EQuIP Rubric for Science

Structure & Function

How do plants' and animals' structures function together to meet their needs?

Curriculum Developer: OpenSciEd

GRADE 4 | FEBRUARY 2026

nsta
National Science Teaching Association

Category I Rating

A	B	C	D	E	F
Explaining Phenomena/ Designing Solutions	Three Dimensions	Integrating the Three Dimensions	Unit Coherence	Multiple Science Domains	Math and ELA
EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE

Score Category I: 3

Category II Rating

A	B	C	D	E	F	G
Relevance and Authenticity	Student Ideas	Building Progressions	Scientific Accuracy	Differentiated Instruction	Teacher Support for Unit Coherence	Scaffolded Differentiation Over Time
EXTENSIVE	EXTENSIVE	ADEQUATE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE

Score Category II: 3

Category III Rating

A	B	C	D	E	F
Monitoring 3D Student Performance	Formative	Scoring Guidance	Unbiased Tasks/Items	Coherent Assessment System	Opportunity to Learn
EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE	EXTENSIVE

Score Category III: 3

UNIT 2.4

Sum Categories	**9**
Rating	**E**

Overall Summary Comments

This unit is designed for the *Next Generation Science Standards* (*NGSS*), including clear and compelling evidence of the following criteria:

- **Integrating the Three Dimensions:** The unit materials demonstrate clear evidence of students using grade-appropriate elements of the three dimensions together throughout the learning process in service of explaining a phenomenon.
- **Unit Coherence:** Each lesson's focus is defined using student questions and ideas related to their progress in designing solutions.
- **Student Ideas:** This unit offers several opportunities for students to express, clarify, justify, interpret, and represent their ideas. The materials also provide opportunities for students to provide peer feedback and to receive and reflect on feedback related to their thinking and reasoning.
- **Differentiated Instruction:** Supportive ways to access instruction are suggested for multilingual learners and students with disabilities.
- **Teacher Support for Unit Coherence:** The navigation routines provide the teachers with multiple methods of moving from one lesson to the next. These methods involve aspects of all three dimensions.
- **Opportunity to Learn:** The unit includes a coherent system of opportunities for students to receive feedback from peers and the teacher, revise their thinking and then use their learning on a subsequent task.

The unit was reviewed to "provide constructive criterion-based feedback and suggestions for improvement to developers" (EQuIP Rubric for Lessons & Units: Science (Version 3.1). Reviewers recommend focusing on the following criteria during revisions:

- **Building Progressions:** Provide teachers with ways to identify prior learning expected for the elemental level of the three dimensions. Include support for teachers regarding specific student "alternate conceptions."

Why are there two colors of text in this report?

Black text is used in this report to identify direct quotations or paraphrases of a lesson/unit (the evidence) and why/how this evidence indicates the criterion is being met (the reasoning). (EQuIP Rubric for Lessons & Units: Science (Version 3.1))

Black text is also used for evidence and reasoning that does not affect the rating of the criterion.

Purple text is used in this report to identify direct quotations or paraphrases of a lesson/unit (the evidence) and why/how this evidence indicates that the criterion is NOT being met (the reasoning). (EQuIP Rubric for Lessons & Units: Science (Version 3.1)) The exception to this is when a criterion is rated as "extensive." In those cases, purple is used as a visual cue to *"provide constructive criterion-based feedback and suggestions for improvement to developers"* (EQuIP Rubric for Lessons & Units: Science (Version 3.1)).

CATEGORY I
NGSS 3D Design

I.A. Explaining Phenomena / Designing Solutions

EXTENSIVE

Making sense of phenomena and/or designing solutions to a problem drive student learning.

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem solving.

ii. The focus of the lesson is to support students in making sense of phenomena and/or designing solutions to problems.

iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical, life, and/or earth and space sciences.

The reviewers found **extensive** evidence that making sense of phenomena drives student learning. The materials are organized to support students in figuring out how flying squirrels use a system of internal and external structures to meet their needs for survival, growth, and reproduction. Student questions and prior experiences related to the phenomenon are used to motivate sense-making and problem solving. The central phenomenon is logically partitioned into three lesson sets that increase in complexity: students first investigate the external structures of squirrels and how these structures support survival, growth, and reproduction (Lessons 1–5), they then examine sensory systems and light reflection that explain the nocturnal behavior of flying squirrels and how their structures support meeting needs at night (Lessons 6–10), and finally they compare these animal systems to plant structure that support survival and growth (Lessons 11–13). Across the unit, students engage in ongoing modeling to explain the phenomena, moving from early descriptions of squirrel structures to coherent system models that integrate sense receptors and memory.

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem-solving.

Student-centered focus on phenomena or problems

The unit is anchored by a series of phenomena that drive student learning across the three lesson sets. The phenomenon for the first set of lessons (1-5) is introduced in the first lesson. This lesson set is anchored by the general phenomenon that squirrels have external structures that support the functions of survival, growth, and reproduction.

- Lesson 1, Navigate, Step 1: "Introduce the flying squirrel. Tell students that you have a picture of a squirrel that looked really interesting to you and you are excited to share it with them. Explain that the squirrel in the picture is called a flying squirrel. Display slide A and ask students to turn and tell a partner what they notice and wonder about the flying squirrel in the picture. Facilitate a discussion about what students noticed and wondered." (Lesson 1, Teacher Guide)
- Lesson 2, Connect, Step 3: "Establish why it's helpful to connect to related phenomena. Display slide E. Ask students to consider how connecting with other animal parts and needs could help us figure out how the flying squirrel's parts work together." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 7, "Revise our model to explain how the flying squirrel uses its parts to move through the air. Celebrate the work that students have done and suggest we return to our model from the previous lesson to add our new ideas (refer to slide O). Use the sample prompts below to support students in adding ideas about how the flying squirrel uses its parts to move through the air." (Lesson 3, Teacher Guide)
- Lesson 4, Connect, Step 4, "Facilitate a discussion with the class. Display slide H. Facilitate a discussion with the class about what we notice from the infographic about how bats slow down and land. Record students' observations on the Bat Structures chart using the chart as a visual scaffold to make thinking visible. This helps all students track how

evidence about the bat's body parts and their functions builds towards our investigation and connection to a flying squirrel's parts." (Lesson 4, Teacher Guide)

- Lesson 5, Connect, Step 6, "Introduce a new squirrel. Congratulate students on everything they've figured out about how flying squirrels use their system of body structures to stay in trees because it's safer for them and that's where most of their food is located. So by gliding from tree to tree, flying squirrels are able to meet their needs. Display slide M. Tell students that your friend sent you this video when they heard your class was trying to figure out information about squirrels." and "Tell students you are going to play the video of the tree squirrel and that you would like for them to think about the structures they notice the tree squirrel using." (Lesson 5, Teacher Guide)
- In Lesson 6, Explore, Step 4, students conduct investigations to reach conclusions about how squirrels can find their food even in the dark of the night.

The phenomenon for the second set of lessons (6-10) is introduced in Lesson 6. This lesson set is anchored by the general phenomenon that flying squirrels meet their needs at night and tree squirrels meet theirs during the day.

- Lesson 6, Synthesize, Step 5, "Develop a model of how squirrels use light to see their food. Tell students that now that we have carried out this investigation, we can add what we have figured out to the model we started earlier in the lesson. Have students bring *Investigating Light* and gather in a Scientists Circle. Display slide J the chart paper labeled "Do squirrels need light to see their food?" and facilitate a discussion about how squirrels need light to see their food." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 3, "Tell students that it sounds like we have some ideas about what to revise on this model. Display slide H and the chart paper labeled "How does the amount of light shining on an object impact how much we can see?" and invite students to work together as a class to develop a model that explains how the amount of light impacts what we can see." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize, Step 5: "Motivate an examination of another sense phenomenon. Ask students whether they think we've answered our question about how ground squirrels might be able to meet their needs in the dark using their sense of smell. Focus on the idea that animals are getting information from their smell receptors that they can then use to help them meet their needs for food, avoiding predators and finding mates. Ask them to recall how flying squirrels meet their needs. Listen for them to say that flying squirrels get information by using their sense of sight or seeing." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "Add to our How senses help animals model as a class. Encourage students to have their copies of *Taste or Hearing Receptors Model* accessible and display the *How senses help animals model* that we have been working on as a class. As a class, add the taste and hearing receptors to our *how Senses help animals model* and reflect on all of the receptors that animals can use to make sense of their environment." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2: "Introduce the Flying Squirrel Senses Situation Cards. Display slide C. Pass out one set of Flying Squirrel Senses Situation Cards to each pair. Direct students to find the Choosing Food card (the one shown on the slide). Read the card out loud to the class and invite them to read along with you. Ask students to take a moment to think by themselves about which sense receptors the flying squirrel is using and what it is doing with the information from the sense receptors. Invite students to share their ideas with the class." (Lesson 10, Teacher Guide)

The phenomenon for the third set of lessons (11-13) is introduced in Lesson 11. The phenomenon is to figure out if plants have systems of structures that allow them to survive and grow.

- Lesson 11, Navigate, Step 1, "Point out that it sounds like all of the structures that flying squirrels use require them to move around in order to survive and grow. Display slide B and ask students to consider how a plant might survive and grow without moving much, if at all. Consider having a live plant visible for students to reference as well." (Lesson 11, Teacher Guide)
- Lesson 12, Synthesize, Step 5, "Updated our claims and model. Return to the list of claims on the whiteboard and allow students time to add new claims. Display the *How the Lima Bean Plant System Works* chart from last class (Refer to slide O) and suggest that we use our claims to add new ideas about how the seeds get water and how new seeds can form." (Lesson 12, Teacher Guide)
- Lesson 13, Connect, Step 2, "Transition to the flower investigation. Summarize that the article helped us understand why plants need pollinators like hummingbirds, but it seems like we want to know more about the flowers' structures and their functions in getting pollination to happen. Suggest we investigate those structures next." (Lesson 13, Teacher Guide)

Consistent student-driven learning over time

- Unit Overview: "The anchoring phenomenon for this unit is students' observations of flying squirrels. In Lesson 1 students make and record observations from videos, photos, and text of flying squirrels using parts of their bodies to meet their needs. In Lesson 11, there is a re-anchoring move when students build on their observations from earlier lessons about animals and begin to think how plants are able to use their structures to meet their needs, even though they don't move as much as flying squirrels do." (Unit Overview)
- Lesson 1, Explore, Step 1: "Tell students that you have a picture of a squirrel that looked really interesting to you and you are excited to share it with them. Explain that the squirrel in the picture is called a flying squirrel. Display slide A and ask students to turn and tell a partner what they notice and wonder about the flying squirrel in the picture." and "Watch videos of flying squirrels. Display slide B and explain that we will need a place to record our observations of the flying squirrels as we watch the videos. Distribute the Video Observations handout and ask students to record what they notice and wonder about the flying squirrels. Play the video at least twice giving students time to observe and record their noticings and wonderings. Ask students to turn and tell a partner what they noticed and wondered about the flying squirrels." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 5, "Elicit students' questions. Display slide J. Distribute one sticky note to each student (or two sticky notes if you have extra time or a small class). Direct students to look back at the work we've done thinking about how flying squirrels use their parts to meet their needs. Ask, What questions do we need to answer to decide how any living thing might use its parts to meet its needs? Ask students to use a marker to write one question on their sticky note. They should write their questions so they are big and bold—we want to be able to see the questions clearly. Remind students that it is part of our mission in this unit to answer these questions.Organize questions into a Driving Question Board (DQB). Gather students in a Scientists Circle where they can see the prepared chart paper or other board space; have them bring their sticky-note questions. Explain that we want to gather and organize our scientific questions in a way that will help guide the investigations we do and help us track the ideas we figure out along the way. Explain that it is important that we hear everybody's questions, and we might find that we have questions similar to some of our classmates' questions. As we share, we'll organize our questions into groups so we can more easily plan investigations and track what we have figured out." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate, Step 1, "Recall where we left off. Display slide A. Direct students' attention Driving Question board and Ideas for Investigation charts from the previous lesson. Circle or highlight questions that students had

around how the flying squirrel can move through the air. Ask students if they have any new questions to add, and allow students to record them and add them to the DQB." (Lesson 3, Teacher Guide)

- Lesson 5, Synthesize, Step 3: "Celebrate what we've figured out so far. Congratulate students on figuring out a bit of the mystery behind why flying squirrels glide instead of climb. Remind them we'd also talked about figuring out some information about flying squirrel predators. Let students know that you have another set of data cards for them to consider but this one has information about flying squirrel predators." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate, Step 7: "Discuss where to go next. Display slide P Say something like "Since light needs to be shining on an object in order for it to be seen, how can flying squirrel eyes see their food at night when there is not very much light? Ideas to listen and look for:
  - Maybe they have special eyes that help them see better than us.
  - I am thinking that they can't really see them, there are just way less predators out at night when it is dark.
  - I have heard that some animals have special vision that allows them to see in the dark, maybe they have that.
- Tells students that it sounds like we still have questions about how the flying squirrels are able to see their predators in the dark. We will need to continue to investigate those wonderings in our next lesson." (Lesson 6, Teacher Guide) The teacher "tells" the students that they need to continue investigating. The materials do not create an explicit need from the students' perspective.
- Lesson 7, Navigate, Step 1, "Revisit Lesson 6 Model to problematize how to move our science thinking forward. Display slide A and the lesson 6 "Do squirrels need light to see their food?" model. Ask students to turn and talk to a classmate to discuss what we investigated together in the previous lesson. Call on a few pairs of students to share their thoughts and allow them to reference the model or materials to express their ideas. Facilitate a discussion about what we figured out about light in our last lesson and problematize what still needs to be figured out about light." (Lesson 7, Teacher Guide)
- Lesson 8, Connect, Step 1, "Identify related phenomena. Display slide A and support students in recalling that we were interested in finding out more about other living things that were out meeting their needs in the dark. Ask students if there are any new examples of living things that they thought of or heard about from others in their community. Refer to the *How do animals and plants use their parts to meet their needs?* chart from Lesson 2 where students had previously mentioned other animals (parts of animals), especially those that are active in the dark. Accept all responses and emphasize that there are a lot of living things that spend a lot of their time in the dark." (Lesson 8, Teacher Guide)
- Lesson 9, Connect, Step 2: "Read *animal whisker information cards*. Present slide C and let students know that you have some cards with information about how four different animals use their whiskers. Invite students to read the cards in pairs and discuss how the animals are using their whiskers and what kind of sense receptors whiskers use to detect information." (Lesson 9, Teacher Guide)
- Lesson 10, Navigate, Step 6, "Revisit the Driving Question Board to decide where to go next. Display slide K. Celebrate with students that we have figured out that animals have internal and external structures that work together as a system to help them perform the functions they need. Refer to the Driving Question Board and point out any questions about plants. Ask students if they think that plants also have special structures to help perform functions that meet their needs." (Lesson 10, Teacher Guide)
- Lesson 11, Connect, Step 2, "Acknowledge that we see plants growing and living in many places in our lives, even in and around our school and we know they need light and water to do both. Display slide D and ask students to consider how looking at plants that are living and growing in or around our school could help us figure out how they are able to do that without moving." (Lesson 11, Teacher Guide)

- Lesson 12, Navigate, Step 7, "Consider where to go next. Display slide Q and have students share what they notice and wonder about the image. Use the sample prompts below to support students in figuring out what to investigate in the next lesson." (Lesson 12, Teacher Guide)

When multiple phenomena and /or problems are used

- Lesson 2, Synthesize, Step 5, "Elicit students' questions. Display slide J. Distribute one sticky note to each student (or two sticky notes if you have extra time or a small class). Direct students to look back at the work we've done thinking about how flying squirrels use their parts to meet their needs. Ask, What questions do we need to answer to decide how any living thing might use its parts to meet its needs? Ask students to use a marker to write one question on their sticky note. They should write their questions so they are big and bold—we want to be able to see the questions clearly. Remind students that it is part of our mission in this unit to answer these questions." (Lesson 2, Teacher Guide) Students create a driving question board about both animal and plant structures.
- Lesson 5, Navigate, Step 8: "Consider saying something like, " It sounds like both kinds of squirrels have similarities and differences in their system of structures that are really helpful for them to perform the tasks that they need to in order to find food, build shelter, and avoid predators." Point to the picture on the slide and ask students if they notice anything else that's different between the pictures of the two kinds of squirrels." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate, Step 1, "Facilitate a class discussion about what we figured out in the last lesson. Display slide A and remind students that we have been figuring out so much about flying squirrels. Refer back to our initial consensus model that we started in Lesson 1 and revised in Lesson 4. Facilitate a discussion about what we figured out about flying squirrels in the last lesson and what we were left wondering about...Acknowledge that it seems like we are not in agreement about whether the squirrels even need light to see in the dark, we should explore this idea further." (Lesson 6, Teacher Guide)
- Lesson 10, Navigate, Step 6, "Revisit the Driving Question Board to decide where to go next. Display slide K. Celebrate with students that we have figured out that animals have internal and external structures that work together as a system to help them perform the functions they need. Refer to the Driving Question Board and point out any questions about plants. Ask students if they think that plants also have special structures to help perform functions that meet their needs."
- Lesson 11, Navigate, Step 1, "Point out that it sounds like we are not really sure what structures plants have to help them to survive and grow, and how they use those structures to survive and grow since they stay in one place. Take a few minutes to revisit the DQB to surface any questions that students had about plants In Lesson 2 that have not yet been answered. Use this and the uncertainty surrounding the structures plants use to survive and grow to motivate a need to investigate plant structures." (Lesson 11, Teacher Guide)

ii. The focus of the unit is to support students in making sense of phenomena and/or designing solutions to problems.

