Grade 4: Life Science Module

Lesson Sequence 10: Design Challenge: Structures for Seed Dispersal

Lesson Sequence 10: Design Challenge: Structures for Seed Dispersal

Overview

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

This is the last lesson sequence in the arc of lessons about the function of different plant structures. In this lesson sequence, students learn about the many different adaptations of seeds for dispersal and survival. Students participate in an engineering design challenge in which they must construct a method of dispersing a mock "seed" as far across the classroom as possible using wind, water, or "walk-by" animal dispersal. This challenge can be simplified by having students use only one method of dispersal (wind dispersal).

Although this lesson sequence reinforces important concepts about the structures of plants and gives students a chance to experiment with creating structures with specific functions, this lesson sequence is optional. If students do not do this lesson sequence, they may need additional scaffolding when completing the engineering design cycle in Lesson Sequence 11.

Lesson Sequence Focusing Question and Big Ideas

What is the cause and effect relationship between the structures of seeds and how they are dispersed?

- Seeds have specialized structures that cause them to be dispersed by different methods.
- For example, the structure of an air pocket causes a seed to be able to float, buoyed by air, and the effect is that the seed can be dispersed by water. Another example is that the tuffs of a dandelion seed cause the seed to float; the effect is wind dispersal. Additionally, the hooks of a burdock seed cause it to attach to a passing animal; the effect is "walk-by" dispersal.

Long-Term Learning Addressed (Based on NGSS)

Generate and compare multiple solutions about how seeds can be spread in a variety of ways, including wind, water, and animals. (Based on NGSS 4-LS1-1)

This sequence of lessons explicitly addresses:

Science and Engineering Practices:

- **Developing and Using Models:** Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system. *Students develop and use a model of a seed dispersal structure and test how well it fulfills its function to give seeds a better chance of germinating. Note: This Science and Engineering Practice is not explicitly aligned with 4-LS1-1.*
- **Constructing Explanation and Designing Solution:** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. *When posed with the problem of how to disperse a modeled "seed," students design a solution based on provided materials. Note: This Science and Engineering Practice is not explicitly aligned with 4-LS1-1.*

Crosscutting Concepts:

- **Cause and Effect:** Events that occur together with regularity might or might not signify a cause and effect relationship. *Students learn there is a direct cause and effect relationship between the physical features of the seed and how it is spread. Note: This Crosscutting Concept is not explicitly aligned with 4-LS1-1.*
- **Structure and Function:** The way in which a living thing is shaped and its substructures determine its properties and function. *Students learn that each seed dispersal structure has a specific function. Note: This Crosscutting Concept is not explicitly aligned with 4-LS1-1.*

Disciplinary Core Ideas:

- **LS1.A Structure and Function:** Plants and animals have both internal and external structures that serve various functions to support survival, growth, behavior, and reproduction. *Students learn how various seed structures function in dispersal.*

Lesson Sequence Learning Targets

- I can explain how a seed's structure affects its dispersal.
- I can design a way for a seed to be dispersed.

Ongoing Assessment

- Scientists Meeting: Building Understanding
- Student science notebook: Structures for Seed Dispersal entry

Agenda

Total Time: 2.5 hours of instruction

Section 1

1. **Opening**
   A. Scientists Meeting: Building Understanding (15 minutes)
   B. Reviewing Learning Targets (5 minutes)
2. **Obtaining and Evaluating Information**
   A. Close Reading: "Seeds on the Move" (30 minutes)
   B. Communicating Information (10 minutes)
   Optional Extension: Biomimicry Lesson

Section 2

1. **Engineering Design Cycle**
   A. Introducing the Challenge (10 minutes)
   B. Imagining: Seed Dispersal Options (10 minutes)
   C. Planning: Seed Dispersal Structure and Function (15 minutes)
   D. Creating: Seed Dispersal Mechanism (15 minutes)
   E. Revising: Seed Dispersal Mechanism (20 minutes)

Section 3

1. **Communicating Information**
   A. Scientists Meeting: Building Understanding (20 minutes)
   Optional Extension: Seed Walk

Teaching Notes

Purpose of lesson sequence and alignment with NGSS standards:

