Grade 4: Life Science Module

Lesson Sequence 1: Anchoring Phenomenon

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Overview

Total Time: 1.5 hours of instruction (divided into two sections)

Lesson Sequence 1 kicks off the Life Science Module with an anchoring phenomenon—a puzzling or engaging situation that creates a "need to know" for students, in this case, about the internal and external structures in plants and animals and how they function. The anchoring phenomenon for this Life Science Module is the "Dim Effect": The phenomenon when something that humans imagine is later found to already exist in nature. This makes the students wonder: How does someone imagine an animal that is so realistic that it really might exist? Could I do that? What would I need to know to create a realistic but fictional animal? Students are then challenged to create a realistic yet fictional animal for a movie, which takes place in the tundra, grasslands, or desert. This challenge is the performance task for the Life Science Module, and students begin to gather information about each ecosystem so they can better design an animal that will realistically live in one of the ecosystems.

NOTE: Be sure you have prepared the plants at least 1 week in advance of launching this lesson. Refer to Grade 4 Life Science Module Overview for additional information.

Module Guiding Question and Big Ideas

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?

- For both plants and animals, the internal and external structures of an organism function together to ensure that the organism is able to obtain food, grow, avoid predators, and reproduce. These functions are all essential to an organism being able to survive well.
- Because all habitats have different hardships and available resources, the structures of the organism living there must be specialized for survival under those specific conditions. If any structure was removed from the organism, its system would be incomplete and it would not survive as well.

Long-Term Learning Addressed (Based on NGSS)

- Construct an argument of how the internal and external structures of both plants and animals function together as a system to help them survive well in a given ecosystem. (Based on NGSS 4-LS1-1)
- Since the purpose of this lesson sequence is to launch the module and build student engagement, it does not yet explicitly teach any of the Science and Engineering Practices, Crosscutting Concepts, or Disciplinary Core Ideas. See Teaching Notes.

Lesson Sequence Learning Targets

- I can explain how animators use scientific practices to create convincing animated characters.
- I can make detailed observations of the desert, grassland, and tundra ecosystems.

Ongoing Assessment

- Scientists Meeting: Gathering Ideas
- Student science notebook: Anchoring Phenomenon entry
  - — Google Earth Tour Notes

Agenda

Total Time: 1.5 hours of instruction

Section 1

1. **Asking Questions**
   - A. Reviewing Learning Targets (5 minutes)
   - B. Anchoring Phenomenon: Engaging the Scientist (15 minutes)
   - C. Introducing the Performance Task (10 minutes)

Section 2

2. **Obtaining Information**
   - A. Launching Science Notebooks (10 minutes)
     Optional Extension: Personalizing My Notebook
   - B. Exploring Mock Google Earth Tour (20 minutes)
     Optional Extension: Google Earth Tour
   - C. Scientists Meeting: Gathering Ideas (30 minutes)

Teaching Notes

Purpose of lesson sequence and alignment with NGSS standards:

- In this lesson sequence, students are introduced to the anchoring phenomenon for the module, which is meant to activate student thinking and interest in the module guiding question, as well as to create a "need to know" for the learning targets. Because the purpose of this lesson sequence is to activate student thinking through the anchoring phenomenon, there are no Crosscutting Concepts, Science and Engineering Practices or Disciplinary Core Ideas explicitly addressed. Students are asking questions (a Science and Engineering Practice), but this practice is not explicitly taught, nor are students expected to meet the rigor of formulating questions in the 3–5 grade level band. As students observe different ecosystems and the organisms that live there, they are noting things that work together in a system and have specific structures (both Crosscutting Concepts). Again, these Crosscutting Concepts are not explicitly taught at this point but will be in the following lessons. Both the guiding question and the long-term learning are aligned to 4-LS1-1 by the end of the module, students will meet the long term learning and the guiding question.
- In Section 1, students are introduced to the anchoring phenomenon for the module and the performance task that they will complete in Lesson Sequence 11.
- In Section 2, students are introduced to two important ongoing routines in the science classroom: the student science notebook and the Scientists Meeting. These routines will provide formative assessment throughout the module of the Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core ideas aligned with 4-LS1-1, 4-LS1-2, and

3-LS4-3. Students also build background knowledge of the desert, tundra, and grassland ecosystems through a Mock Google Earth tour.