Close match between the phenomena/problems and the student learning objectives throughout the materials

Lesson 1: **Develop a model to describe** how a flying squirrel's **structures work together** to **meet its needs.**

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)

Lesson 2: **Develop a model to describe** how an animal and/or plant's **structures work together** to **meet its needs.**

- Lesson 2, Explore, Step 4, "Read and model in pairs. Distribute 1 infographic card and the coordinating page from the Other Living Things Needs Model handout to each pair, and give pairs time to read and develop their models. Be sure at least one pair develops a model for each organism." (Lesson 2, Teacher Guide)

Lesson 3: **Construct an argument using a model and various media to support the claim that flying squirrels have internal and external structures, like bones and a patagium, that have specific shapes which function to help them glide through the air.**

- Lesson 3, Synthesize, Step 6, "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book." (Lesson 3, Teacher Guide)

Lesson 4: **Construct an argument** about how **different animals' internal and external structures function together as a system to carry out the function of landing safely on trees in order to support their survival.**

- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system)." (Lesson 4, Teacher Guide)

Lesson 5: **Construct an argument from evidence** that **tree squirrels can also meet their needs for survival, growth, and reproduction in the trees with the system of structures they have**.

- Lesson 5, Synthesize, Step 7, "Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide)

Lesson 6: **Use a model to describe how light reflects off of an object and into eyes causing** it to be **seen.**

- Lesson 6, Connect, Step 6, "Distribute Our Experiences with Reflected Light and display slide L. Encourage students to use the model we created as a class as a guide for creating their model. Give students time to complete their models." (Lesson 6, Teacher Guide)

Lesson 7: **Develop a model that explains** how a flying squirrel's **larger eyes cause more light to enter their eye, helping them to see with less light (effect).**

- Lesson 7, Synthesize, Step 6, "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference." (Lesson 7, Teacher Guide)

Lesson 8: **Develop and revise a model to describe how receptors are part of a larger system that allow living things to sense the world around them**

- Lesson 8, Synthesize, Step 5, "Lead a Building Understanding Discussion to revise the model for smelling. Display slide I and lead a discussion to revise the model to include smell receptors and functions. An example revised model can be seen below." (Lesson 8, Teacher Guide)

Lesson 9: **Develop and revise models to describe how taste and hearing receptors are part of a system that allow living things to sense the world around them.**

- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)

Lesson 10: **Develop a model to describe** how flying squirrels use their **system of sense receptors to perform behaviors that aid in reproduction**.

- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)

Lesson 11: **Develop a model to describe** that **plants have structures that function** to **support survival and growth**.

- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)

Lesson 12: **Support an argument** that **plants have structures that work together to help the plant grow, survive, and reproduce** with **evidence from various sources**.

- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)

Lesson 13: **Construct an argument supported by evidence in the form of a model that flowers have internal and external structures (a system of interacting components) that function to support reproduction.**

- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

iii. When engineering is a learning focus, it is integrated with developing disciplinary core ideas from physical science, life, and/or earth and space sciences.

When students are designing solutions to problems (with or without connections to ETS DCIs)

- N/A, engineering is not a learning focus of this unit.

Criterion-Based Suggestions for Improvement:

- Ensure that "[s]tudents regularly return to the phenomena or problems to add layers of explanation or iterate on solutions based on learning, or regularly build on what they have learned from smaller phenomena or problems to explain a broader science topic." (Detailed Guidance, p. 7).
  - For example, in Lesson 6, when navigating to the next lesson, rather than the teacher stating they will continue investigating wonderings, provide a prompt for students to look back at the Initial Consensus Model from Lesson 1. This allows them to identify exactly which part of the flying squirrel's "meeting needs" system is still a mystery, necessitating the next investigation.

I.B. Three Dimensions

(All 3 dimensions must be rated at least "adequate" to mark "adequate" overall)

EXTENSIVE

Builds understanding of multiple grade-appropriate elements of the science and engineering practices (SEPs), disciplinary core ideas (DCIs), and crosscutting concepts (CCCs) *that are deliberately selected to aid student sense-making of phenomena and/or designing of solutions.*

Document evidence and reasoning, and evaluate whether or not there is sufficient evidence of quality for each dimension separately.

Evidence needs to be at the *element level* of the dimensions (see rubric introduction for a description of what is meant by "element")

The reviewers found **extensive** evidence that the materials provide students with opportunities to build understanding of grade-appropriate elements across the three dimensions, as students regularly engage with all three dimensions to make sense of the anchoring or lesson-level phenomenon. The unit centers on students using targeted elements of all three dimensions that are clearly identified and addressed throughout the unit to explain how internal and external structures of flying squirrels and other living things help them meet their needs.

Rating for Criterion: SEP **EXTENSIVE**

i. Provides opportunities to *develop and use* specific elements of the SEP[s].

Reviewers found **extensive** evidence that students use grade-appropriate Science and Engineering Practices (SEPs) to figure out the unit's science ideas. The materials excel in Developing and Using Models (MOD), specifically by having students move beyond simple drawings to revise their models based on new evidence (Lessons 7–11). Students also Engage in Argument from Evidence (ARG) by giving and receiving peer feedback to improve their explanations (Lesson 9). Students Obtain, Evaluate, and Communicate Information (INFO) by combining facts from books and media to explain how animals and plants survive. Students use the SEPs as active tools to make sense of the natural world.

MOD: Developing and Using Models

Claimed Element: **MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**

Claimed in Lessons 7, 8, 9, 10, and 11. Evidence was found in 7, 8, 9, 10 and 11. Examples include

- Lesson 7, Synthesize, Step 3: "Tell students that it sounds like we have some ideas about what to revise on this model. Display slide H and the chart paper labeled "How does the amount of light shining on an object impact how much we can see?" and invite students to work together as a class to develop a model that explains how the amount of light impacts what we can see." (Lesson 7, Teacher Guide)
- Lesson 8, Explore, Step 3: "Develop an initial model for how smelling the world works. Display slide G and invite students to form a Scientists Circle. Place the Model for Smelling the World chart in a place where all students can see. Use the prompts below to support students in co-constructing the model for smelling. Invite students to label the model in both English and their preferred language modality." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6: "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2: "Develop a model to explain the Choosing Food card. Suggest that we build a model similar to the Model for Smelling the World. Ask students to give you a thumbs up or a thumbs down to show agreement. Display slide D. Pass out 1 copy of the Video Observations handout to each student. Direct students to the space for recording the Choosing Food model. Ask partners to work together to model the information on the Choosing Food card. Make sure to have the Model for Smelling the World displayed so students can reference it while they work. Let students know that each partner should record the model on their own handout." (Lesson 10, teacher guide)
- Lesson 11, Synthesize, Step 7: "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)

Claimed Element: **MOD E4: Develop and/or use models to describe and/or predict phenomena.**

Claimed in Lessons 1, 2, 6,10, and 13. Evidence was found in 1, 2, 6, 10, and 13. Examples include

- Lesson 1, Synthesize, Step 5: "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2, "Begin the initial consensus model. Display slide C. Title a piece of chart paper or a shared digital space with the question we're trying to explain: "How do flying squirrels use their parts to meet their needs?" Include the outline of a flying squirrel body on the chart as well, found on the Flying Squirrel Illustration reference." (Lesson 2, Teacher Guide)
- Lesson 6, Synthesize, Step 5, "Develop a model of how squirrels use light to see their food. Tell students that now that we have carried out this investigation, we can add what we have figured out to the model we started earlier in the lesson. Have students bring Investigating Light and gather in a Scientists Circle. Display slide J the chart paper labeled "Do squirrels need light to see their food?" and facilitate a discussion about how squirrels need light to see their food." (Lesson 6, Teacher Guide)
- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)
- Lesson 13, Synthesize, Step 4: "Read the assessment directions aloud, and take a few moments to clarify the task: construct an argument supported by a model. Remind students that they have constructed arguments and developed and used models many times in this unit and prior science work. In this task, their model for how a flower's structures work together to get pollen moved by a hummingbird will support their claim. Point out that it is important to label where the evidence for their ideas came from: the article or their flower investigation. Invite and answer any clarifying questions." (Lesson 13, Teacher Guide)

ARG: Engaging in Argument from Evidence

Claimed Element: **ARG E3: Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions.**

Claimed in Lessons 9 and 13. Evidence was found in Lessons 9 and 13. Examples include:

- Lesson 9, Synthesize, Step 6, "Share our models with another pair. Display slide O and group students with a pair who developed a model for the other sense receptor. Encourage students to take turns reading and explaining their model to the other pair. Invite the other pair to respectfully listen and provide supportive feedback using the prompts on slide O. Remind students that helpful feedback should focus on science ideas in the model, include celebrations and questions, and be kind, specific, and aimed at helping their classmates strengthen their thinking. When both pairs have had time to share their models with each other, give students time to revise their models based on the feedback if they gained new ideas or clarifications from the discussion." (Lesson 9, Teacher Guide)

- Lesson 13, Synthesize, Step 5: "Give and receive feedback. After students have completed their Flower Pollination Model assessment, display slide H and distribute the Peer Feedback handout. Pair students to give and receive feedback about their arguments supported by models. Remind students that the purpose of giving feedback is to help improve our work by emphasizing things to look and listen for, such as: Does the model support the claim? Is it helping answer the question? Does the model help you see how the flower structures work together?" (Lesson 13, Teacher Guide)

Claimed Element: **ARG E4: Construct and/or support an argument with evidence, data, and/or a model.**

Claimed in Lessons 3, 4, 5, 12 and 13. Evidence was found in Lessons 3, 4, 5, 12 and 13. Examples include:

- Lesson 3, Synthesize, Step 4: "Vote with your feet. Display slide I and ask students to stand up. Point to one side of the room for students to go to if they think the flying squirrel does fly. Then point to the other side and ask students to go there if they think the flying squirrel does not fly. Invite students with mobility limitations to share their ideas in another way—for example, by holding up a colored card from their seat. Ask a few students in each area to share their thinking. Accept all responses." Step 4 Sidebar: "As students make a claim for their position, ask them to share their thinking for why they think the flying squirrel flies or does not. Push students to supply evidence from the investigation, photos, and or videos to support their claims. Later in the lesson students will use evidence to develop an argument using a scaffolded handout." (Lesson 3, Teacher Guide)
- Lesson 3, Synthesize, Step 6: "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book. Help students to make the connection that these observations can serve as evidence to support our arguments." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system). Give students time to construct and revise their arguments with their partners." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Step 3: "Use a model to help answer our question. Ask students to turn and talk with a partner about our model. Remind them that we want to figure out why flying squirrels glide from tree to tree rather than climbing up and down trees to get to their food. After a few moments, invite them to share what they talked about. Look and listen for ideas about Path 1 being shorter or easier than Path 2 and express curiosity about how they know that without measuring. Agree that Path 1 looks shorter but suggest that we should measure the paths, just to confirm. Use a ruler to measure the paths, talking out loud as you do so. Invite students to help you calculate the paths. (Lesson 5, Teacher Guide)
- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

INFO: Obtaining, Evaluating, and Communicating Information

Claimed Element: **INFO E2: Compare and/or combine across complex texts and/or other reliable media to support the engagement in other scientific and/or engineering practices.**

Claimed in Lesson 3. Evidence was found in Lesson 3. Examples include:

- Lesson 3, Connect, Step 5, "Read infographics with a partner. Acknowledge that students suggested we could look at additional sources, like books about other living things, to see if it helps us figure out if a flying squirrel can actually fly. Display slide L and introduce the infographics. Pass out a set of Animal Infographics to each pair." (Lesson 3, Teacher Guide)

Claimed Element: **INFO E3: Combine information in written text with that contained in corresponding tables, diagrams, and/or charts to support the engagement in other scientific and/or engineering practices.**

Claimed in Lessons 2, 4, 12 and 13. Evidence was found in Lessons 2, 4, 12 and 13. Examples include:

- Lesson 2, Explore, Step 4: "Introduce the infographics. Display slide H and and tell students that we can read to find out more about how other things meet their needs, especially in the dark. Explain that since it was helpful to model how the flying squirrel's parts help it meet needs, we will work in pairs to develop models to describe how the animals and 1 plant on these cards use parts to meet their needs." (Lesson 2, Teacher Guide)
- Lesson 4, Synthesize, Step 5, "Give students time to construct and revise their arguments with their partners. Remind students that they can use resources around the classroom—like the Bat Structures chart and their earlier flying squirrel sketches Construct an argument to help them get ideas for their arguments." (Lesson 4, Teacher Guide)
- Lesson 12, Explore, Step 3: "Discover other structures of the lima bean. Display slide I. Tell students that you have some informational cards that might tell us more about other structures of the lima bean seed. Show students that the cards have pictures of the lima bean at different points as it grows into a plant. Have students form groups of 4 and distribute only cards 1-4 of the prepared set of Lima Bean Stages Cards. Have each student observe and read their card closely for a minute or two and then encourage them to work together to put the cards in order. Circulate as students work together and use the following questions to probe students' thinking. Encourage students to use their words, gestures, and pictures to express their ideas.
  - What structures do you see in the pictures?
  - What do you think the functions of those structures are?" (Lesson 12, Teacher Guide)
- Lesson 13, Connect, Step 2, "Read aloud the article. Use the following prompts to conduct an interactive read aloud of the New Garden Opens at Wide Creek Elementary article. For each question, invite students to turn and talk with a partner before sharing ideas with the whole class." (Lesson 13, Teacher Guide)

Claimed Element: **INFO E4: Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.**

Claimed in Lesson 10. Evidence was found in Lesson 10. Examples include:

- Lesson 10, Explore, Step 2, "Introduce the Flying Squirrel Senses Situation Cards. Display slide C. Pass out one set of Flying Squirrel Senses Situation Cards to each pair. Direct students to find the Choosing Food card (the one shown on the slide). Read the card out loud to the class and invite them to read along with you. Ask students to take a moment to think by themselves about which sense receptors the flying squirrel is using and what it is doing with the information from the sense receptors. Invite students to share their ideas with the class."

Criterion-Based Suggestions for Improvement: N/A

Rating for Criterion: DCI **EXTENSIVE**

ii. Provides opportunities to develop and use specific elements of the DCI(s).

Reviewers found **extensive** evidence that the materials successfully teach core ideas in Life and Physical Science. The unit is especially strong in showing how animal body parts work together to process information. For example, students model how "sense receptors" (like ears and noses) send information to the brain to help animals take action, such as caring for their young. In Lessons 6 and 7, students figure out that objects are only visible when light reflects, or "bounces," off a surface and enters the eye. By the end of the unit, students can explain how both plant and animal structures work as systems to help them grow and survive. Students have multiple opportunities to build the following science ideas: LS1.A Structure and Function, LS1.D Information Processing, and PS4.B: Electromagnetic Radiation.