- To help students understand more about plant external structures for reproduction and survival (a Disciplinary Core Idea), students investigate the cause and effect relationship (a Crosscutting Concept) between seeds and their mechanism for dispersal.
- In Section 1, students begin this two-part investigation by participating in a Scientists Meeting in order to reflect on the question of why seeds need to move away from the parent plant. They then move on to viewing a video and reading an article about seed dispersal.
- In Section 2, students use the Engineering Design Cycle to design their own seed dispersal structures. By doing so, students actively construct an explanation (a Science and Engineering Practice) for how seeds are dispersed, and design their own solution (another Science and Engineering Practice) for the dispersal of a mock seed.
- Finally, in Section 3, students synthesize the information and discuss the cause and effect relationship (a Crosscutting Concept) between a seed dispersal mechanism and survival in the ecosystem in which the seed must be dispersed.

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

- This is the final lesson sequence in which students explore different specialized structures of plants that support survival. After this lesson sequence, students should return to the investigation about the specialized structures of grass (begun in Lesson Sequence 8) and the investigation about seeds (began in Lesson Sequence 9). They will complete Section 3 of Lesson Sequence 8 and Section 3 of Lesson Sequence 9 before moving on to Lesson Sequence 11.

How it connects to the CCSS Standards and EL Education's Language Arts Grade 4 Module 2:

- Language Arts Grade 4 Module 2 focuses on defense mechanisms needed for survival. Encourage students to see connections between animal adaptations for survival and plant adaptations for survival.
- Students do a close read in this lesson in order to determine the gist, identify unfamiliar vocabulary words, and learn about how structures function for seed dispersal. Students use some of the same practices for close reading that they are familiar with from Language Arts Grade 4 Module 2. This text provides students the opportunity to practice reading informational texts (CCSS ELA RI.4.1 and RI.4.3).
- The Scientists Meetings in Section 1 and Section 3 provide students with the opportunity to practice their speaking and listening skills while collaborating in whole-group discussions (CCSS ELA SL.4.1)

Possible student misconceptions:

- Students may think that seeds are stationary. In fact, they are mobile. Consider showing students a photo of a field with wildflowers spread apart. Ask students how they think the wildflowers started growing in so many different places.
- Students may think that one means of dispersal is better than another. Instead, students should be encouraged to understand that each method of seed dispersal is useful based on

the seed's habitat and other individual characteristics by discussing the different characteristics of various ecosystems. For example, water dispersal would not work well in a desert, whereas water dispersal is excellent for aquatic ecosystems. Ask students to think about the desert, tundra, or grassland. What seed dispersal would work well in each ecosystem?

Possible broader connections:

- Look around the schoolyard to see what types of seeds are being dispersed. Common seeds include helicopter seeds from maple trees as well as grass that has gone to seed.
- Connect seed dispersal to students' previous learning about animals moving. Say: "Animals have specialized structures to help them move when they need to obtain resources (food). What specialized structures do plants have for moving their seeds so that the seeds will have access to the resources they need?"

Areas where students may need additional support:

- If students are unfamiliar with close reading practices used in Language Arts Grade 4 Module 2, take a few minutes to introduce them to these practices. Consider additional supports such as copying the text so that there is only one paragraph on each page, with an organized space for recording the gist and meanings of the unfamiliar words on that page or consider providing running notes on today's text.
- If students have not previously experienced an engineering design challenge, consider discussing goals for design—the time limits imposed may frustrate some students who work more slowly than others. Alternatively, you may wish to give students more time.

Down the road:

- This lesson sequence is good preparation for Lesson Sequence 11, in which students will again use the Engineering Design Cycle to create their fictional animal for the performance task.
- Students should continue to observe the investigations they set up in Lesson Sequences 8 and 9 throughout this lesson sequence. After this lesson sequence, students should return to Section 3 of Lesson Sequence 8 and Section 3 of Lesson Sequence 9 to synthesize their results. See Grade 4 Life Science Module overview for a lesson sequence timeline.

In advance:

- Read each section and complete the Preparing to Teach: Self-Coaching Guide.
- Gather the materials for the engineering design challenge in Section 2. Provide materials for construction in bins or containers with clear labels so that students will be able to more easily clean up after themselves at the conclusion of the design period. Consider setting up an area for testing designs (with fan and/or tub with water) and providing clear guidelines for how many groups can be in the area at once.
- Post: Norms of a Scientists Meeting anchor chart, Life Science Module guiding question, lesson sequence learning targets, lesson sequence focusing question, Concepts Scientists Think About anchor chart, Plant Structures and Functions anchor chart.