- In this lesson sequence, students receive their science notebooks and familiarize themselves with them. These notebooks will be used to structure students' note-taking throughout the module. Take some time to introduce this practice. Use the professional science notebook entries to lend authenticity to the task. Note: The example professional science notebook entries are not to teach students something about a particular ecosystem but rather to show them the way that professional scientists use a notebook. Focus students on structure so that students understand the purpose and usefulness of the notebook both for this module but also for scientist more generally.
- In this lesson sequence, the teacher starts the teacher science notebook. Consider using a composition notebook or single-subject spiral notebook. This teacher science notebook serves two purposes. First, it serves as a model for collecting information in a science classroom. When taking notes in the notebook, be transparent and point out the practice to students. Consider saying something like: "This is very interesting. I'm going to collect this information in my notebook so I can refer to it later." Then, when you use the information collected, point it out to students by saying something like: "Three days ago, I heard X share an idea that I want to return to now." Second, the teacher science notebook serves as an additional record of student learning. Use the notes collected during Scientists Meetings and other class discussion time in conjunction with student work to guide instruction, create appropriate scaffolding, record student learning and misunderstandings, and make connections between the science content and students' lives. Refer to it often.
- In this lesson sequence, students participate in their first Scientists Meeting. This is a structure for classroom discussion that repeats throughout the module. Scientists Meetings provide an opportunity for students to make their thinking public and defend their ideas based upon evidence collected through experimentation, observation, or research. They also provide an opportunity for students to "rehearse" their ideas before writing. The teacher's role is to facilitate discourse among students through thoughtful questioning. See Key Features of the Life Science Modules in the introduction for more information.

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

- N/A: This is the first lesson sequence in the module.

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

- In Language Arts Grade 4 Module 2, students study many animals that live in the desert, tundra, or grassland ecosystems.
- Consider using some of the same vocabulary strategies, such as a Word Wall, that are used in EL Language Arts Grade 4 Module 2.
- The student science notebook is an opportunity for students to practice informative writing and gathering evidence (CCSS ELA W.4.2 and W.4.8).
- 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.4.1).

Possible student misconceptions:

- Students may think that all characters in animated movies are real animals. In fact, animators use the structures of real animals to design their characters but sometimes combine structures from multiple animals (including humans). As students study animators, they learn that animators use real animals all the time.
- Students may misconstrue the Dim Effect as an observation that suggests that nature imitates art created by humans. Instead, help students see that the Dim Effect occurs because there is so much diversity of life on earth that anything humans think they have created likely already exists in nature; it just has not yet been discovered by humans. Consider sharing data with students about the number of animals that have been discovered in recent years. A simple internet search for "new species discovered" would yield many results.

Possible broader connections:

- Each year, scientists discover new organisms. The Dim Effect is a more unique example of one of these discoveries appearing similar to a human design. But many newly discovered organisms bear no resemblance to any animated character. Consider teaching students about other organisms that have recently been discovered.
- Students may have experience in their art classes creating or drawing live subjects. Consider asking students to bring in such work.
- Consider creating partnerships with art educators or local artists in launching this lesson sequence.

