no results yet, we have predicted how the duckweed traits will be influenced.)
- Encourage students to build on one another's ideas:

  "Can someone paraphrase what Student A said?"

  "Who thinks something similar to Student A?

  "Who thinks something different from Student A?"

  "Can you add to what Student A said?"
- If conflicting information arises, help students challenge one another's ideas respectfully:

  "Why do you think you have different conclusions from Student A's?"

  "With what in Student A's argument do you disagree? On what points do you agree? What evidence do you have to support those ideas?"
- Draw students' attention to the Planning a Frog Pond anchor chart and ask:

  "Why is it important to understand that the environment—or the food, water, and shelter or space—of the organism's habitat can affect its traits and its survival when creating a frog pond?" (We need to carefully consider how to make the frog pond as healthy as possible for the frog, so its traits will be positively affected and it will survive well.)
- Record the class's conclusions on the Planning a Frog Pond anchor chart.

Preparing to Teach: Self-Coaching Guide

1. How well are my students keeping the norms? Do they need a more formal check-in before and/or after this Scientists Meeting?
2. How can I help students who struggle to participate in class conversation?