LS1.A: Structure and Function

Claimed Element: **4-LS1.A E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.**

Claimed in Lessons: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13. Evidence was found in 1, 2, 3, 4, 5, 7, 9, 10, 11, 12, and 13 claimed lessons, examples include:

- Lesson 1, Explore, Step 4, "How would wings, the ability to move around in the dark, and a brain with really good memory help a flying squirrel meet their needs?" (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2: "Let's recall some of the needs of the flying squirrel that we have been considering and write them on our consensus model. Let's consider which parts are working together to meet which needs and highlight them in the same color that need is written in, (Lesson 2 Slides, Slide D)
- Lesson 3, Connect, Step 5, "Consider structures that are similar to the bird. Elevate students' noticings about the bird flapping its wings. Suggest we return to our related phenomena and consider if other animals on our list also have wings that they can flap. As students point those out, underline them or place a symbol like a W near them. (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 3, "Class discuss what we figured out from the flying squirrel structure investigation. Ask students to bring the Flying Squirrel Landing Investigation handout and gather in a scientists' circle. Have a set of the materials from the investigation in a place that students can see and reference them as they discuss. Display slide E and ask students to share their initial ideas about how each structure helped the flying squirrel model (glider) land, and about whether and how these parts worked together. After students have a chance to discuss with their partner, facilitate a discussion about these ideas using the table below. (Lesson 4, Teacher Guide)
- Lesson 5, Connect, Step 6: "Tree squirrels use their sharp claws to hold tightly to the tree. Then, they use their hands to pull down acorns from a branch. They use their teeth to crunch through the hard shell of seeds. " (Lesson 5 Book, Tree Squirrels_ How They Meet Their Needs in the Forest)
- Lesson 5, Connect, Step 6, "Prompts to Use: What do you notice about the system of body structures of tree squirrels compared to what we've figured out about flying squirrels? Feel free to use your hands and bodies to show your thinking. Ideas to look and listen for: *They have a lot of similarities to flying squirrels: 4 legs, ears, eyes, hands/claws, tails.*

The structures look different when compared with flying squirrels: smaller eyes, bigger ears, bigger claws, no skin flap, bigger back legs.They use their legs to jump like flying squirrels but they don't glide. (Lesson 5, Teacher Guide)

- Lesson 6, Connect, Step 6: "Ask students to describe what they think caused them to be able to see the objects after they got some light. Press them to include the idea of light reflecting off the objects in their descriptions. Tell students that it sounds like many of us have had experiences with light reflecting off of objects so that we can see them. We are all going to have a chance to develop models of a time when we were first not able to see something because there was no light and then being able to see it because a source of light became available. Distribute Our Experiences with Reflected Light and display slide L." (Lesson 6, Teacher Guide)
- Lesson 7, Connect, Step 7, "Why are the structures of the moth and butterfly eyes different? How is this similar to the differences in the tree and flying squirrel eye structures?" (Lesson 7, Teacher Guide) Students consider this question and how the structure helps them to find food to survive.
- Lesson 8, Connect, Step 6: "Read about receptors that collect light information. Display slide K and tell students that there is another chapter in the book that is about gathering light information using the sense of sight or seeing. Return to Remarkable Receptors: How Animals Navigate Their Environment and read pages 8-11 to students." (Lesson 8, Teacher Guide) The book the class reads together shares information about smell receptors on different living things that allows them to sense things and receive information that gets sent to the brain.
- Lesson 8, Connect, Step 6: "Catfish have receptors for smell all over their body. These receptors help catfish smell predators swimming nearby. When the catfishes' receptors detect danger, they send a message to its brain. The catfish quickly swims away or hides in rocks and plants to stay safe. Snakes don't have ears or noses like humans, but they have special receptors that help them detect smells using their tongue." (Lesson 8 Book, Remarkable Receptors)
- Lesson 9, Synthesize, Step 6: "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2, "Debrief what we figured out from the cards. Bring the class together again and display slide G. Ask students what all these scenarios had in common. Ideas to look and listen for: They were all about caring for babies. How the mother flying squirrels use their different sense receptors to help them take care of their babies. The mother squirrel remembered important things like how the babies smell to help her take care of them." (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize, Step 3: "What plant structures did we observe? What plant structures do we think we would observe if we cut the plant open, or looked under the soil? What functions do we think these structures support?" (Lesson 11 Slides, Slide F)
- Lesson 12, Explore, Step 3, "Discover other structures of the lima bean. Display slide I. Tell students that you have some informational cards that might tell us more about other structures of the lima bean seed. Show students that the cards have pictures of the lima bean at different points as it grows into a plant. Have students form groups of 4 and distribute only cards 1-4 of the prepared set of Lima Bean Stages Cards. Have each student observe and read their card closely for a minute or two and then encourage them to work together to put the cards in order." (Lesson 12, Teacher Guide)
- In Lesson 13, Explore, Step 3 the class discusses their examination of a flower. "Prompts to use: Which flower structures make sure pollen gets moved between flowers? What about them helps get that job done? Ideas to look and listen for: The stalks with the pollen on them and where the pollen needs to go stick out so the hummingbirds will have to bump them when they reach in to get nectar. The pollen is so light and dusty that it moves onto the bird really easily. The stalk where the pollen needs to go is sticky on the end, so some pollen from another flower will get pulled off the hummingbird when it bumps it. Somewhere inside the flower it makes nectar, which the hummingbird wants to get." (Lesson 13, Teacher Guide)

LS1.D: Information Processing

Claimed Element: **4-LS1.D E1: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.**

Claimed in Lessons: 1, 2, 8, 9, and 10. Evidence was found in 1, 2, 8, 9, and 10 claimed lessons, examples include

- Lesson 1, Connect, Step 2: "What body parts do you think help get and find those foods? They use their eyes to see the food, and their paws/claws to get it, like grabbing insects. They have to remember where they hid their food, so is that using their brain?" (Lesson 1, Teacher Guide)
- Lesson 1, Synthesize, Step 5: "How do their parts work together so they can move around their environment at night? How does their brain work? How do their parts work together to allow them to fly through the air?" (Lesson 1 Slides, Slide T)
- Lesson 2, Synthesize, Step 2: "Prompt to use: How do we think their brain works? Ideas to look and listen for: Their brains need to remember where they hid their food, so I think their brains make a little map of where food is. I think they store information about who their predators are and where their food is in their brain. Brains tell the body what to do, so I think the brain would be the thing telling it to move the wings to fly to get away from a predator.
- Lesson 2, Infographics Meeting Needs in the Dark: Students analyze images of different organisms and read about these organisms that live in the dark. (Lesson 2, Student Handout)
- Lesson 8, Connect, Step 4, "Gather evidence about smell receptors from a book. Display slide H and read pages Remarkable Receptors: How Animals Navigate Their Environment. Use the prompts below to support students in figuring out how living things collect smells to make sense of the world around them. During the read-aloud, pause frequently to emphasize key takeaways and highlight the word 'receptor.' Use gestures, visuals, and examples from the book to help multilingual students connect the term to its meaning—such as showing how different animals use their noses, eyes, or ears to sense the world." (Lesson 8, Teacher Guide)
- Lesson 8, Connect, Step 6: "Read about receptors that collect light information. Display slide K and tell students that there is another chapter in the book that is about gathering light information using the sense of sight or seeing. Return to Remarkable Receptors: How Animals Navigate Their Environment and read pages 8-11 to students." (Lesson 8, Teacher Guide) The book the class reads together shares information about smell receptors on different living things that allows them to sense things and receive information that gets sent to the brain.
- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2: "Introduce the Flying Squirrel Senses Situation Cards. Display slide C. Pass out one set of Flying Squirrel Senses Situation Cards to each pair. Direct students to find the Choosing Food card (the one shown on the slide). Read the card out loud to the class and invite them to read along with you. Ask students to take a moment to think by themselves about which sense receptors the flying squirrel is using and what it is doing with the information from the sense receptors. Invite students to share their ideas with the class." (Lesson 10, Teacher Guide)

PS4.B: Electromagnetic Radiation

Claimed Element: **4-PS4.B E1: An object can be seen when light reflected from its surface enters the eyes.**

Claimed in Lessons: 1, 2, 6, and 7. Evidence was found in Lessons 6 and 7, examples include

Lesson 1

- 4.4 Structure & Function SEP-DCI-CCC-ELA-Math-Matrix: "Students begin to consider that being able to see objects is related to the amount of light available when they explore in this lesson how flying squirrels are most active during the dark of night. Students raise questions and initial ideas that will motivate their investigations of these ideas in future lessons. In this lesson, students are focused on flying squirrels' sight; in Lesson 2 they will broaden to other animals when they begin to connect to related phenomena." (4.4 Structure & Function SEP-DCI-CCC-ELA-Math-Matrix)The provided description in the Matrix indicates that students will consider amounts of light. Students are encouraged to focus on part of this DCI around the structure of the eye as part of why a squirrel sees at night, but they are not prompted to explicitly consider how light reflects off surfaces and enters the eye structure for the squirrel to see.
  - Explore, Step 1: "They seemed to be out at night, so we think they use their big eyes to see in the dark." (Lesson 1, Teacher Guide) Although this discussion connects eyes and light, there is no discussion of the pathway of light into the eye.
  - Explore, Step 4, "Think about the squirrel challenges that you were not able to complete, what would have helped you be able to?" Students consider how squirrels may be able to see in the dark. They do not specifically engage with the idea of light reflection in this lesson.
  - Explore, Step 4: "Prompts to use: Think about the squirrel challenges that you were not able to complete, what would have helped you be able to? Ideas to look and listen for: I needed the lights on or night vision or something because I couldn't see anything!" (Lesson 1, Teacher Guide) Though students are encouraged to think about the need of light in order to see, they do not discuss why light helps us see things, ie: reflection off objects.

Lesson 2

- 4.4 Structure & Function SEP-DCI-CCC-ELA-Math-Matrix: "Students begin to consider that being able to see objects is related to the amount of light available when they develop the initial class consensus model for how flying squirrels meet their needs in the dark, when they read and discuss how raccoons' eyes help them see in the dark, and when they connect to other related phenomena. Students raise questions about these initial ideas that will motivate their investigations of these ideas in future lessons." (4.4 Structure & Function SEP-DCI-CCC-ELA-Math-Matrix) The provided description in the Matrix indicates that students will consider amounts of light, students are not prompted to consider the reflection of light on objects into the raccoon's eyes in order for them to see.
  - Synthesize, Step 2: " Prompt to use: They are doing all of this at night! What parts help them move around their environment in the dark? Ideas to look and listen for: I think they have night vision! I think their eyes are special and can see in the dark somehow. Maybe their eyes can see even with a tiny bit of light?" (Lesson 2, Teacher Guide) This discussion does not consider how light (through reflection) allows our eyes to see an object. Students consider how squirrels may be able to see in the dark. They do not specifically engage with the idea of light reflection in this lesson.

Lesson 6

- Synthesize, Step 5: "Draw the light into the model as students come to a consensus on how it should be represented. Tell students that scientists have a name for when light is thrown back from a surface, like you are describing happening to the light on the berry bouncing back into squirrels' eyes. They call that reflecting. Add reflect to the word wall." (Lesson 6, Teacher Guide)

- Synthesize, Step 5 the class discusses the results of an investigation. "Prompts to use: Let's take a look at the model we have created. How would you use it to explain what causes a squirrel to be able to see its berry? Ideas to look and listen for: The light shines on the berry and then into the squirrel's eyes so it can see the berry. There needs to be light shining onto the berry so the light can bounce off of it and into the squirrel's eye so it can be seen." (Lesson 6, Teacher Guide) This investigation surfaces common student misconceptions that are addressed in the second investigation in this lesson with the eclipse glasses.
- Synthesize, Step 5 Sidebar: "Students may not come up with the idea that light is bouncing off the object. Students sometimes think that light getting into the eyes activates "eyesight" which then can see the object because there is light shining on the object - an explanation that does not require reflection to explain their observations. If students do not connect the idea that light is traveling directly from the berry to the eye, suggest that possibility and ask students if that could explain their results." (Lesson 6, Teacher Guide) This investigation helps students understand that our eyes cannot see without light hitting the object

Lesson 7

- Navigate, Step 1: "Prompts to use: What did this investigation help us figure out? Feel free to use your hands and bodies to express your ideas! Ideas to look and listen for: Light needs to reflect off of their food and into their eyes so they can see it *students gestures with hands*" (Lesson 7, Teacher Guide)
- Explore, Step 2, "Why do you think the trees were so hard to see? Look back at our Lesson 6 "Do squirrels need light to see their food?" model if that helps you make sense of what you saw." (Lesson 7, Teacher Guide) Students consider this question in a whole group discussion. The answer they may provide is, "Since there is less light shining on the trees, there is less light reflecting off of them and getting into our eyes, so they are harder to see. Less light on the trees means less light to reflect off of it and get into our eyes, which means we can't see much." (Lesson 7, Teacher Guide)
- Explore Step 5, Students discuss the following question and may provide the following answers, "Why do you think we saw more pictures with the cups with the larger holes? There was more space for light to enter the cup and reflect back into our eyes. There was more light reflecting off of the objects and more light means you can see more." (Lesson 7, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure "[s]tudents use the SEP, CCC, and DCI elements that are listed as key learning objectives in service of making sense of phenomena or designing solutions to problems." (Detailed Guidance, p.10)
  - For 4-PS4.B E1: In Lessons 1 and 2, consider having students draw initial "light paths" showing how they think they see the squirrel; this provides a baseline model that can be revised in Lesson 6 to include the specific mechanism of light reflecting off the squirrel and into the eye.

Rating for Criterion: CCC **EXTENSIVE**

iii. Provides opportunities to *develop and use* specific elements of the CCC(s).

The reviewers found **extensive** evidence that students use Crosscutting Concepts (CCCs) to figure out phenomena. The unit is strong in Systems and System Models (SYS), as students explain how sense receptors, the brain, and plant xylem interact to perform functions that individual parts cannot, particularly in Lessons 4, 9, 10, and 13. In Lessons 6 and 7, students use Cause and Effect (CE) to prove that the amount of light is the specific cause for how clearly an object is seen. Additionally, students apply the Structure and Function (SF) lens to investigate how the unique shapes of internal and external parts are designed for survival. These concepts are revisited across different contexts providing students multiple opportunities to build the following crosscutting concepts: SYS, CE, and SF.