Areas where students may need additional support:

- Students may need additional support with understanding the difference between an ecosystem and a habitat. An ecosystem is the living and non-living things that make up an environment. When students learn about the performance task, be sure to explain that within large ecosystems (like the desert, tundra, and grasslands), animals and plants have a more specific place where their needs for survival are met. This more specific place is the organisms' habitat. In a habitat, animals and plants get the food, shelter, water, air, and space they need.
- If students are using an optional digital Google Earth Tour in place of the Mock Google Earth Tour, they may need additional support using the Google Earth tour feature. Consider giving students an extra 5 minutes to simply play with the technology before having them make their detailed observations.
- Students may need additional support using their student science notebook. Consider showing them models of completed notebooks. Highlight the structure of the notebook. Teacher directions are on the left-hand side of the page; students add their thinking to the right-hand side. See the Grade 4 Life Science Module Overview for additional information.

Down the road:

- In Lesson Sequence 2, students will work in expert groups to learn more about the specific characteristics of desert, tundra, and grassland ecosystems.
- Students will continue to use the student science notebook and may need support keeping track of this important material. Consider where and how you will have students store it so they can work on it and refer to past entries.

- Continue to care for the grass and radish plants seeded in preparation for use in Lesson Sequence 8.

In advance:

- Read each section and complete the Preparing to Teach: Self-Coaching Guide.
- See Key Features of the Life Science Modules in the introduction for more information on Scientists Meetings.
- Prepare student science notebooks and consider where students will store them in the classroom so they will be readily available.
- Create a teacher science notebook.
- Prepare technology necessary to play "Aaron's Art Tips—18 Drawing and Painting Animals From Life" <https://www.youtube.com/watch?v=Azk8n047Nhg>
- Choose a clip from *A Bug's Life* that includes the character Dim (found in scenes with the circus bugs) and prepare the necessary technology to play the scene.
- Create the Mock Google Earth Tour. Place a world map with highlighted desert, grassland, and tundra on each table, along with the color pictures associated with that ecosystem. See Supporting Materials.
- Post: Life Science Module guiding question, lesson sequence learning targets.

Optional extensions:

- *Personalizing My Notebook:* Give students time to decorate their science notebooks or attach an additional cover. For suggestions see <http://www.calacademy.org/educators/teacher-perspectives-value-science-notebooking>.
- *Google Earth Tour:* If you have the technical resources, create a digital Google Earth Tour in place of the Mock Google Earth Tour. Upload the images suggested for the mock tour into Google Earth. Then link each image with a location. Then you can create a tour for each ecosystem and download it onto the student computers.

Vocabulary

animator: a person whose job is to create cartoons

Dim Effect: phenomenon in which something that humans create is later found in nature

organism: a living thing, including plants and animals

habitat: the natural home of an organism where its needs for food, water, shelter, and space are met

ecosystem: the living and non-living things that make up an environment

structure: a part of a living thing

specialized structure: a thing that is specially designed for a specific task

explanatory model: a drawing or 3-D representation that has labels to explain an idea

grassland: a large, open area of land covered mainly by grass

desert: a dry or arid land area with very little rainfall and sparse plant life

tundra: a land area that is very cold and has a short growing season with very little rainfall and sparse plant life

Materials

General Materials

- ☑ "Aaron's Art Tips—18 Drawing and Painting Animals From Life" (video; play 1:00–2:45; see Teaching Notes)
- ☑ Image of a Rhinoceros beetle and Dim (one to display)
- ☑ Performance Task: Animal Design Challenge Explanatory Model (one per student and one to display)
- ☑ Professional science notebook entries (one to display)
- ☑ Student science notebook (one per student)
  - — Anchoring Phenomenon entry (page 4 of student science notebook)
- ☑ Mock Google Earth Tour (two sets per ecosystem; see Teaching Notes)
- ☑ Tundra, Desert, and Grasslands World Map (one to display)
- ☑ Norms of a Scientists Meeting anchor chart (new, teacher-created; see supporting materials)
- ☑ Life Science Module driving question (one to display)

Science-Specific Materials

- ☑ *A Bug's Life* (clip chosen by teacher; see Teaching Notes)
- ☑ Teacher science notebook (for teacher reference; see Teaching Notes)