Optional extensions:

- *Biomimicry:* Students study examples where engineers have mimicked the structures of plants. For example, the creation of Velcro® was inspired by the hooks of a burdock seed.
- *Seed Walk:* Students go outside and look for tall grass with seeds and observe the structures of grass seeds and how they help with wind dispersal in real life.

Vocabulary

dispersal: moving from one place to another
mechanism: a tool or structure

Materials

General Materials

- ☑ Norms of a Scientists Meeting anchor chart (begun in Lesson Sequence 1)
- ☑ Life Science Module guiding question (from Lesson Sequence 1; one to display)
- ☑ Teacher science notebook (one for teacher use)
- ☑ Lesson sequence focusing question (one to display)
- ☑ Concepts Scientists Think About anchor chart (begun in Lesson Sequence 2; added to in Section 1)
- ☑ Student science notebook (from Lesson Sequence 1; one per student)
  - Structures for Seed Dispersal entry (page 56 of student science notebook)
- ☑ "Seeds on the Move" (one per student)
- ☑ Plant Structures and Functions anchor chart (begun in Lesson Sequence 7; added to in Section 1)
- ☑ Pictures of mature grasses with seeds (one to display)

Science-Specific Materials (gathered by the teacher)

- ☑ Variety of seeds that use different dispersal mechanisms (e.g., bean, grass, lima bean, maple seeds/helicopter seeds, apple/fruit (apple cut in half to expose seeds), coconut, burdock, and dandelion (one set per class; used in Section 1)
- ☑ Materials for constructing the Engineering Design Challenge (one set for every four students; used in Section 2)
  - Two or three seed models (e.g., packing peanuts, marbles, bingo chips, small oval rocks, buttons, washers of different sizes, beads, or any other small item that can be a mock seed)
  - A variety of dispersal structures (e.g., Velcro®, strips of paper, tape, plastic bags, paper clips, bubble wrap, tissue paper, coffee filter, or any other item that can be used as a mock structure)
  - Tape, string, pipe cleaners, twist ties, scissors (for attaching and building)
- ☑ Materials for testing the engineering design challenge (two sets per class; used in Section 2)
  - Long plastic bin and fan (water dispersal), fan (wind dispersal), wool glove (animal dispersal)

Section 1: Opening

A. Scientists Meeting: Building Understanding (15 minutes)

- Ask students to bring their student science notebooks and gather for a Scientists Meeting.
- Remind them that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher.

- Direct students' attention to the **Norms of a Scientists Meeting anchor chart**:
  - We take turns talking.
  - We build on one another's ideas.
  - We disagree respectfully.
  - We ask questions when we don't understand.
- Direct students' attention to the posted Life Science Module guiding question:
  - "How do the internal and external structures of plants or animals function together as a system to help them survive well in a given habitat?"
- Tell students the goal of this meeting is to build their understanding of the structures and functions of plants.
- Remind them that they already have some ideas on how to answer the guiding question.
- Using a total participation technique, invite responses from the group [1]:

  "What structures of plants do you know help a plant survive? How do they support survival?" (Students should name seeds, the basic structures of plants, and the specialized structures of plants for a particular ecosystem.)

  "How do the parts work together?" (Responses will vary. Examples: The seed coat protects the embryo before it is ready to grow; the pads of a cactus store the water that the roots absorb.)
- Encourage students to listen to and respond to one another's ideas. Consider using or prompting students to use the following:

  What do you mean by ...?"

  "Tell me more about ..."

  "This is what I think you are saying ..."

  "Who can add to this idea?

  "Explain what John said in your own words."
- After a few minutes, assure students they will learn more information to help them answer the guiding question. Tell them they will build a deeper understanding of seeds and their structures.
- Show students a **variety of seeds that use different dispersal mechanisms**—both new (maple seed/helicopter seeds, coconut, burdock) and familiar (green bean, grass, lima bean, dandelion, apple) [2].
- Using a total participation technique, invite responses from the group:

  "Where can I find the seeds?" (Responses will vary. Do not correct students, but take note of misconceptions.)