CE: Cause and Effect

Claimed Element: **CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change.**

Claimed in Lessons 6 and 7. Evidence was found in 6 and 7, examples include

- Lesson 6, Synthesize, Step 3, "Think about which time you saw the berry the most clearly. What caused us to be able to see it clearly?" (Lesson 6, Teacher Guide) Students engage in this question during a whole group discussion.
- Lesson 6, Synthesize, Step 3: "Tell students that it seems like we are in agreement that light shining directly on an object causes it to be seen more easily and with more detail." (Lesson 6, Teacher Guide)
- Lesson 7, Explore, Step 2, "Observe photos. Display slide F and tell students that you have some sets of photographs taken in a forest environment at different times. With your partner you will get a chance to observe each set of photos and consider the amount of light in each and how that affects how much you can see. Distribute Observing the Forest at Night to each pair of students. Encourage students to talk with their partner about their observations—pointing out details in the photos, comparing what they each notice, and agreeing on how much light is present—as this collaborative talk supports more careful observation and helps students synthesize what they see before recording their ideas on their handout Observing the Forest at Night." (Lesson 7, Teacher Guide)
- Lesson 7, Synthesize, Step 6: "We are going to work with a partner to develop a model that explains what causes a flying squirrel to be able to see even when there is not very much light." (Lesson 7 Slides, Slide Y)

SYS: Systems and System Models

Claimed Element: **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.**

Claimed in Lessons 4, 5, 8, and 13. Evidence was found in 4, 5, 8 and 13, examples include

- Lesson 4, Synthesize, Step 3, "Briefly review our models as a class. Invite a few volunteers to share their models. Emphasize that models can look different but should all explain how the structures work together to help the flying squirrel survive. As students share their ideas, record students' thinking on a Squirrel Systems chart in the class or in a virtual space. Use their ideas to help them create a claim that represents their understanding, such as "Flying squirrels need many parts to work together in order to land safely on a tree." Guide students to identify that when a group of parts work together (interact) to do something or to make something happen, this is called a system." (Lesson 4, Teacher Guide)

- Lesson 4, Synthesize Step 3: "Encourage students to label each part and use arrows or lines to show how parts connect or depend on each other. Students can also add short notes or phrases to explain how the parts function together as a system to help the flying squirrel land safely. As students are drawing their models, consider circulating the room and listening for how they describe relationships between parts (for example,"the arms help the claws grab")." (Lesson 4, Teacher Guide)
- Lesson 5, Connect, Step 6: "Construct a model of tree squirrel structures and their functions. Explain that as you read, you're going to pause on each page and will ask students to identify the different structures tree squirrels use to meet their needs. Record what they notice using a model titled "How do the system of tree squirrel structures function to meet its needs?". Suggest that we use the same color coding we used during Lesson 1 in order to identify the purpose of each of these structures. Scribe student ideas about the function of various structures and point to illustrations that help students connect to the purpose. Encourage students to look and listen for how the tree squirrel uses its structures to survive. " (Lesson 5, Teacher Guide)
- In Lesson 8, Synthesize, Step 5 the class discusses what is needed to revise the model. "We should probably add smell receptors to our model. We should add finding food, mates, and dangers to our model. It said that the information goes to the brain, we need to add that. Living things use their memories too, we need to add that." (Lesson 8, Teacher Guide) Although there is a reference in the Teacher Guide that this model is an example of a system, students are not exposed to the word system.
- In Lesson 13, Explore, Step 3 the class discusses their examination of a flower. "Prompts to use: Which flower structures make sure pollen gets moved between flowers? What about them helps get that job done? Ideas to look and listen for: The stalks with the pollen on them and where the pollen needs to go stick out so the hummingbirds will have to bump them when they reach in to get nectar. The pollen is so light and dusty that it moves onto the bird really easily. The stalk where the pollen needs to go is sticky on the end, so some pollen from another flower will get pulled off the hummingbird when it bumps it. Somewhere inside the flower it makes nectar, which the hummingbird wants to get." AND "Prompts to use: Would the flower be able to do its job without the other parts of the plant system? Ideas to look and listen for: No - the plant wouldn't be able to grow flowers and make pollen and seeds if it didn't have water coming up from the roots through the xylem." (Lesson 13, Teacher Guide)

SYS: Systems and System Models

Claimed Element: **SYS E2: A system can be described in terms of its components and their interactions.**

Claimed in Lessons 1, 2, 9, 10, 11, 12, and 13. Evidence was found in 1, 2, 9, 10, 11, 12, and 13, examples include

- Lesson 1, Synthesize, Step 5, "When students develop initial models on the Initial Model handout, you have an assessment moment for Learning Goal 1 with the purpose of determining students' initial ideas about how squirrel parts work together to meet their needs, current use of the practice of modeling, and current understanding of systems as interacting components." (Lesson 1, Teacher Guide)
- In Lesson 1, Synthesize, Step 5, students respond to a prompt "How do their parts work together so they can move around their environment at night? " (Lesson 1 Slides, Slide T) "At this point, students are starting to consider the squirrel's parts as components that interact to support the squirrel's body system, but they will likely not yet use the words "components" or "system". However, the idea of "parts working together" that they model will help reveal their current thinking in order to inform instruction about systems thinking as the unit goes on." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2: Teacher Prompt: "Some of us have already mentioned ideas about parts working together, like feet and legs for jumping. What other ideas do we have about the flying squirrel's parts working together?" Ideas to look and listen for: "They use their eyes to see where they're going and their legs move to get them there.Their brains help them find the food their mouths eat. (And their legs/skin flaps help them get there.)" (Lesson 2, Teacher Guide)

- Lesson 9, Synthesize, Step 4: "Act out how the system works. Point to the "How senses help animals" system model developed in Lesson 8. Ask students if they think that touch receptors might work the same way that smell and sight receptors work. Display slide J and suggest to students that acting out how touch receptors function as part of a system, could help us connect what we figured out about touch receptors in this lesson with what we figured out about smell receptors in our last lesson." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Step 3: "Develop a model to explain how flying squirrels use their many sense receptors to take care of their babies in the dark including:
  - The type of information being received from sense receptors
  - The receptor used to receive the information
  - The brain
  - The memory
- What the information causes the animal to decide to do next Use the "How senses help animals" models we have been developing in class as a reference but feel free to represent your ideas in a way that makes sense to you. Draw and/or use words to show your thinking." (Lesson 10, Student Assessment, Caring for Babies)
- Lesson 11, Synthesize, Step 7, "We are noticing tubes inside of the celery plant that are red and blue now, so we know they are carrying water throughout the plant. Scientists call those tubes xylem, which is just a shorter way of saying, "tubes that carry water". Feel free to use the word "xylem" or "tubes that carry water" when describing the structures that carry water throughout the celery plant. What do these observations of the celery plants tell us about the structures that help a celery plant meet its need for water?" (Lesson 11, Teacher Guide)
- Lesson 12, Explore, Step 3: "Ask students what ideas they have about what structures might be parts of a system that forms new seeds" (Lesson 12, Teacher Guide)
- Lesson 13, Explore Step 3: "Debrief the main takeaways of the investigation. Display slide F and refer back to the How the Lima Bean Plant System Works Model. Support students in connecting what they just figured out about flower structures to what they have already figured out about the structures and functions of the plant system." (Lesson 13, Teacher Guide)

SF: Structure and Function

Claimed Element: **SF E2: Substructures have shapes and parts that serve functions.**

Claimed in Lessons 1, 3, and 11. Evidence was found in 1, 3, and 11, examples include

- Lesson 1, Connect 2, Structures and Function Sidebar: "In this lesson, students begin to consider the structures and substructures of a flying squirrel (without using those specific words). As they develop models to explain how flying squirrels use their body parts to meet their needs, they will consider the shapes and parts of those substructures and the functions they serve." (Lesson 1, Teacher Guide)
- Lesson 3, Connect, Step 5: "Consider structures that are similar to the bird. Elevate students' noticings about the bird flapping its wings. Suggest we return to our related phenomena and consider if other animals on our list also have wings that they can flap. As students point those out, underline them or place a symbol like a W near them." (Lesson 3, Teacher Guide)
- Lesson 11, Connect, Step 2, "Go on a plant tour. Determine the locations in and around your school that would allow for students to observe several live plants. If time and resources allow, take students outside to observe plants on the school grounds. As students observe the plants, encourage them to record their observations on Plant Tour Observations. Ask questions like: What structures of the plant do you notice? Where are the structures on the plant?" (Lesson 11, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure that "students are supported to develop deep competence in specific elements such that they could be applied to more than one context." [Detailed Guidance, p.10]
  - Lesson 8: Consider how there can be an explicit connection to the idea that a larger structure can be seen as a system of smaller parts.
  - Consider expanding the use of the words of the CCCs (cause, effect, system, component, interaction) with students so that students can see how they could be applied in more than one context for the CCCs. This could look like a class figuring out how patterns can be useful, or the teacher facilitating students to think explicitly about why it is useful to compare different kinds of systems. (Detailed Guidance, p. 10)

I.C. Integrating the Three Dimensions

EXTENSIVE

Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

The reviewers found **extensive** evidence that student sense-making of phenomena requires performances that integrate elements of the SEPs, CCCs, and DCIs. Throughout the unit, students are expected to explain how animal and plant structures function as systems to support survival and reproduction, which requires them to use grade-appropriate elements of the three dimensions simultaneously. For example, students develop models (SEP) of sensory systems (CCC) to explain how internal and external structures function (DCI) to process information. The three dimensions are not used in isolation; students consistently apply crosscutting concepts such as Systems and System Models and Cause and Effect to deepen their understanding of science ideas through scientific practices such as Modeling and Argumentation.

Learning is integrated

Throughout the unit, learning is integrated to support students in making sense of the phenomenon.

- Lesson 1, Synthesize Step 5, students integrate the use of the elements when they develop an initial model to how flying squirrels' parts work in order to meet their needs in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. MOD-E4: Develop and/or use models to describe and/or predict phenomena.**
- Lesson 2, Synthesize, Step 2, students integrate the use of the elements when they develop a consensus model to explain how flying squirrels use their parts to meet their needs in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. MOD-E4: Develop and/or use models to describe and/or predict phenomena.**
- Lesson 3, Synthesize, Step 6, students integrate the use of the elements when they use the additional evidence they have collected so far to support an argument about the way the flying squirrel moves through the air in the three dimensions **SF-E2: Substructures have shapes and parts that serve functions. LS1.A-E1: Plants and animals**

have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.

- Lesson 4, Synthesize, Step 5, students integrate the use of the elements when they construct arguments to explain how different animals' structures function together as a system to help them survive by landing safely in the three dimensions **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**
- Lesson 6, Connect, Step 6, students integrate the use of the elements when they share their models to consider how light caused us to be able to see things more clearly in the three dimensions **CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change. PS4.B-E1:An object can be seen when light reflected from its surface enters the eyes. MOD-E4: Develop and/or use models to describe and/or predict phenomena.**
- Lesson 7, Synthesize, Step 6, students integrate the use of the elements when they develop a model that explains how a flying squirrel's larger eyes cause more light to enter their eye in the three dimensions **CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change. PS4.B-E1:An object can be seen when light reflected from its surface enters the eyes. MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**
- Lesson 8, Synthesize, Step 5, students integrate the use of the elements when they revise the model to include smell receptors and functions in the three dimensions **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. LS1.D-E1: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**
- Lesson 9, Synthesize, Step 6, students integrate the use of the elements when they develop a model for taste or hearing receptors in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.D-E1: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**
- Lesson 11, Synthesize, Step 7, students integrate the use of the elements when they develop a model to describe that plants have structures that function to support survival and growth in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**
- Lesson 12, Synthesize, Step 6, students integrate the use of the elements when they support an argument that plants have structures that work together to help the plant grow, survive, and reproduce with evidence from various sources in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**

Integration to support student sense-making over time

- Lesson 5, Synthesize, Step 7, students integrate the use of the elements when they construct arguments to explain tree squirrel systems in the three dimensions **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**
- Lesson 10, Synthesize, Step 3, students integrate the use of the elements when they develop a model to describe how flying squirrels use their system of sense receptors to perform behaviors that aid in reproduction in the three dimensions **SYS-E2 A system can be described in terms of its components and their interactions. LS1.D-E1: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. MOD-E4: Develop and/or use models to describe and/or predict phenomena.**
- Lesson 13, Synthesize, Step 6, students integrate the use of the elements when they construct an argument supported by evidence in the form of a model that flowers have internal and external structures (a system of interacting components) that function to support reproduction in the three dimensions **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**

Criterion-Based Suggestions for Improvement: N/A

I.D. Unit Coherence

EXTENSIVE

Lessons fit together to target a set of performance expectations.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.

The lessons in this unit are designed as a coherent, student-driven sequence. Coherence is explicitly supported through a consistent "Navigation" routine in which students identify new questions or those they still need answers to, to bridge findings from one lesson to the next. For instance, the transition from Lesson 10 to Lesson 11 naturally shifts the inquiry from animal structures to plant structures and how each helps animals and plants function to meet their needs. The routine ensures that the building of science ideas is motivated by students' own wonderings about the phenomena. Furthermore, the unit demonstrates coherence by bundling three Performance Expectations (4-LS1-1, 4-LS1-2, and 4-PS4-2). The evidence shows a clear instructional progression in which students move from developing initial models of squirrel parts in Lesson 1 to constructing arguments regarding internal systems, sense receptors, and plant growth by Lesson 13.

i. Each lesson builds on prior lessons by addressing questions raised in those lessons, cultivating new questions that build on what students figured out, or cultivating new questions from related phenomena, problems, and prior student experiences.

- Lesson 1, Synthesize, Step 5, "Navigate to next time's work. Close today's lesson by celebrating the work students have done with modeling their initial ideas. Point out that we will need to share our models with each other next time so we can begin to make sense of how flying squirrels use many of their parts together to meet all of their needs." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate, Step 6, "Brainstorm ideas for investigation. Display slide L. Have students find a partner or form a group of three with students they have not worked with yet. Distribute the Ideas for investigation handout to each group. Give students about 5 minutes to generate investigation ideas, encouraging them to look back at their questions on our Driving Question Board and how we could get evidence to answer those questions." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate, Step 1: "Recall where we left off. Display slide A. Direct students' attention Driving Question board and Ideas for Investigation charts from the previous lesson. Circle or highlight questions that students had around how the flying squirrel can move through the air. Ask students if they have any new questions to add, and allow students to record them and add them to the DQB." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Step 6, Students update their consensus model and then, "Brainstorm ideas. Display slide M and invite students to turn and talk with a partner about what new questions they have about flying squirrels' systems and their functions. If needed, consider prompting the students by asking something like, "Why might flying squirrels need to glide through the trees in the first place?" After students brainstorm with a partner, invite pairs to share out to the class. All ideas are valid for now. Tell students that we will return to these ideas in the next lesson." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate, Step 8, "Class discusses where we should go next. Display slide S and ask students to explain what they figured out about the system of structures that flying and tree squirrels have to help them find food, build shelter, and avoid predators...Consider saying something like, " It sounds like both kinds of squirrels have similarities and differences in their system of structures that are really helpful for them to perform the tasks that they need to in order to find food, build shelter, and avoid predators." Point to the picture on the slide and ask students if they notice anything else that's different between the pictures of the two kinds of squirrels." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate, Step 1: "Facilitate a class discussion about what we figured out in the last lesson. Display slide A and remind students that we have been figuring out so much about flying squirrels. Refer back to our initial consensus model that we started in Lesson 1 and revised in Lesson 4. Facilitate a discussion about what we figured out about flying squirrels in the last lesson and what we were left wondering about." (Lesson 6, Teacher Guide)
- Lesson 7, Navigate, Step 1: "Revisit Lesson 6 Model to problematize how to move our science thinking forward. Display slide A and the lesson 6 "Do squirrels need light to see their food?" model. Ask students to turn and talk to a classmate to discuss what we investigated together in the previous lesson. Call on a few pairs of students to share their thoughts and allow them to reference the model or materials to express their ideas. Facilitate a discussion about what we figured out about light in our last lesson and problematize what still needs to be figured out about light." (Lesson 7, Teacher Guide)
- Lesson 8, Connect, Step 1, "Identify related phenomena. Display slide A and support students in recalling that we were interested in finding out more about other living things that were out meeting their needs in the dark. Ask students if there are any new examples of living things that they thought of or heard about from others in their community. Refer to the How do animals and plants use their parts to meet their needs? chart from Lesson 2 where students had previously mentioned other animals (parts of animals), especially those that are active in the dark." (Lesson 8, Teacher Guide)

- Lesson 9, Navigate, Step 1: "Display slide B. Do you know any other animals that have whiskers? What do you think they use them for?" (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Step 4: "Celebrate what we've figured out. Share your excitement with students about how much we've figured out about flying squirrels so far. Explain that these sense receptors are the final piece of the puzzle for how flying squirrels use their system of structures to perform the functions they need to survive and grow. Transition to the next step by saying we have figured out a lot of things today so let's take some time to reflect on our own and see if we still have any questions." (Lesson 10, Teacher Guide)
- Lesson 11, Navigate, Step 1, Students return to their consensus model of the squirrel as a way to bridge the unit to the new phenomena of plant structures. "Point out that it sounds like all of the structures that flying squirrels use require them to move around in order to survive and grow. Display slide B and ask students to consider how a plant might survive and grow without moving much, if at all. Consider having a live plant visible for students to reference as well." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate, Step 7, "Consider where to go next. Display slide Q and have students share what they notice and wonder about the image. Use the sample prompts below to support students in figuring out what to investigate in the next lesson...Add new questions to the Driving Question Board and close the lesson by suggesting we carry out some of these investigations during our next science class." (Lesson 12, Teacher Guide)
- Lesson 13, Navigate, Step 7: "Celebrate all the questions and ideas students have figured out. Display slide J. Work together with the class to revisit the Driving Question Board and highlight how students' ideas and questions have grown and changed. Celebrate students' growth in developing new science ideas, and also how well they engaged in different science practices. Remind students that scientists expect not to have all their questions answered, and they are always thinking of new questions, too!" (Lesson 13, Teacher Guide)

ii. The lessons help students develop toward proficiency in a targeted set of performance expectations.