Section 1: Asking Questions

A. Reviewing Learning Targets (5 minutes)

- Direct students' attention to the posted lesson sequence learning targets.
- Read them aloud as students follow along, reading silently in their heads:
  - ***"I can explain how animators use scientific practices to create convincing animated characters."***
  - ***"I can make detailed observation of the desert, grassland, and tundra ecosystems."***
- Tell students that they are going to be learning about and eventually doing the work of *animators*. Using a total participation technique, invite responses from the group:

  "What is the job of an animator?"
- Underline the words *desert*, *grassland*, *tundra*, and *ecosystems*. Do not define these words yet. Tell students that they will be learning about these things in the next few lessons [1].
- Using a total participation technique, invite responses from the group:

  "Based on the learning targets, what will you be practicing today?" (explaining what animators do, making detailed observations)

Preparing to Teach: Self-Coaching Guide

1. What vocabulary may students need additional support with?

B. Anchoring Phenomenon: Engaging the Scientist (15 minutes)

- Using a total participation technique, invite responses from the group [1]:

  "What are your favorite animated characters?" (Responses will vary.)

  "How do you think the animators create animals that can seem so real to us?"(Responses will vary.)

- Tell students that now they will watch a video about an animator, Aaron Blaise. Mr. Blaise is an artist who loves to draw animals—both animated and realistic looking. As students watch, they should listen for how artists learn about the animals in order to animate the characters they draw.
- Show **"Aaron's Art Tips—18 Drawing and Painting Animals From Life."**
- Clarify for students that words like *anatomy*, *structure*, and *form* are all referring to the body of the animal.
- Ask students to turn and talk. Then cold call a few pairs to share out:

  "What have we learned about what animators do to create realistic animals?" (observe real animals)

  "In what ways do artists and animators act like scientists?" (They observe closely and pay attention to the details of an animal's body. They collect information about the animal and share their observations with others)

- Show the clip from **A Bug's Life**, pausing it while Dim is on the screen.
- Display the **image of a Rhinoceros beetle** and **Dim**. Ask:

  "This is beetle is called a* Megaceras briansaltini. *Look closely at the animals. What do you notice about the character Dim and the real Rhinoceros beetle?" (Both have horn noses; they are different colors; they have the same body shape.)

  "What do you think animators did to create the character Dim?" (looked at live Rhinoceros beetles, or pictures of them)

- Tell students the real Rhinoceros beetle actually was not discovered until eight years <u>after</u> *A Bug's Life* was created. The scientist who discovered the new Rhinoceros beetle species named this the *Dim Effect* after the character in *A Bug's Life* [2].
- Tell students that every year, scientists discover many *organisms*. Scientists believe that there are countless organisms that have yet to be discovered by humans [3].
- Using a total participation technique, invite responses from the group:

  "What questions and wonderings do you still have about the Dim Effect?"

- Record students' questions and ideas in the **teacher science notebook**.
- Clarify misconceptions as necessary. Example: Animals are not created by animators. Rather, if animators work to create realistic animals, they may design an animal that already exists in nature because there are so many animals that have yet to be discovered.
- Consider sharing data with students about how many animals have been discovered in recent years.

Preparing to Teach: Self-Coaching Guide

1. How can I steer the conversation to talk about the ways animated cartoons are realistic and not just a list of cartoons we like?
2. How can I ensure that my students will not get the misconception that nature imitates art?
3. What can I quickly show that organisms are being discovered all the time?