  "Why do you think the seeds are inside the fruit or vegetable?" (Responses will vary. Do not correct students, but take note of misconceptions.)
- To begin the conversation about seed dispersal, ask students to turn and talk to an elbow partner. Then invite pairs to share out. As students share, encourage them to respond to their classmates' ideas, creating a conversation among students:

  "Why do you think seeds need to move away from the parent plant?" (Responses will vary. Do not correct students, but take note of misconceptions.)

  Scaffold: "What do plants need to grow?" (Responses will vary. Do not correct students, but take note of misconceptions.)

"How do you think these seeds might move from one place to another?" (Responses will vary. Do not correct students, but take note of misconceptions.)

"Would all of these seeds move in the same way?" (Responses will vary. Do not correct students, but take note of misconceptions. Lead students to notice that because the seeds are different shapes and sizes, they may not all use the same method of transportation.)

- As students share, clarify and capture their ideas in the **teacher science notebook**.
- Invite students to return to their seats.

Preparing to Teach: Self-Coaching Guide

1. At this point in the module, what do I expect my students to name about plants?
2. What examples will I bring in? What do I think my students may be familiar with? What may be unfamiliar?

Note: It is important to show students the fruit or vegetable rather than just the seed because that can influence the way the seed is dispersed.

B. Reviewing Learning Targets (5 minutes)

- Direct students' attention to the posted learning targets and read them aloud as students follow along, reading silently in their heads (1):

  "I can explain how a seed's structure affects its dispersal."

  "I can design a way for a seed to be dispersed."

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

  "What examples can you give of how you can explain something?" (Using words, pictures, actions)

- Direct students' attention to the posted **lesson sequence focusing question**:
  - "What is the cause and effect relationship between the structures of seeds and how they are dispersed?"
- Remind students that *cause and effect* is a relationship that scientists pay special attention to.
- Tell students that they will be learning about the structures of seeds, and then using those structures to test their own designs for dispersal.
- Draw students' attentions to the **Concepts Scientists Think About anchor chart** and add the example "Testing designed seed structures for dispersal" to the "Cause and Effect" column.
- Invite students to open their **student science notebook** to the **Structures for Seed Dispersal entry** and put their finger on the "Opening" section.
- Once students have their finger on the "Opening" section, ask students to jot down key words or draw pictures to clarify the concepts in the learning targets and focusing question.

Preparing to Teach: Self-Coaching Guide

1. Which of these learning targets will my students need support with? How can I best support them?

Section 1: Obtaining and Evaluating Information

A. Close Reading: "Seeds on the Move" (30 minutes)

- Distribute **"Seeds on the Move"** to each student.
- Tell students that they will work hard as readers today to learn about the structures that seeds use for moving. Remind students that when they read complex texts, they often need to read the text multiple times. Tell them it's okay if they do not understand everything the text says the first time [(1)].
- Remind students of some of the close reading practices they follow in their Language Arts lessons [(2)]:
  - Read small chunks of the text slowly and think about the gist.
  - Talk with my partner or group about the text.
  - Circle or underline words I don't know.
  - Write notes or answer questions about the text.
- Refer students to the "Obtaining and Evaluating Information" section in the Structures for Seed Dispersal entry in their student science notebook. Let students know they are going to have the opportunity to independently read the text. Tell them to stop after each paragraph during this first read and jot the gist of that paragraph and any unfamiliar vocabulary in their notebook. Remind them that drawing a picture is another way that scientists record information. Review and model finding the gist as necessary.
- Ask students to begin reading. Circulate and support them as they read and determine the gist.
- After 10 minutes, ask students to turn and talk to an elbow partner [(3)]:

  "What gist notes or vocabulary words did you write down? What similarities and differences are there between our notes?"
- After 5 minutes, refocus the whole class. Point out to students that their job is to learn everything they can about the structures that seeds use for moving. Explain that they should gather as many *facts*, *definitions*, and *details* as they can as they read. Clarify these terms as needed.
- Tell students they are going to read the text again. This time, they should read closely for details to add to the Reading Closely about Structures and Functions graphic organizer in the Plant Structures Are a System entry of their science notebook.
- Consider doing a brief guided practice, as necessary.
- Ask students to begin reading. Circulate and support students as they read.
- Give students 15 minutes to reread the text on their own for a second read, writing down key details in their science notebook.