The lessons help students develop toward proficiency in a targeted set of performance expectations. 3 target Performance Expectations are:

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4: "Share and record ideas. Bring students back together in a whole group and display slide I along with the Class Consensus Model and How do animals and plants use their parts to meet their needs? chart. Suggest that it will be helpful to record the ideas we have now about other animal parts, but that our flying squirrel Consensus Model is already quite full. Explain that we can continue to use our How do animals and plants use their parts to meet their needs? chart to record ongoing ideas about how parts help plants and animals meet their needs." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 6, "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book." (Lesson 3, Teacher Guide)

- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system)." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Step 7, "Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize, Step5: "It sounds like we are saying that light needs to get into eyes in order for the object to be seen. How could we represent that in our model?" (Lesson 6, Teacher Guide)
- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)
- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4: "Share and record ideas. Bring students back together in a whole group and display slide I along with the Class Consensus Model and How do animals and plants use their parts to meet their needs? chart. Suggest that it will be helpful to record the ideas we have now about other animal parts, but that our flying squirrel Consensus Model is already quite full. Explain that we can continue to use our How do animals and plants use their parts to meet their needs? chart to record ongoing ideas about how parts help plants and animals meet their needs." (Lesson 2, Teacher Guide)
- Lesson 8, Synthesize, Step 5, "Lead a Building Understanding Discussion to revise the model for smelling. Display slide I and lead a discussion to revise the model to include smell receptors and functions. An example revised model can be seen below." (Lesson 8, Teacher Guide)

- Lesson 9, Synthesize, Step 4: "Summarize what we figured out. After students have shared their ideas from their investigation, summarizing their thinking. Highlight how many students noticed the way the squirrel used touch receptors to help it notice where it was in space, in order not to run into something, like the tunnel walls." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)

4-PS4-2: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

- Lesson 6, Synthesize, Step 5: "It sounds like we are saying that light needs to get into eyes in order for the object to be seen. How could we represent that in our model?" (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 6, "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference." (Lesson 7, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

I.E. Multiple Science Domains

EXTENSIVE

When appropriate, links are made across the science domains of life science, physical science, and Earth and space science.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.

ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

The unit demonstrates an **extensive** integration of multiple science domains because the anchor phenomenon—how squirrels survive and function in their environment—cannot be explained by life science alone. As noted in the "About the Science" section, students use investigations of light reflecting off surfaces to explain the function of sensory systems. Furthermore, the unit uses the CCCs of Cause and Effect and Structure and Function as a bridge between these domains.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.

The unit uses science ideas from both the life science and physical science domains to explain "How do plants' and animals' structures function together to meet their needs?" As animals' needs are met through using their vision, the phenomenon requires multiple domains in order for students to explain it.

- About the Science, "This unit focuses on developing the foundational science idea that living things have specific structures that have functions that allow them to complete certain behaviors that support survival, growth, and reproduction. The unit is anchored in close observations of flying squirrels. Students are likely to come to school with many life experiences related to squirrels and might have ideas about what squirrels do and why. The squirrels they may see every day are similar to the tree squirrels in this unit, but they are also introduced to the flying squirrel, and the ground squirrel. They compare the body parts (structures) of these squirrels along with various other animals in the context of how they interact with their environment, and then use what they learn to help elucidate the sensory systems of animals. Students also directly observe multiple plant structures and how those structures function to support plants' survival, growth and reproduction. They figure out that light needs to be reflected off objects and into our eyes for animals (including us humans) to see, and that living things have sensors and receptors that allow them to process many types of sensory information (e.g light, touch, sound, taste). Students use this understanding to help them describe how squirrels and other organisms are different from each other, and how they interact differently within their environment using that sensory information. They do this by developing and using models, and by constructing arguments to explain how the structures enable functions that allow various animals and plants to survive, grow, and reproduce." (Unit 4.4, About the Science)
- Unit Front Matter, there is a section titled "Which Performance Expectations does this unit build toward?". In this section, there is a description for teachers about where the DCIs for the 3 performance expectations that are addressed in this unit. For example, "Students figure out ideas about how animals can see objects in Lessons 6 and 7. They are curious about how flying squirrels and other animals active in the dark can see their food, shelters, and predators. Students use investigations with objects (such as foods a squirrel might eat) and varying amounts of light reflecting from them and varying sizes of eye openings to figure out that an object can be seen when light reflected from its surface enters the eyes" and "Students share initial ideas and questions about how senses help animals function in the dark in Lessons 1 and 2, and they explore eyesight specifically in Lessons 6 and 7, but then they go on to investigate additional sense receptors. In Lessons 8 and 9, students use investigations of smells and whiskers, read a book, and develop models to figure out that animals respond to inputs from sense receptors with behaviors that help them survive based upon memories related to the input. Then in Lesson 10 students have an opportunity to put these pieces together as they figure out and explain how flying squirrels use their senses to care for their young (supporting reproduction)." (Unit 4.4, Unit Front Matter)
- Lesson 6, Synthesize, Step 5: "What caused you to not be able to see the berry in this investigation? *Because there was no light getting into my eyes. The glasses were blocking the light from my eyes. The light could not get into my eyes.*" (Lesson 6, Teacher Guide)
- Lesson 6 Connect, Step 6: "Ask students to describe what they think caused them to be able to see the objects after they got some light. Press them to include the idea of light reflecting off the object in their descriptions. Tell students that it sounds like many of us have had experiences with light reflecting off of objects so that we can see them." (Lesson 6, Teacher Guide)
- Lesson 7, Explore, Step 5: "If you had to meet your needs at night in the forest, which eyes would you want? Why? *I would want larger eyes because they let more light in. There is not a lot of light at night, so I would need large eyes to let in as much light as I could.*" (Lesson 7, Teacher Guide)

ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.

The focal CCCs for the unit are Cause and Effect, Systems and System Models, and Structure and Function. The crosscutting concepts of Cause and Effect and Structure and Function are used to make sense of phenomena where linking understanding of both life and physical science is required.

- Lesson 6, Connect, Step 6: "Ask students to describe what they think caused them to be able to see the objects after they got some light. Press them to include the idea of light reflecting off the object in their descriptions. Tell students that it sounds like many of us have had experiences with light reflecting off of objects so that we can see them." (Lesson 6, Teacher Guide)
- Lesson 7, Explore, Step 5, Cause and Effect Sidebar "An important element of this cross-cutting concept is using cause and effect relationships to identify and explain change. Students do this as they investigate and then explain how the size of an eye can affect the amount of light that can enter it, thus affecting how clearly an object can be seen by the eye." (Lesson 7, Teacher Guide)
- Lesson 7, Explore, Step 5: "How can we find out if larger eyes cause animals to be able to see better, even at night?" (Lesson 7, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

I.F. Math and ELA

EXTENSIVE

Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.

The unit provides **extensive** evidence of integrating grade-appropriate Mathematics and English Language Arts (ELA) to support science sense-making. Students practice determining main ideas (RI.4.2) and interpreting visual information (RI.4.7) as they investigate animal structures and light reflection. Mathematically, students engage in MP2 (Reasoning abstractly and quantitatively) during Lesson 7 by using physical models to represent the abstract concept of light entering an eye.

ELA

CCSS.ELA-LITERACY.RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

Claimed in Lessons 1 and 7. Evidence was found in the claimed Lessons 1 and 7. Examples include:

- Lesson 1, Connect, Step 2, Literacy Supports Sidebar, "As students reread and answer questions about the text they are using text information as evidence to explain different ways that flying squirrels meet their needs. This work helps students gain practice with determining the main idea of a text and the key details that support it (RI.4.2)." (Lesson 1, Teacher Guide)
- Lesson 7, Connect, Step 7, Literacy Supports Sidebar, "As students read and answer questions about the text they are using text information as evidence to compare and contrast the structures of moth and butterfly eyes. This work helps students gain practice with determining the main idea of a text and the key details that support it (RI.4.2)." (Lesson 7, Teacher Guide)

CCSS-ELA-LITERACY.RI.4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

Claimed in Lesson 10. Evidence was found in the claimed lesson 10. Examples include:

- Lesson 10, Explore, Step 2, Literacy Supports Sidebar, "After reading the Flying Squirrel Senses Situation Cards, students can recall the events on each card in chronological order. Sequencing the events in this manner supports their comprehension of the information in the cards. It also helps students make sense of how and when squirrels use sense receptors to navigate their environment (RI.4.5)." (Lesson 10, Teacher Guide)

CCSS-ELA-LITERACY.RI.4.6 Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.

Claimed in Lesson 5. Evidence was found in the claimed lesson 5. Examples include:

- Lesson 5, Connect, Step 6, Literacy Supports Sidebar, "Support students as they compare and contrast their firsthand experiences seeing squirrel structures with what they have observed in videos and read about in books secondhand. This supports RI.4.6 and offers students the opportunity to use their developing science ideas to explain their investigation and compare it to what they have figured out about structure and function in the unit thus far." (Lesson 5, Teacher Guide)

CCSS-ELA-LITERACY.RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Claimed in Lessons 2, 4, 8, 9, 13. Evidence was found in the claimed Lessons 2, 4, 8, 9, and 13. Examples include:

- Lesson 2, Explore, Step 4, Literacy Supports Sidebar, Support students as they interpret information about the needs of the animals depicted in the infographics. Encourage students to notice and explain the relationship between the animal's body parts and how the animal meets its needs. This supports RI.4.7 and prepares students to apply what they have figured out about flying squirrels to other animals." (Lesson 2, Teacher Guide)
- Lesson 4, Connect, Step 4, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of the reading of the infographic. Emphasize that students are reading the article to gather evidence about how an animal lands safely. Support students in using text, images, and image captions as evidence for explaining how the Little Brown Bat lands. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking."
- Lesson 8, Connect, Step 4, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of reading the book to students. Emphasize that students are reading the book to gather evidence about smell receptors. Support students in using text, images, and image captions as evidence for explaining the purpose of sense receptors. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking." (Lesson 8, Teacher Guide)
- Lesson 9, Connect, Step 5, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of reading the book to students. Emphasize that students are reading the book to gather evidence about taste or hearing receptors. Support students in using text, images, and image captions as evidence for explaining the purpose of sense receptors. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking." (Lesson 9, Teacher Guide)
- Lesson 13, Connect, Step 2, Literacy Supports Sidebar, "The New Garden Opens at Wide Creek Elementary article includes a diagram that explains key details about the process of pollination. Support students in explaining the diagram itself and understanding how this diagram illustrates a key idea in the text. Consider allowing students to explain the diagram to a peer before sharing aloud with the class. This supports RI.4.7 and helps students understand the process of pollination and so they are prepared to engage in the upcoming flower investigation." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

Claimed in Lesson 3. Evidence was found in the claimed Lesson 3. Examples include:

- Lesson 3, Connect, Step 5, "Support students as they compare and contrast differences between the animals depicted in the infographics. Encourage students to notice details that are similar or different as they integrate information between the texts so that they can speak knowledgeably on the subject (RI.4.9)." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.W.4.2D Use precise language and domain-specific vocabulary to inform about or explain the topic.

Claimed in Lesson 5. Evidence was found in the claimed Lesson 5. Examples include:

- Lesson 5, Synthesize, Step 7, Literacy Supports Sidebar, As students complete the Arguments About Tree Squirrel System of Body Structures assessment, remind them to use precise and domain-specific vocabulary or drawings to explain their science ideas in their argument. This supports W.5.2D and encourages the use of sophisticated science vocabulary in students' writing." (Lesson 5, Teacher Guide)

CCSS-ELA-LITERACY.W.4.5 With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.

Claimed in Lessons 4 and 13. Evidence was found in the claimed Lessons 4 and 13. Examples include:

- Lesson 4, Synthesize, Step 5, Literacy Supports Sidebar, "Peer review and feedback offers students the opportunity to develop and strengthen their written argument by revising and editing it. This work supports W.4.5 and students gain practice writing clear scientific arguments that are supported with evidence" (Lesson 4, Teacher Guide)
- Lesson 13, Synthesize, Step 4, Literacy Support, "Encourage students to use clear sentences, illustrations, and appropriate punctuation and capitalization to improve communication of ideas. Use the peer review as an opportunity to strengthen their ideas through revising and editing their writing (W.4.5, L.4.1))." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

Claimed in Lessons 4, 8, 9. Evidence was found in the claimed lessons 4, 8, and 9. Examples include:

- Lesson 4, Connect, Step 4, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of the reading of the infographic. Emphasize that students are reading the article to gather evidence about how an animal lands safely. Support students in using text, images, and image captions as evidence for explaining how the Little Brown Bat lands. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking."
- Lesson 8, Connect, Step 4, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of reading the book to students. Emphasize that students are reading the book to gather evidence about smell receptors. Support students in using text, images, and image captions as evidence for explaining the purpose of sense receptors. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking." (Lesson 8, Teacher Guide)
- Lesson 9, Connect, Step 5, Literacy Supports Sidebar, "Prior to reading, consider reiterating the purpose of reading the book to students. Emphasize that students are reading the book to gather evidence about taste or hearing receptors. Support students in using text, images, and image captions as evidence for explaining the purpose of sense receptors. This work supports W.4.9 and RI.4.7 as students use text information and text features to enhance their sensemaking." (Lesson 9, Teacher Guide)

CCSS-ELA-LITERACY.SL.4.1B Follow agreed-upon rules for discussions and carry out assigned roles.

Claimed in Lessons 1 and 2. Evidence was found in the claimed lessons 1 and 2. Examples include:

- Lesson 1, Explore, Step 1, Literacy Supports Sidebar, "As we share our initial explanations and voice our questions, it is helpful to check in on class agreements and encourage our community to follow the agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). This will support students in practicing SL.4.1B as they follow agreed-upon rules for discussions and further cultivate a safe community for learning science together." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2, Literacy Supports Sidebar, "Establishing classroom agreements provides an opportunity for students to develop and follow agreed-upon rules for discussion. This work supports SL.4.1B." (Lesson 2, Teacher Guide)

CCSS-ELA-LITERACY.SL.4.2 Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Claimed in Lessons 3 and 12. Evidence was found in the claimed lessons 3 and 12. Examples include:

- Lesson 3, Explore, Step 2, Literacy Supports Sidebar, "After students engage with each video, encourage them to paraphrase portions of the multimedia text. Support students in paraphrasing both what was seen and heard to make sense of the structures displayed in the video clips (SL.4.2)." (Lesson 3, Teacher Guide)
- Lesson 12, Synthesize, Step 5, Literacy Supports, "Support students in paraphrasing what they figured out about plant structures and how they function as they update their claims and model. Encourage students to integrate evidence from images, text, and other informational cards that supported their understanding of these concepts (SL.4.2)." (Lesson 12, Teacher Guide)

CCSS-ELA-LITERACY.SL.4.3 Identify the reasons and evidence a speaker provides to support particular points.