C. Introducing the Performance Task (10 minutes)

- Distribute and display the **Performance Task: Animal Design Challenge Explanatory Model**.
- Tell students that for the performance task, they will create their own animals! And just like animators, they will study real plants and animals to create a realistic (but fictional) animal. It might be so realistic that it will be discovered someday, just like Dim and the rhinoceros beetle!
- Focus students on the "Task" section of the performance task handout. Read this section aloud as students follow along, reading silently in their heads.
- Review possible unfamiliar vocabulary words as you come to them. Ask [(1)]:

  "What does* habitat *mean?" (home of an organism that provides for the needs of the organism)
- Clarify that a habitat is different from an ecosystem. The ecosystem is the living and non-living things that make up an environment. It encompasses a larger space than a habitat and can contain many habitats.
- Pause at the phrase structures (*internal and external*). Ask:

  "Based on the other words in the sentence, what do you think* structures *means? Consider both internal and external structures." (arms, legs, stomach, heart, lungs)
- Repeat this process with the phrase *specialized structures*. Ask:

  "Is there a word within the word* specialized *that you recognize?" (special)
- Ask:

  "What would make something a 'special structure'?"
- Repeat this process with the phrase *explanatory model* and the word *explanatory*.
- Ask [(2)]:

  "What would make something a 'model that explains'?" (It would need to include something more than just a picture.)
- Answer clarifying questions about the performance task as necessary. Consider recording them in the teacher science notebook. Tell students that they will learn more about the specifics of the task in future lessons.

Preparing to Teach: Self-Coaching Guide

1. What experience do my students have with these vocabulary words? Consider that students may have learned about habitats in earlier grade levels.
2. What experience do my students have with models?

Section 2: Obtaining Information

A. Launching Science Notebooks (10 minutes)

- Tell students that to be successful on the performance task, they need to gather information. When scientists gather information, they collect it in a science notebook [(1)].
- Display the **professional science notebook entries** to provide authenticity for the work that students will be completing. Encourage students to notice and name one thing they notice about the information in the notebook.
- Distribute the **student science notebooks**. Tell students that just like professional scientists, they will record their questions, thinking, and learning for this module in a notebook.
- Because this is a new tool for students with a unique format, ask students to flip through their student science notebook and think of one "notice" and one "wonder" about how the notebook is set up or what they see inside it to share with an elbow partner.
- Invite students to take 5 minutes to share with their elbow partner.
- After students have shared with an elbow partner, ask for volunteers to share out.
- As needed, respond to student questions and wonders. Be sure they understand that the right-hand side of the page is for them to write their ideas or questions, draw pictures, and jot down any information they learn. Assure them this is their notebook. You will occasionally collect it to look at some of their thinking, but it is mostly for them to keep a record about what they are learning.
- Tell students that as they design an animal, they need to know about the ecosystems where their movie might take place. To help them become more familiar with each of the ecosystems, they will view a Mock Google Earth tour [(2)].

Preparing to Teach: Self-Coaching Guide

1. Have I used a student notebook in my classroom before? How is this similar to or different from what I've done before? Do I have a student model that would be useful to students?
2. What preparations do I need to make so that the transition to the Mock Google Earth tour is smooth?

B. Exploring Mock Google Earth Tour (20 minutes)

- Tell students to turn to the **Anchoring Phenomenon entry** in their student science notebook. Explain that this is where they will take notes about the different ecosystems. Encourage them to think of themselves as explorers, or people who travel to an unknown land.
- Show students **Mock Google Earth Tour**. Tell them that as they move for each ecosystem station they will be moving to different parts of the world [(1)].

- Divide students into pairs and ask them to take their notebooks and move to sit with their partners at one of the ecosystem stations. (You may have multiple pairs at each station)
- Direct students to follow the directions for completing the Mock Google Earth tour section of their Anchoring Phenomenon entry. They should each record their questions and detailed observations about the tour in their own notebook.
- Tell students what signal you will give when it's time to move to the next ecosystem station (2).
- Circulate to support and ask probing questions such as (3):

  "What types of plants are growing?"

  "What do you wonder about the plants that you see in the three ecosystems?"

  "Why is grass the only plant that is in all three ecosystems, and why are the other plants so different?"