Preparing to Teach: Self-Coaching Guide

1. Which students may benefit from reading in a small, teacher-supported group?
2. Are my students familiar with the Close Readers Do These Things anchor chart? How can I use that to support them in this reading?
3. How can I support vocabulary instruction at this point?

B. Communicating Information (10 minutes)

- Draw students' attention to the **Plant Structures and Functions anchor chart**.
- Using a total participation technique, invite responses from the group [1]:

  "What new details about seed structures for dispersal did you learn from 'Seeds on the Move'?"

- Scaffold and/or follow up:

  "What are some examples of structures that allow for seeds to be dispersed by animals, wind, and water?" (Responses will vary. Record all valid answers on the Plant Structures and Functions anchor chart and refer to the supporting materials for possible responses.)

Preparing to Teach: Self-Coaching Guide

1. How can I capture students' voice while still being succinct and focused?

Section 2: Engineering Design Cycle

A. Introducing the Challenge (10 minutes)

- Display the **materials for constructing the engineering design challenge** that are available for engineering their adaptation for dispersal [1].
- Show students the various materials that will be used to model seeds, reminding students that seeds come in many shapes and sizes and therefore need different types of dispersal mechanisms [2].
- Display the **materials for testing the engineering design challenge**.
- Tell students that once they have chosen the object that will model their seed, they will have to design an adaptation to disperse the seed as far across the classroom as possible (or designated area).
- Hold up one object that represents a seed (a marble, packing peanut, etc.). Ask students to silently consider this question:

  "What dispersal mechanism (wind, water, or walk-by) would spread this seed model the farthest? What external part can you create that would help this seed disperse?"

- Share with students the "success criteria" for the challenge: The seed needs to travel at least 2 feet from the parent.
- Answer any clarifying questions about the challenge at this point.
- Explain the engineering design cycle to students and post on the board how much time they will have for each step in the cycle. Post times in visible place.
  - Imagining (10 minutes)
  - Planning (15 minutes)
  - Creating (15 minutes)
  - Improving (15 minutes)
- Give students 5 minutes to arrange themselves into groups of four to complete the challenge, and to decide on roles for building and material gathering [3].

Preparing to Teach: Self-Coaching Guide

1. Note: This engineering design challenge may be simplified by having only wind dispersal.
2. How will I set up the materials for the engineering design challenge so that students can easily and efficiently access them?
3. Will I let students choose their own groups, or will I intentionally group my students?

B. Imagining: Seed Dispersal Options (10 minutes)

- Invite students to begin imagining and brainstorming possibilities for engineering a dispersal structure. Remind students that their design ideas need to be feasible given the provided materials [1] [2].
- Circulate to support students as they work in groups, prompting them as necessary:

  "What structures have we learned about that will improve dispersal?"
- Warn students when they have 2 minutes remaining.

Preparing to Teach: Self-Coaching Guide

1. Which students may benefit from being able to touch the materials at this point?
2. For which students might this be an unnecessary distraction?

C. Planning: Seed Dispersal Structure and Function (15 minutes)

- Invite students to move on to the planning stage with their group. Encourage them to draw an explanatory model of their design plan in the "Engineering Design Cycle" section of the Structures for Seed Dispersal entry in their student science notebooks.
- As students draw the models, encourage them to include labels and rationales for their design choices.
- Circulate to support students as they work in groups, prompting them as necessary [1]:

  "How does this structure in your design function to help a seed spread out?"

  "What causes the seed to be able to be dispersed by the wind, water, etc.?" (light, wind-catching structure)
- Ensure that each group agrees on one mechanism to test and elects one student to draw the group's plan/diagram in his or her science notebook.
- When 3 minutes remain, facilitate students' gathering their materials and preparing their workspace.

Preparing to Teach: Self-Coaching Guide

1. Some groups may need additional support in deciding on a plan. I may want to ask each member of the group to draw an explanatory model. Then the group can see every group member's idea and vote on the one they will use as a group.

D. Creating: Seed Dispersal Mechanism (15 minutes)

- Invite students to move on to the creating stage with their group. Monitor students as they construct their seed dispersal structure with their group.