Claimed in Lesson 11. Evidence was found in the claimed lesson 11. Examples include:

- Lesson 11, Synthesize, Step 7, Literacy supports Sidebar, "As students discuss what they think their plant observations can explain about the structures and functions of the celery plant, remind students that their observations are one form of evidence. They can use evidence to support their science ideas and call out the types of evidence their classmates use to support their thinking within a discussion (SL.4.3)." (Lesson 11, Teacher Guide)

CCSS-ELA-LITERACY.SL.4.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Claimed in Lessons 6 and 12. Evidence was found in the claimed lessons 6 and 12. Examples include:

- Lesson 6, Connect, Step 6, Literacy Supports Sidebar, "Students can communicate their personal experiences with light and reflecting light in a clear and organized manner. Cueing students to tell their experiences sequentially with reminders for descriptive details will support students in speaking clearly and coherently with their peers (SL.4.4)." (Lesson 6, Teacher Guide)
- Lesson 12, Explore, Step 3, Literacy Supports, "Students can communicate their claims about the functions of structures in a clear and organized manner. Cue students to include evidence from previous experiences and investigations with their claims. You can also provide reminders for including descriptive details. These prompts will support students in speaking clearly and coherently with their peers (SL.4.4)." (Lesson 12, Teacher Guide)

CCSS-ELA-LITERACY.L.4.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

Claimed in Lesson 13. Evidence was found in the claimed lesson 13. Examples include:

- Lesson 13, Synthesize, Step 4, Literacy Support, "Encourage students to use clear sentences, illustrations, and appropriate punctuation and capitalization to improve communication of ideas. Use the peer review as an opportunity to strengthen their ideas through revising and editing their writing (W.4.5, L.4.1))." (Lesson 13, Teacher Guide)

CCSS-ELA-LITERACY.L.4.4B Use common, grade-appropriate Greek and Latin affixes and roots as clues to the meaning of a word (e.g., telegraph, photograph, autograph).

Claimed in Lesson 3. Evidence was found in the claimed lesson 3. Examples include:

- Lesson 3, Explore, Step 2, "If your students have been working to use common Greek and Latin affixes and roots as clues to the meaning of a word, discuss with the class how the affixes "in-" (meaning "within") and "ex-" (meaning "out of") help us understand the meaning of internal and external. (L.4.4B)" (Lesson 3, Teacher Guide)
- Lesson 3, Explore, Step 2, Literacy Supports Sidebar: "If your students have been working to use common Greek and Latin affixes and roots as clues to the meaning of a word, discuss with the class how the affixes "in-" (meaning "within") and "ex-" (meaning "out of") help us understand the meaning of internal and external. (L.4.4B)" (Lesson 3, Teacher Guide)

Mathematics

CCSS-MATH-Practice.MP2 Reason abstractly and quantitatively.

Claimed in Lesson 7. Evidence was found in the claimed lesson 7. Examples include:

- Lesson 7, Explore, Step 4, Math Supports Sidebar, "Students will reason abstractly and quantitatively as they use the size of the hole in each cup to make sense of the amount of light entering the eye (MP2). To support their sensemaking, encourage students to compare the size of the circles of light produced in the investigation to familiar circular objects in the classroom, such as coins, the end of a marker, or a magnet, to better visualize and contextualize the differences." (Lesson 7, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

CATEGORY II

NGSS Instructional Supports

II.A. Relevance and Authenticity

EXTENSIVE

Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations).

ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community and/or culture as appropriate.

iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

Reviewers found **extensive** evidence that the materials engage students in authentic, meaningful scenarios in which they experience phenomena as directly as possible. Students observe videos of flying squirrels in Lesson 1 and conduct a physical "plant tour" on school grounds in Lesson 11. The unit bridges classroom learning with students' lives by prompting them to brainstorm related phenomena from their own communities and neighborhoods, such as identifying local nocturnal animals or sharing personal experiences with light and smell. Students are provided opportunities to connect their scientific explanations back to their own lives when they model their personal experiences with reflected light.

i. Students experience phenomena or design problems as directly as possible (firsthand or through media representations)

- Lesson 1, Explore, Step 1: "Watch videos of flying squirrels. Display slide B and explain that we will need a place to record our observations of the flying squirrels as we watch the videos. Distribute the Video Observations handout and ask students to record what they notice and wonder about the flying squirrels. Play the video at least twice giving students time to observe and record their noticings and wonderings. Ask students to turn and tell a partner what they noticed and wondered about the flying squirrels." (Lesson 1, Teacher Guide)
- Lesson 4, Connect, Step 4: "Read an infographic. Display slide G and introduce the infographic Little Brown Bat Landing Infographic. Tell students that now we are going to read about how a different animal, a small brown bat, solves the same problem of landing safely. Read the captions as a class. Ask students to look and listen for clues about which body parts are working together to help the bat slow down and land." (Lesson 4, Teacher Guide)
- Lesson 6, Explore, Step 2,"Acknowledge student ideas and verify that while it would be great to observe a squirrel and its predator, there are all kinds of safety concerns for us and the animals if we bring them into the classroom. We can get some food that a flying squirrel eats and use our own eyes to test out if it can be seen with the lights and without. Tell students that you have some materials that we can use to try out this investigation." (Lesson 6, Teacher Guide)
- Lesson 9, Connect, Step 2: "Read animal whisker information cards. Present slide C and let students know that you have some cards with information about how four different animals use their whiskers. Invite students to read the cards in pairs and discuss how the animals are using their whiskers and what kind of sense receptors whiskers use to detect information. " (Lesson 9, Teacher Guide)
- Lesson 11, Connect, Step 2, "Go on a plant tour. Determine the locations in and around your school that would allow for students to observe several live plants. If time and resources allow, take students outside to observe plants on the school grounds. As students observe the plants, encourage them to record their observations on Plant Tour Observations." (Lesson 11, Teacher Guide)

- Lesson 12, Explore, Step 3: "Discover other structures of the lima bean. Display slide I. Tell students that you have some informational cards that might tell us more about other structures of the lima bean seed. Show students that the cards have pictures of the lima bean at different points as it grows into a plant. Have students form groups of 4 and distribute only cards 1-4 of the prepared set of Lima Bean Stages Cards. Have each student observe and read their card closely for a minute or two and then encourage them to work together to put the cards in order." (Lesson 11, Teacher Guide)

ii. Includes suggestions for how to connect instruction to the students' home, neighborhood, community, and/or culture as appropriate.

- Lesson 1, Connect, Step 3 Sidebar: "As students connect flying squirrel needs to their own needs, some may share stories about home, safety, or food. Be mindful that not all students may always feel safe at home or consistently have enough to eat. Instead of assuming every child's experience, encourage students to share examples that feel true for them, whether from their own lives, their community, or even from stories they've read or heard. You might say: "Everyone's experiences can be a little different, and everyone's experiences, if they want to share them, can help us figure things out. You can think about your own life, or you can connect to something you've seen in a book, movie, or story someone has told you." Offering flexible entry points, all students can participate meaningfully without feeling pressured to share something personal or potentially painful. It is important to avoid assumptions. Instead of saying "We all have a safe home" or "Everyone eats three meals a day" invite a range of examples, such as "People and animals find many different ways to stay safe and get food." (Lesson 1, Teacher Guide)
- Lesson 2, Lesson 2, Connect, Step 3, "Brainstorm related phenomena. Display slide F and the blank chart paper. Draw a quick t-chart with the headings "part" and "How it works to meet a need." Use the prompts on the slide and multiple turn-and-talk moments to help students connect with their own experiences and ideas they have from books or other media to list animals' parts that meet needs, especially for animals we think are active in the dark. Ask students to share their ideas and as they do, record them on the chart." (Lesson 2, Teacher Guide)
- Lesson 3, Connect, Step 5 Sidebar: "Students may have identified other living things that move through the air on their handouts or when discussing related phenomena in the previous lesson. To leverage students' interests and build on their experiences and work outside of the classroom, you might consider adding videos of these living things to the slides to make additional comparisons." (Lesson 3, Teacher Guide)
- Lesson 6, Connect, Step 6, "Display slide K and ask students to consider a time when they were not able to see something because there was not enough light reflecting off of it. Encourage students to share their experiences in sequential order with key ideas and details to ensure that everyone can understand their ideas." (Lesson 6, Teacher Guide)
- Lesson 8, Connect, Step 1, "Identify related phenomena. Display slide A and support students in recalling that we were interested in finding out more about other living things that were out meeting their needs in the dark. Ask students if there are any new examples of living things that they thought of or heard about from others in their community. Refer to the How do animals and plants use their parts to meet their needs? chart from Lesson 2 where students had previously mentioned other animals (parts of animals), especially those that are active in the dark. Accept all responses and emphasize that there are a lot of living things that spend a lot of their time in the dark." (Lesson 8, Teacher Guide)
- Lesson 11, Connect, Step 2: "Prepare to engage in a plant tour. Display slide C and ask students to consider where they typically see plants growing and living. Encourage them to share with a partner and then with the class." (Lesson 11, Teacher Guide)

iii. Provides opportunities for students to connect their explanation of a phenomenon and/or their design solution to a problem to questions from their own experience.

- Lesson 1, Connect, Step 3: "Compare our own needs with flying squirrel needs. Display slide K and the How Flying Squirrels Meet Their Needs chart. Encourage students to reflect on the needs of the flying squirrels. Ask students to turn and tell a partner if any of the flying squirrel needs remind them of any of their own needs. Facilitate a discussion comparing flying squirrel needs and parts to human needs and parts." (Lesson 1, Teacher Guide)
- Lesson 6, Student Handout, Our Experiences with Reflected Light, "Consider a time when you could not see an object clearly because it was dark, and you later saw that same object clearly when there was light. Develop a model that explains what caused you to be able to see the object clearly. Draw two images: one explaining when it was dark and one that explains when there was light. Make sure to include these ideas (they don't need to use these symbols)." (Lesson 6, Student Handout)
- Lesson 8, Explore, Step 3: "Communicate information generated during the Smell Investigation. Display slide F and have students return to their seats. Take a few moments to discuss the results they collected and capture what students are saying on a whiteboard. Start by having each group share what smells they thought were in each container. To support these arguments, ask students who had a particular experience or memory that the smell reminded them to use these experiences to support their claim for the scent's source. Before revealing the actual source of the scent, give students another opportunity to use their past experiences to support a claim, but this time, using the experiences to support the claim that the smell is from something that can safely be eaten." (Lesson 8, Teacher Guide)
- Lesson 11, Synthesize, Step 3, "Participate in a discussion. Display slide F and ask students to have their copy of Plant Tour Observations accessible. Facilitate a discussion about the plants that we observed on our plant tour. As students share their ideas add them to a chart paper labeled "Plant Structures and Functions"" (Lesson 11, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.B. Student Ideas

EXTENSIVE

Student Ideas: Provides opportunities for students to express, clarify, justify, interpret, and represent their ideas and respond to peer and teacher feedback orally and/or in written form as appropriate.

The reviewers found **extensive** evidence that student ideas are central to the instructional process and that the materials provide numerous opportunities for students to express, justify, and build upon their initial theories. Students' noticings and wonderings are documented to drive the unit, and this is sustained through the use of "My Growing Ideas" charts and "Scientists Circles" where consensus is built. The materials explicitly leverage student reasoning through a consistent cycle of initial modeling (e.g., Lesson 1 and 8), peer feedback (e.g., Lessons 4, 6, 7, and 9), and subsequent revision based on new evidence and classmate perspectives.

Student ideas are clarified, justified, and built upon

The teacher has support to facilitate students expressing, clarifying, and/or justifying their ideas. Examples include:

- Students justify their ideas as they support claims with evidence. Elements of the Engaging in Argument from Evidence practice are a major focus of this unit; see I.B SEPs above for additional evidence.

- Throughout the unit, teachers are given prompts to use to elicit student ideas, in every lesson, that are located in tables with headings "Prompts to Use", "Ideas to Look and Listen For," and "Follow-up Response". For Example:
  - In Lesson 1, Explore, Step 4, the class discusses their investigation. "Prompts to use: How would wings, the ability to move around in the dark, and a brain with really good memory help a flying squirrel meet their needs? Ideas to look and listen for: I think their eyes must have night vision. Maybe their eyes just don't need a lot of light to see. Their wings get air under them and help them float. They use their wings to fly like other animals that fly. Their brain probably has more storage than ours. " (Lesson 1, Teacher Guide)
  - In Lesson 6, Synthesize, Step 3, the class discusses the results of an investigation. "Prompts to use: Think about which time you saw the berry the most clearly. What caused us to be able to see it clearly? Ideas to look and listen for Because there was light on it, light helps you see. A student points at their eyes. When it is dark it is harder to see things." (Lesson 6, Teacher Guide)
  - In Lesson 13, Explore, Step 3, the class discusses their examination of a flower. "Prompts to use: Which flower structures make sure pollen gets moved between flowers? What about them helps get that job done? Ideas to look and listen for: The stalks with the pollen on them and where the pollen needs to go stick out so the hummingbirds will have to bump them when they reach in to get nectar. The pollen is so light and dusty that it moves onto the bird really easily. The stalk where the pollen needs to go is sticky on the end, so some pollen from another flower will get pulled off the hummingbird when it bumps it. Somewhere inside the flower it makes nectar, which the hummingbird wants to get." (Lesson 13, Teacher Guide)
- Lesson 1, Explore, Step 4, "Reflect on our squirrel experience. Display slide R and be sure students have their Challenges Instructions and Data Sheet handout available. Ask students to share their experiences with their small group first using the prompts on the slide. Encourage them to notice similarities and differences in their experiences. Then, facilitate a discussion about their experiences with the squirrel challenges." (Lesson 1, Teacher Guide)
- Lesson 3, Navigate, Step 8, "Introduce My Growing Ideas charts. Display slide Q. Say something like, We have just figured out a lot of things and we still have some things we are wondering about, so let's take some time to capture our ideas and questions. If this is the first unit of the year, explain that because students are older and more independent now, they can keep track of their own thinking as we make progress on figuring out our questions. Since this is the first time we are recording our thinking like this, suggest that we practice together today. Then in future lessons, students can work entirely on their own. If needed, model how to fill out the chart (use a handout and document camera, or recreate the chart on board space). After writing the lesson question, How does a flying squirrel move through the air?, ask students to share what they figured out." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 4: "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system). Give students time to construct and revise their arguments with their partners. " (Lesson 4, Teacher Guide)
- Lesson 10, Synthesize, Step 5, "Update my growing ideas. Display slide J. Distribute the My Growing Ideas handout to each student. Encourage students to write or draw one or two ideas about what they learned in this lesson that help them to answer the lesson question. Make clear that My Growing Ideas is their space to record their own thoughts and science ideas, not to copy from the teacher or classmates, and that students should feel free to record their ideas using a combination of writing (in any language), drawing, and symbols. If students are struggling to come up with new questions they have, refer them back to the class driving question board." (Lesson 10, Teacher Guide)
- Lesson 11, Explore, Step 4, "Observe and discuss plants watered in different ways. Display slide H and invite students to look at the two plants. Explain that after these pictures were taken, these two plants were watered in different

ways for 3 weeks. One plant had water placed only on its leaves and the other had water placed only on the soil. Ask students which plant will be healthier after three weeks. Encourage them to share their ideas and/or evidence from lived experiences with a partner first and then with the class." (Lesson 11, Teacher Guide)

Artifacts show evidence of students' reasoning and changes in their thinking over time

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4: "Read and model in pairs. Distribute 1 infographic card and the coordinating page from the Other Living Things Needs Model handout to each pair, and give pairs time to read and develop their models. Be sure at least one pair develops a model for each organism. Share and record ideas. Bring students back together in a whole group and display slide I along with the Class Consensus Model and How do animals and plants use their parts to meet their needs? chart. Suggest that it will be helpful to record the ideas we have now about other animal parts, but that our flying squirrel Consensus Model is already quite full. Explain that we can continue to use our How do animals and plants use their parts to meet their needs? chart to record ongoing ideas about how parts help plants and animals meet their needs." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 6: "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book. Help students to make the connection that these observations can serve as evidence to support our arguments. Give students time to complete the handout." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5: "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system). Give students time to construct and revise their arguments with their partners. Remind students that they can use resources around the classroom—like the Bat Structures chart and their earlier flying squirrel sketches Construct an argument to help them get ideas for their arguments. Encourage students to refer back to these visual models as evidence, using them to explain how different body parts interact as a system. These shared representations can serve as scaffolds for organizing thinking and language, supporting students as they connect observations across investigations to construct well-supported claims." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize, Step 6: "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference. " (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and

the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)

- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)
- Lesson 12, Synthesize, Step 5, "Updated our claims and model. Return to the list of claims on the whiteboard and allow students time to add new claims. Display the How the Lima Bean Plant System Works chart from last class (Refer to slide O) and suggest that we use our claims to add new ideas about how the seeds get water and how new seeds can form. Use the prompts below to support students in updating the model." (Lesson 12, Teacher Guide)

Students receive feedback and revise their thinking accordingly.