  "What do you notice about the similarities and differences of each of the ecosystems?"
- Record students' answers in the teacher science notebook to revisit later in the unit and for evaluation of student participation.
- Ensure students notice that grass or grass-like plants are a unique type of plant because they are found in all three ecosystems. Encourage students to wonder about the grasses' ability to survive under many conditions. Tell students that they will keep thinking about grass throughout the module.
- Display the **Tundra, Desert, and Grasslands World Map**.
- After students have visited each station, refocus students whole group. Ask:

  "What do you notice about where grasslands, deserts, and tundra are located around the world?" (Grasslands, deserts, and tundras are all over the world. This means grass grows all over the world.)
- Congratulate students on being explorers and making detailed observations.

Preparing to Teach: Self-Coaching Guide

1. Could I create a Google Earth Tour instead and take my students to the computer lab?
2. How will I help students transition between ecosystems? Will I have them move with a sound or allow them to move at their own pace?
3. What questions will I ask to stimulate closer observations?

C. Scientists Meeting: Gathering Ideas (30 minutes)

- Ask students to bring their science notebooks and gather for a Scientists Meeting.
- Gather students in a whole group area on the floor.
- Explain to students:
  - They are starting a *routine* they will continue throughout the module.
  - This is a special class *conversation* where they talk about important science concepts and the new concepts they are learning.
  - They should always *gather* in a circle and be respectful of one another's space.
  - They will be using the *things* they write in their student science notebook to help them explain their ideas, so they should always bring their notebook to the meeting.

- Tell students that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher (1).
- 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.
- Share with students that the goal of today's Scientists Meeting is to gather ideas and questions about the driving question for this module.
- Direct students' attention to the posted **Life Science Module driving 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 that as they work to complete the performance task, they will be able to answer this driving question.
- Ask students to discuss with an elbow partner (2):

  ***"What are the different words or phrases in this question that you need to learn more about in order to answer the question?"* (internal and external, structures, function, system, survive well, habitat)**

- As students share out, rephrase their ideas into sub-questions and list them under the driving question. See page 1 of the student science notebook for some examples (3).
- Ask students to talk with an elbow partner:

  "What are your thoughts and wonders about the words* structure *and* function *so far?" (Responses will vary.)

  "What are your thoughts and wonders about the phrase* survive well *so far?" (Responses will vary.)

  "How will learning about the structures of plants and animals help you design a realistic animal for the performance task?" (We will be able to make the animal have features that look real.)

- Ask pairs to share out; capture their ideas in the teacher science notebook.
- Continue asking questions to elicit students' background knowledge about the key terms in the module driving question.
- As students share out, push them to provide evidence for their ideas:

  "What have you seen, heard, or read that makes you think that?"

  "What experience have you had that supports that idea?"

- Ask questions to help students connect their ideas:

  "Do others agree or disagree? Why?"

  "Can someone paraphrase what Student A said?"

- Ask students to turn to the Mock Google Earth Tour Questions section in their student science notebook.

- Remind students that the ecosystems they viewed on the tour contain the habitats of organisms living there.
- Using a total participation technique, invite students to share their responses to the Google Earth tour questions.
- Encourage students to connect to build on one another's ideas by asking:

  "Did someone have something similar to what X observed? How was it the same?"
- Record student responses and questions in the teacher science notebook, being sure to think aloud and model for students the habit of recording questions and thinking that will be returned to later (4).
- Let students know that in the coming lessons they will spend a significant amount of time investigating how structures function in various ecosystems, and that you look forward to seeing how their ideas change and grow.
- At the end of the conversation, direct students' attention to the Norms of a Scientists Meeting anchor chart. Briefly discuss how well the class kept the norms of the Scientists Meeting (5).

Preparing to Teach: Self-Coaching Guide

1. A Scientists Meeting is different from a regular group discussion. What group norms will I emphasize?
2. Remember that at this point I want to gather information about what the students already know about these key terms. *I do not need to define them yet*. What words do I anticipate they will need to unpack?
3. What are some example sub-questions?
4. How will I capture this valuable information about students' prior knowledge?
5. How much practice do my students have with self-evaluation? Will they need a more structured way to reflect on how well they kept the norms?

Notes