- Ensure that all students are participating and that students are cooperating to develop solutions [1].
- Warn students when they have 2 minutes remaining.
- After 15 minutes, refocus the whole group.

Preparing to Teach: Self-Coaching Guide

1. How can I support groups so that all members are participating?

E. Revising: Seed Dispersal Mechanism (20 minutes)

- Tell students that they will now test their designs to see how well they work. Assure them that they will have the opportunity to revise their designs [1].
- Have each group test its design one-by-one using the fan, tub of water, or wool glove based on the dispersal method for which those group members were designing. While each group is testing its design, encourage other groups to watch to gather ideas for their own designs.
- After each group tests its design, prompt the group members to record the results of their trial in the "Data/Observation" section of the Structures for Seed Dispersal entry in their student science notebook.
- After all groups have tested their designs, invite them to reflect as a group on the data from their trials:

  "What structure might help your seed model travel farther?"
- Give students 5–10 minutes to revise their original design [2].
- Refocus whole group of students. Provide time for each group to test their design one-by-one again.

Preparing to Teach: Self-Coaching Guide

1. How can I build some flexibility into this step of the design process?
2. Would students benefit from multiple chances to improve, or would that be a distraction at this point?

Section 3: Evaluating Information

A. Scientists Meeting: Building Understanding (20 minutes)

- Ask students to bring their student science notebooks and gather for a Scientists Meeting.
- Remind them that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher.
- Direct students' attention to the Norms of a Scientists Meeting anchor chart [1]:
  - We take turns talking.
  - We build on one another's ideas.
  - We disagree respectfully.
  - We ask questions when we don't understand.

- Direct students' attention to the posted Life Science Module guiding question:
  - "How do the internal and external structures of plants or animals function together as a system to help them survive well in a given habitat?"
- Remind students they are studying how the structures of plants and animals function to help those organisms survive and that they have learned a lot of new information about seeds and their structures for dispersal.
- Invite a few groups to explain how their model seed is similar to what happens in nature and how it is different. Ask [2] [3]:

  "What are the limits to your model of showing how seeds are dispersed in the real world?" (My model shows only one structure without including the parent plant, which also provides an advantage.)

  What structures worked best with each dispersal method? (Responses will vary.)

  How did your model help you test the cause and effect relationships among seed structures, seed dispersal method, and survival? (The structures best suited to the dispersal method caused the seed to move the farthest, and that gives it the best chance at survival.)
- Encourage students to listen to and respond to one another's ideas. Consider using or prompting students to use the following:

  "What do you mean by ...?"

  "Tell me more about ..."

  "This is what I think you are saying ..."

  "Who can add to this idea?"

  "Explain what John said in your own words."
- After 10 minutes, show students grass seeds and **pictures of mature grasses with seeds**.
- Using a total participation technique, invite responses from the group:

  "What do you think would be the best dispersal mechanism for grasses, and why do you think that?" (Responses will vary. Students should notice that grass is tall, so the seed can be caught by a gust of wind easily. Grass seeds are small and light, so they can be carried by the wind easily. Students may notice that some grass species have seeds with a sheath that can catch the wind like a parachute.)

  "How does the habitat influence the best dispersal mechanism?" (Seed dispersal structures are adapted to fit in a habitat. For example, if there is a lot of water in the habitat, then a plant may be adapted to use water as a dispersal method.)
- Ask students to turn and talk to an elbow partner [4]:

  "What dispersal mechanisms would work best in your assigned ecosystem (desert, grassland, or tundra)?" (Wind or animal because the tundra, desert, and grasslands are all dry.)
- Invite a few pairs to share out. As students share, clarify and capture their ideas in the teacher science notebook.
- Invite students to return to their seats.
- Provide students 5 minutes to answer the questions in their science notebooks in the "Evaluating Information" section of their Structures for Seed Dispersal entry. Encourage them to include drawings to support their thinking.

- Collect student science notebooks to check for completion and as a formative assessment of student understanding.

Preparing to Teach: Self-Coaching Guide

1. How well are my students keeping the norms of the Scientists Meeting?
2. Which specific examples from the design challenge can I bring in?
3. How can I encourage my students to use the data collected during the trials as evidence to support their thinking?
4. Would it be helpful for students to talk with someone in their ecosystem expert group?