Students receive constructive feedback from both the teacher and peers. For example

- Lesson 4, Synthesize, Step 5: "Pairs provide peer feedback on each others' arguments. Display slide J and explain that scientists often review and strengthen each others' ideas by giving feedback. Tell students they will now use the checklist on the bottom of Construct an argument to provide feedback on their partners' argument. Remind them that when giving feedback, it is important to focus on the work, not the person. As pairs are giving feedback with the checklist, circulate around the room. Listen for students referring to their model for evidence and identifying connections among structures, and facilitated as needed. Allow students to refer to classroom charts, word wall cards, and other resources (e.g., word banks, bilingual glossaries, sentence stems, or checklists and their home language) as needed to organize their thoughts." (Lesson 4, Teacher Guide)
- Lesson 6, Connect, Step 6, "Share our models with small groups. Explain that we are going to share our models with our small group in order to share our experiences with one another and to provide feedback on our models to each other. Display slide M and share the questions to consider while looking and listening to our peers' models. Remind students that the purpose of providing feedback to each other is so that we can improve our scientific ideas and practices to help each other think more deeply—not to judge or fix someone's work. Encourage students to ask curious questions instead of saying whether something is right or wrong. For example, they might say, "What made you show the light this way?" or "Can you tell me more about how the light here helps you see?" rather than, "You forgot light" or "That's not how it works." Emphasize that feedback should focus on ideas in the model, not the person, and that everyone's model is a work in progress." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 6, "Participate in a gallery tour of the models. Display slide Z and tell students that we will be participating in a gallery tour of each others' models with the goal of providing productive feedback and getting ideas for revision of our own models. Ask students to tape their model on a space on the wall where their classmates will be able to see it. Invite students to tour the classroom to observe their classmates' models. Distribute 2 sticky notes to each student and encourage them to use them to leave feedback on their classmates' models as they tour them. Revise our models. Display slide AA and give students time to review the feedback provided by their classmates and to consider the models they observed during the gallery tour. Encourage students to use that information to revise their models." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "Share our models with another pair. Display slide O and group students with a pair who developed a model for the other sense receptor. Encourage students to take turns reading and explaining their model to the other pair. Invite the other pair to respectfully listen and provide supportive feedback using the prompts on slide O. Remind students that helpful feedback should focus on science ideas in the model, include celebrations and questions, and be kind, specific, and aimed at helping their classmates strengthen their thinking. When both pairs

have had time to share their models with each other, give students time to revise their models based on the feedback if they gained new ideas or clarifications from the discussion." (Lesson 9, Teacher Guide)

- Lesson 13, Synthesize, Step 5: "Give and receive feedback. After students have completed their Flower Pollination Model assessment, display slide H and distribute the Peer Feedback handout. Pair students to give and receive feedback about their arguments supported by models. Remind students that the purpose of giving feedback is to help improve our work by emphasizing things to look and listen for, such as: Does the model support the claim? Is it helping answer the question? Does the model help you see how the flower structures work together?" (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.C Building Progressions

ADEQUATE

Identifies and builds on students' prior learning in all three dimensions, including providing the following support to teachers:

i. Explicitly identifying prior student learning expected for all three dimensions

ii. Clearly explaining how the prior learning will be built upon.

The reviewers found **adequate** evidence that the materials identify and build upon students' prior proficiency across all three dimensions. The "Unit Front Matter" and "About the Science" sections explicitly link the unit's content to specific prior units (e.g., Unit K.4 and Unit 1.1) and everyday experiences, such as caring for pets or gardens. The materials successfully outline a clear Unit Progression, particularly for the Science and Engineering Practices and Crosscutting Concepts; for example, "Systems and System Models" progresses from "parts working together" in Lesson 1 to "identifying components and interactions" by Lesson 8. The materials explicitly identify prior learning expected for all three dimensions, but not at the element level. And there is a notable gap in support for teachers regarding specific student "Alternative Conceptions." There is little information about the ideas students may bring to the unit topics or about how the teacher can help students negotiate their understandings.

i. Explicitly identifying prior student learning expected for all three dimensions

The Unit Front Matter describes prior student learning for all three dimensions.

Disciplinary Core Ideas:

- Animal and Plant Needs: Survival is an important idea that surfaces in Lesson 3 and throughout the unit. Students will have prior experiences and ideas that survival happens when a plant or animal meets its needs. In science class, students learn about plants and animals meeting their food and water needs (and light for plants) during kindergarten (K-LS1-1). In the OpenSciEd program, this learning experience occurs in Unit K.4: Do birds, other animals, and plants need people to help take care of them?. In addition to school learning, students may also have experiences and knowledge developed by taking care of plants and animals outside of school (e.g., watering house plants, tending a garden, raising sheep, feeding a pet). All of this prior knowledge and experience is helpful as students make sense of what the needs of plants and animals are and how they have a system of structures that support their needs.
- Plant and Animal Structures and Functions: Through everyday experiences with animals and plants, students may enter 4th grade with ideas about the external parts that plants and animals have and ideas about what these parts are

used for. For example, students may recognize that a goldfish has fins and can swim but birds they see outside have wings and can fly. Students who have completed Unit K.4: Do birds, other animals, and plants need people to help take care of them? will have figured out animals need food, water, air, and homes to live and grow. Plants need water and sunlight to live and grow. Students can build on these ideas in this unit when they connect how animals and plants use their parts in ways to meet their needs and this helps them survive.

- Light and Information: Through everyday experiences with light, students may enter 4th grade with ideas about how light makes objects easier to see. Students who have experienced Unit 1.1: How can we read under covers when it's dark? will also have ideas about how light shines through and reflects off of different objects. Students can build on these ideas as they make sense of how light reflecting off of objects and into eyes allows the objects to be seen. They will also build on the idea that different amounts of light allow different amounts of an object to be seen with clarity. Throughout student's K-5 experiences they will encounter the words light and information in many ways, in this unit, students establish that light is reflected for you to see.
- Senses and Sense Receptors: Students have been using their senses (e.g. sight, touch, hearing) to make observations of their world in and outside of the classroom. This unit provides the first opportunity for students to formally consider how animals use their senses to support survival and reproduction, and leverages students' noticings about how they make sense of the world to help them figure out how other animals use senses. This unit may also be the first time students consider how a body's sense receptors interact with the brain to help make memories and guide actions. Students may or may not be familiar with the similarities and differences between our human sense receptors and those of other animals (e.g. snakes smelling with their tongues), and you can leverage those ideas to support engagement as students figure things out in this unit.
- The information in the front matter is general and does not reference specific elements of the DCIs. And, prior learning is not presented at the element level.

Science and Engineering Practices:

- Developing and Using Models:In previous grades, students have worked to identify the difference between a model and the real thing as well as developed simple models to represent tools, amounts, and/or relationships. In this unit, students begin to develop more complex models that can be used to explain or predict phenomena. They begin to develop systems models individually and independently.
- Engaging in Argument from Evidence: Students may consider argumentation to be negative. They may bring ideas about everyday arguments to the classroom. This unit will introduce students to the idea of scientific argumentation and how scientists use evidence to try to reach agreement to help explain observations about the natural world. Students will have multiple opportunities to practice scientific argumentation throughout the unit.
- The information in the front matter is general and does not reference specific elements of the SEPs. And, prior learning is not presented at the element level.

Crosscutting Concepts:

- Structure and Function: Students will enter school with everyday ideas about the relationship between the structure of objects in the world around them and their functions. For example, they may notice that objects they use in their everyday lives, like eating utensils, can have parts with different shapes that can change how they work. Children may choose to use a fork with pointed edges to pick up certain foods, but a spoon with a curved cup to scoop up liquids. In addition, students also might bring in ideas about this crosscutting concept from Unit 1.2: How can we communicate using objects that make sound?, and Unit 1.4: How do the ways plants and animals look and act help them live and grow? which they may have experienced in younger grades.

- Systems and System Models: From prior grades and everyday experiences, students may know that systems are made of parts that work together. They can likely think of many different examples of systems, which are elicited and then leveraged when systems are introduced. Students will advance their understanding of systems by identifying parts as components, the ways that those components work together as interactions to help the living thing survive, grow, and reproduce.
- The information in the front matter is general and does not reference specific elements of the CCCs. And, prior learning is not presented at the element level.

ii. Clearly explaining how the prior learning will be built upon.

- Alignment With The Three Dimensions Of NGSS: "The following three tables explain how students engage in Science and Engineering Practices, use Crosscutting Concepts, and figure out Disciplinary Core Ideas in this unit's lessons. The codes used to identify each dimension's elements are described in the Teacher Handbook." This document explains at the element level "How Students Engage in this Practice". (Alignment with the Three Dimensions of NGSS)
- Lesson 1, Synthesize, Step 5, Systems and System Models Sidebar "An important element of this crosscutting concept is to describe a system in terms of its components and their interactions. At this point, students are starting to consider the squirrel's parts as components that interact to support the squirrel's body system, but they will likely not yet use the words "components" or "system". However, the idea of "parts working together" that they model will help reveal their current thinking in order to inform instruction about systems thinking as the unit goes on.
- Lesson 2, Connect, Step 3 Teaching Tip Sidebar: "If students experienced Unit 2.4: How can plants grow in different places? They will have specific ideas about plant parts that help meet needs for seed dispersal and pollination. If your students do not have ideas to share about plants, jot a note that we should have lots of plant questions when it's time to build the Driving Question Board." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 4 Engaging in Argumentation from Evidence Sidebar: "As students make a claim for their position, ask them to share their thinking for why they think the flying squirrel flies or does not. Push students to supply evidence from the investigation, photos, and or videos to support their claims. Later in the lesson students will use evidence to develop an argument using a scaffolded handout." (Lesson 3, Teacher Guide)
- Lesson 3, Synthesize, Step 6 Engaging in Argumentation from Evidence Sidebar: "Students who have experienced Unit 4.2 have had an opportunity to practice engaging in argument from evidence, and this unit provides multiple supports and opportunities for students as they develop this practice. This practice was also intentionally developed in Units 3.2 and 3.4, so students may have experiences from those units to connect with and build on." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5 Sidebar: "Students engage in this practice when they use evidence from their model to support a claim about how an organism's body parts interact as a system. Using firsthand observations of the experiences they had with structures functioning together and reading an infographic will support students as they engage in the practice of writing an argument. Students will have individual opportunities to construct arguments based on evidence in Lesson 5 (about animal structures) and in Lesson 13 (about plant structures)." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize, Step 3, Cause and Effect Sidebar, "Students engage in this crosscutting concept as they consider the cause and effect relationship between an object being seen and the presence of light shining on it. This is the first time that this crosscutting concept is being developed in this unit. Students will build on this thinking in Lesson 7 when they consider the relationship between the amount of light shining on an object and how clearly it can be seen." (Lesson 6, Teacher Guide)

- Lesson 7, Synthesize, Step 3, Developing and Using Models Sidebar, "Students have had many experiences collaboratively developing and/or revising models based on evidence, but this may be their first time showing the relationships among variables for frequent and regular occurring events. The class will continue to practice using this element of modeling in Lessons 8-11." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "An important element of this practice is to respectfully provide and receive critiques from peers by citing relevant evidence and posing specific questions. Students will have another formal opportunity to give and receive peer feedback in Lesson 13." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2 Developing and Using Models Sidebar: "This is an opportunity for students to continue practicing developing models that represent relationships between multiple variables. Students previously did this in Lessons 8 and 9 in this unit. They will individually develop models that represent relationships between multiple variables in this lesson's assessment. Then in the third lesson set, students will transition to modeling structures and functions in a new context: plants." (Lesson 10, Teacher Guide)
- Lesson 11, Synthesize, Step 7 Developing and Using Models Sidebar: "Students have been developing the practice of modeling throughout the unit. In this lesson they are increasing the complexity of the task by using multiple sources of evidence to support their model. Students will have opportunities to practice using this element of modeling again in multiple fifth grade units." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate, Step 7 Teaching Tip Sidebar: "If students in your class experienced Unit 2.4: How can plants grow in different places? they will bring in ideas about pollinators, so their questions might be more specific to the flower's structures or connected to the process of pollination. Students will make further connections to these ideas in Lesson 13 and/or investigate these ideas if they did not experience Unit 2.4." (Lesson 12, Teacher Guide)
- No explicit support is provided to teachers to clarify their understanding of potential alternate conceptions they or their students may hold as they build toward students' three-dimensional learning. There is little information about possible student misconceptions and how teachers can structure instruction to help students negotiate their understandings.

Criterion-Based Suggestions for Improvement:

- Ensure that "[t]he materials explicitly state the expected level of prior proficiency students should have with individual elements of all three dimensions for the core learning in the materials." [Detailed Guidance, p. 24]
  - Consider identifying prior learning at the element level across the unit whenever prior learning is addressed.
- Ensure that "[e]xplicit support is provided to teachers to clarify adult understanding of the potential alternate conceptions that they, or their students, may have while building toward students' three-dimensional learning" [Detailed Guidance, p. 25]
  - Consider providing specific guidance regarding alternative conceptions in the About the Science Document

II.D. Scientific Accuracy

EXTENSIVE

Scientific Accuracy: Uses scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning.

The reviewers found **extensive** evidence that the materials are scientifically accurate and technically sound for the 4th-grade level. The "About the Science" document provides high-quality background for teachers, correctly identifying the grade-band boundaries for light (focusing on reflection rather than refraction) and structures. The materials successfully cover complex topics, like the vascular system, in a grade-appropriate way that maintains scientific accuracy.

The unit features an "About the Science" document designed to enhance teacher understanding. This document outlines the essential science ideas students will encounter in each lesson. It also includes a section titled "What are the boundaries of science ideas in this unit?", which clarifies science concepts that are above grade level or outside the unit's learning objectives. Additionally, the "What are recommended adult-level learning resources for the science concepts in this unit?" section provides background information and resources for teachers on the key scientific topics.

- Example of the science ideas that students will figure out: "Light. In this unit, fourth graders will explore how we see objects by discovering that light must be reflected off the object and reach our eyes in order to be seen. Students will also explore how the size of the eye opening allows in more or less light which changes how much can be seen in an environment. Students will not be exploring how we see color reflecting or absorption of light. Students will not explore the path of light or the details of how light reflects by being refracted." (About the Science)
- Example of the science ideas that students will figure out: "Sense receptors. Every sense has its own specific type of sensory receptor. These receptors are complex and fascinating biological structures that variously allow organisms to receive sensory information via sound, light, heat, pressure, and various molecular structures, among other things. In this unit we consider receptors to be structures that have the function of receiving information. We do not learn any details about those receptors other than the fact that they receive information allowing organisms to see, smell, feel, hear and taste. Connecting the idea of receptors with senses in this way sets students up to learn more about them at a more microscopic level in middle school."
- Example of the science ideas that students will figure out: "Plant structures. Students explore several plant structures in Lessons 11-13. While labeling these structures can make it easier to talk about them, do not expect students to memorize or correctly use the names of these parts. If students invent descriptive names for the parts, that is fine as long as they understand which part they are referring to. For example, the word "xylem" is used when students investigate the structures involved in carrying water from the roots to the rest of the plant to allow students to have a handy (and scientifically appropriate) term to use, but knowledge of that vocabulary is not required and should not be assessed. The names for other structures in the seed, plant and flowers may be familiar to you, but students do not need to know their names at this point. Within the stem, the xylem is a system of tubular structures that functions to carry water and minerals from the roots to the rest of the plant. The phloem is a similar set of tubes within the stem and other parts of the plant that move molecules from the photosynthetic structures throughout the plant's other tissues." (About the Science)
- Example of adult-level learning resources: "National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, DC: The National Academies Press. Download for free: https://nap.nationalacademies.org/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts Read about PS4.B on pages 133-135, LS1.A on pages 143-145, and LS1.D on pages 149-150." (About the Science)

- Lesson 6, Synthesize, Step 5, Teaching Tip Sidebar, "Students may not come up with the idea that light is bouncing off the object. Students sometimes think that light getting into the eyes activates "eyesight" which then can see the object because there is light shining on the object - an explanation that does not require reflection to explain their observations. If students do not connect the idea that light is traveling directly from the berry to the eye, suggest that possibility and ask students if that could explain their results. If students experienced Unit 1.1, they will have prior knowledge about light reflecting to build on, and students may have heard this word in their other experiences, too. Let students know that reflecting means light bouncing off something." (Lesson 6, Teacher Guide)
- Lesson 9, Connect, Step 5, "Gather more information from a book. Display slide M and let students know that the book we started reading in Lesson 8, also has chapters that explain how other animals use taste and hearing receptors to make sense of their environment. Encourage students to consider which of the two types of receptors they are more interested in reading about. Pair students up in a way that works effectively for your class and invite the students to read about either taste or hearing receptors from Meet the Expert: Aide Macias Muñoz. Show them how to use Taste or Hearing Receptors Model to track what they are noticing as they read. As students read, encourage them to notice the structures that different animals use." (Lesson 9, Teacher Guide)
- Lesson 11, Synthesize, Step 7, "Facilitate a discussion about what we noticed from the celery plant investigation and what we think this tells us about the structures of the celery plant and their functions. As students share their thoughts, encourage them to use their observations from the Celery Plant Investigation to support their thinking and to provide visuals for the class. Encourage students to reference the celery plant and share their observations with their classmates. You may introduce the word xylem as an option, but what matters most is that students understand the function of this structure—how it carries water through the plant—rather than memorizing the term itself." (Lesson 11, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

II.E. Differentiated Instruction

EXTENSIVE

Provides guidance for teachers to support differentiated instruction by including:

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities that are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.

ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

The reviewers found **extensive** evidence that the materials provide supportive ways for all students to access instruction and meet the targeted expectations. The unit is grounded in five clear equity principles and utilizes "Broadening Access" callouts that offer specific, high-quality strategies for multilingual learners and students with disabilities, such as using home languages, physical gestures (kinesthetic engagement), and tactile models (e.g., using string/yarn to represent light rays). The inclusion of specific "Lesson Assessment Tools" provides teachers with concrete "If you notice.../Possible Next Steps..." guidance to support students who are struggling with specific three-dimensional goals, such as representing information flow

in a system. While the unit provides robust scaffolds for access and support for struggling learners, the guidance for students who have already met the performance expectations is less frequent, often appearing as optional extensions rather than a systematic approach to deepening their understanding of the practices or crosscutting concepts throughout the unit.

i. Supportive ways to access instruction, including appropriate linguistic, visual, and kinesthetic engagement opportunities are essential for effective science and engineering learning and particularly beneficial for multilingual learners and students with disabilities.

The materials provide teachers with information to support students of different levels in learning and engaging with the content. For example,

- 4.4 Structure and Function Unit Front Matter "The unit- and lesson-level phenomena were chosen specifically for their relevance to students of this age group and for their use of materials that students may have familiarity with from their everyday lives. However, because the disciplinary core ideas explored through these phenomena directly involve light and seeing, it may be necessary to adjust the explorations in this unit to ensure all students have opportunities for equitable participation. This is an important consideration if there are students in your class with visual impairments. It is critical that any adjustments made maintain the rigor of the sensemaking work that students engage in throughout this unit. We encourage you to follow the guidance of students' IEPs/504s and to seek assistance from members of your school team who specialize in different aspects of equitable and accessible learning while implementing this unit. Classroom, school, district, and state-based resources may also be able to provide specific suggestions and intervention support to meet the specific needs of individual students. Some unit-specific strategies to consider include: Provide books with enlarged text and/or images in high contrast when looking at animal structures. Use specific and detailed language when describing investigation materials, procedures, and observations in all lessons." (4.4, Unit Front Matter)
- The Teacher Handbook document also contains UDL and differentiation supports including: "Building an equitable classroom culture for OpenSciEd Elementary Teacher Handbook, Building an Equitable Classroom Community for Science, "The OpenSciEd Elementary program aims to create equitable science instruction for all students, centering students' resources, interests, and identities in the classroom community's sensemaking work. In particular, there are five principles that guide our equity design stance. Though described separately, it is important to note that these principles are not mutually exclusive and often intersect in critical ways."
- Lesson 7, Synthesize, Step 3 Sidebar: "To help students visualize how different amounts of light impact what can be seen, you might provide pieces of yellow yarn to represent light rays. Using yarn allows students to add, remove, or adjust rays easily—for example, removing a strand to show less light, or adding multiple strands to show more light—making abstract ideas about light intensity and reflection more tangible. If you try this, think through logistics—how the yarn will attach to the poster, how it can be moved as students adjust their ideas, and how multiple paths might be represented. If using yarn is logistically challenging, drawing light paths with a yellow marker or crayon is an equally effective way for students to represent and reason about how light travels from the source to objects and into the eye. The key is providing a clear, manipulable reference that supports students' understanding of the relationship between light and visibility." (Lesson 7, Teacher Guide)

Differentiation strategies address the needs of students when an obvious need arises: Emerging multilingual students learning English

- OpenSciEd Elementary Teacher Handbook, "Broadening Access callouts focus on moments during instruction in which a certain population may benefit from a particular strategy--for example, supporting language development for emergent multilingual learners, providing extended learning opportunities or readings for students with high interest, providing specific strategies for students with special learning needs." (OpenSciEd Elementary Teacher Handbook)

- Lesson 1, Explore, Step 1, Broadening Access Sidebar, "Completing one row together helps students see how to extract evidence from the Notice and Wonder chart and reason about the function of each squirrel body part for the squirrel's needs. Model your thinking aloud—point out where you notice clues, how you connect observations to possible needs/functions, and how to justify your ideas. This supports multiple means of engagement, representation, and action/expression, helping all students access and participate in sensemaking while scaffolding their subsequent partner work." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2, "The Discussion Supports and Icons with Discussion Supports are available to support students as they share their ideas with the class. Some students may benefit from additional time to examine and/or translate the discussion supports in order to increase their confidence and motivation prior to participating in the class discussion." (Lesson 2, Teacher Guide)
- Lesson 3, Connection Section, Step 5, Broadening Access Sidebar, "While students read the infographics with a partner, encourage partners to stop on key words like glide, flap, and patagium, using the visuals on the infographic and gestures to make ideas concrete. Prompt students to act out movements, and discuss what they notice about how animals move—using their home languages or gestures as needed. Invite partners to talk through their ideas together using the pictures before sharing with the class. This supports all students, in particular multilingual learners" (Lesson 3, Teacher Guide)
- Lesson 5, Connect, Step 5 Broadening Access Sidebar: "As you read, support multilingual learners by showing key words and visuals related to the ideas students are listening for—such as survive, predator, paws, flaps, legs—and model how to connect the visuals to the vocabulary. Encourage students to use their home language to think, take notes, or talk with a partner about what they notice. Offer sentence starters, visual cues, or graphic organizers to help students process and represent their ideas. This approach gives students multiple ways to comprehend, engage with, and express understanding of the information about tree squirrels." (Lesson 5, Teacher Guide)
- Lesson 9, Connect, Step 2 Broadening Access Sidebar: " Support multilingual students by pairing them with a bilingual peer or partner. Encourage students to discuss the cards in their home language or use gestures before sharing with the whole group." (Lesson 9, Teacher guide)
- Lesson 12, Explore, Step 3 Broadening Access Sidebar: "If your class includes multilingual learners, consider giving those students the cards with photos instead of descriptions, provide accompanying translations, or strategic student pairing, allowing them to fully participate without the need to decode all the words." (Lesson 12, Teacher Guide)

Learners with special needs (visual impairments, tactile engagement, etc.)

- "Since one of this unit's core ideas is about how eyes work to help animals see, it is especially important to consider and plan for how students with low vision, blindness, or other visual impairments will participate in the unit and how they will feel about the figuring out they do. Consider ways to engage all students in science talks through the Scientists Circle. This is an opportunity for students to see and hear one another to build community learning across the class. During the Scientists Circle discussions, it is important to look for how students are sharing their ideas in addition to what ideas and questions they might be sharing. Students might share ideas through talk, motions, gestures, facial expressions, etc. Young children have many rich ways of communicating, and it is important to welcome, recognize, and value all their ways of communicating. Throughout this unit, students will develop additional language resources and practices that will further support their scientific communication." (Structure and Function Front Matter)
- Accessing visual phenomena and developing an understanding of sight-related disciplinary core ideas The unit- and lesson-level phenomena were chosen specifically for their relevance to students of this age group and for their use of materials that students may have familiarity with from their everyday lives. However, because the disciplinary core ideas explored through these phenomena directly involve light and seeing, it may be necessary to adjust the

explorations in this unit to ensure all students have opportunities for equitable participation. This is an important consideration if there are students in your class with visual impairments. It is critical that any adjustments made maintain the rigor of the sensemaking work that students engage in throughout this unit." and "Use specific and detailed language when describing investigation materials, procedures, and observations in all lessons. Provide detailed descriptions of important visual information that is occurring during an investigation. For example, describe what can be seen in the book (words, pictures, level of detail). Describe details about the vision test lines (presence, absence, size, shape, color) in the lightbox in Lesson 8." (Structure and Function Front Matter)

- Lesson 5, Synthesize, Step 3, Broadening Access Sidebar, "Drawing the model gives students a visual way to represent and reason about how flying squirrels move between trees to get food. Encourage students to use the sketch to make their thinking visible, showing both gliding and climbing paths. For students who may struggle with spatial reasoning or drawing, offer support such as labeling key elements, using arrows or lines to indicate movement, or working with a partner to discuss and co-draw ideas. Visualizing the paths helps students compare and synthesize different movement strategies, making abstract concepts about animal locomotion and energy use more concrete." (Lesson 5, Teacher Guide)
- Lesson 6, Explore, Step 2, Broadening Access Sidebar, "If you have a student(s) who is blind or has a visual impairment, you will need to adjust the investigations in the lesson to ensure their equitable participation. Work with the student's case manager as needed, but ideas for providing multiple means of engagement include providing clear and detailed spoken descriptions of what happens when testing different light conditions and providing a tactile model to represent how light travels and can reflect off an object into the eye. Ensure the student is included in making predictions, discussing results, and building models so they are part of the scientific reasoning process, not just receiving information." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 6, Broadening Access Sidebar, "If any students have mobility or vision challenges, consider ways to ensure they can fully engage with the gallery of light/eye models. You might take digital photos of each model so students can view them on a device or printed copy, allowing them to zoom in or examine details closely, such as the paths of light, eye opening size, or amount of reflected light. Include screen reader-friendly text or audio descriptions if possible. Pair students with a peer who can describe these key features aloud, or have all students take turns explaining their own model, which benefits auditory access for everyone. For students with mobility limitations, you could circulate models around small groups or allow students to remain at their desks while participating in discussions." (Lesson 7, Teacher Guide)

Learners reading below grade level:

- Lesson 1, Connect, Step 2: "Read a book about how flying squirrels meet their needs. Display slide I and tell students that you have a book about flying squirrels that can give us more information about how they meet their needs. Read aloud the Soaring Squirrels book, inviting students to participate in any routine you have for reading a book aloud. Remind students to consider the question that's guiding our reading: How do flying squirrels meet their needs?" (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4: "Introduce the infographics. Display slide H and and tell students that we can read to find out more about how other things meet their needs, especially in the dark. Explain that since it was helpful to model how the flying squirrel's parts help it meet needs, we will work in pairs to develop models to describe how the animals and 1 plant on these cards use parts to meet their needs." (Lesson 2, Teacher Guide)
- Lesson 3, Connect, Step 5: "Read infographics with a partner." (Lesson 3, Teacher Guide)
- Lesson 3, Synthesize, Step 6, Broadening Access Sidebar, "Before students write, consider briefly revisiting a key piece of evidence using a picture or a short video clip. Use gestures, simple language, and quick sentence starters to support recall. Invite students to talk with a partner in any language to rehearse their claim and which evidence supports it

before the whole group. As needed, provide a small word bank and let students point to images if speaking or writing is hard. As students complete the handout, allow multiple ways to show thinking—circling, sketching, using labels, or giving a brief oral explanation—to help all learners, especially multilingual learners, express their ideas clearly."

- Lesson 5, Connect, Step 6: "Construct a model of tree squirrel structures and their functions. Explain that as you read, you're going to pause on each page and will ask students to identify the different structures tree squirrels use to meet their needs. Record what they notice using a model titled "How do the system of tree squirrel structures function to meet its needs?"." (Lesson 5, Teacher Guide)
- Lesson 5, Connect, Step 6, Broadening Access Sidebar, "As you read, support multilingual learners by showing key words and visuals related to the ideas students are listening for—such as survive, predator, paws, flaps, legs—and model how to connect the visuals to the vocabulary. Encourage students to use their home language to think, take notes, or talk with a partner about what they notice. Offer sentence starters, visual cues, or graphic organizers to help students process and represent their ideas. This approach gives students multiple ways to comprehend, engage with, and express understanding of the information about tree squirrels." (Lesson 5, Teacher Guide)
- Lesson 7, Connect, Step 7: "Gather the students to read the book out loud to them. Read the book pausing to discuss the following prompts." (Lesson 7, Teacher Guide)
- Lesson 8, Connect, Step 4: "Gather evidence about smell receptors from a book. Display slide H and read pages Remarkable Receptors: How Animals Navigate Their Environment. Use the prompts below to support students in figuring out how living things collect smells to make sense of the world around them. During the read-aloud, pause frequently to emphasize key takeaways and highlight the word 'receptor.' Use gestures, visuals, and examples from the book to help multilingual students connect the term to its meaning—such as showing how different animals use their noses, eyes, or ears to sense the world." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6, Broadening Access Sidebar, "Some students may find it challenging to turn the written information about sense receptors into visual models. If you notice this barrier where students may need more support in developing their models, consider reading about and co-modeling one of the sense receptors as a class and then having students read about and model the other in pairs. Additionally you can provide model stems: "sound enters…", "the receptor sends…". If you notice that students may need less support in developing their models, consider having them develop their sense receptor model independently." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2: "Work in pairs to read the rest of the Flying Squirrel Senses Situation Cards. Ask students to read over the rest of the cards with their partners, focusing on similarities and differences. Let students know that we aren't modeling the rest of the cards, just reading them with our partners." (Lesson 10, Teacher Guide)
- Lesson 13, Connect, Step 2, Literacy Supports Sidebar, "The New Garden Opens at Wide Creek Elementary article includes a diagram that explains key details about the process of pollination. Support students in explaining the diagram itself and understanding how this diagram illustrates a key idea in the text. Consider allowing students to explain the diagram to a peer before sharing aloud with the class. This supports RI.4.7 and helps students understand the process of pollination and so they are prepared to engage in the upcoming flower investigation." (Lesson 13, Teacher Guide)

ii. Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.

- Lesson 4, Lesson 4 Assessment Tool, "If you notice…Students are naming individual structures (e.g., wings, claws) but not describing how they work together as a system. Possible Next Steps…If this applies to students in your class: Have students revisit their investigation notes and physically gesture or use their glider models to show how one part helps another (e.g., "the tail slows it so the claws can grab"). Encourage them to add arrows or connecting words ("helps," "so that") in their argument." (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize, Step 3 sidebar: "Drawing the model gives students a visual way to represent and reason about how flying squirrels move between trees to get food. Encourage students to use the sketch to make their thinking visible, showing both gliding and climbing paths. For students who may struggle with spatial reasoning or drawing, offer support such as labeling key elements, using arrows or lines to indicate movement, or working with a partner to discuss and co-draw ideas. Visualizing the paths helps students compare and synthesize different movement strategies, making abstract concepts about animal locomotion and energy use more concrete." (Lesson 5, Teacher Guide)
- Lesson 6, Lesson Assessment Guidance, "If students need more support in grasping the idea that light reflects off of objects, consider making physical models of light reflecting by using string to represent the light traveling from its source, to an object, to an eye." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 3, Broadening Access Sidebar, "To help students visualize how different amounts of light impact what can be seen, you might provide pieces of yellow yarn to represent light rays. Using yarn allows students to add, remove, or adjust rays easily—for example, removing a strand to show less light, or adding multiple strands to show more light—making abstract ideas about light intensity and reflection more tangible. If you try this, think through logistics—how the yarn will attach to the poster, how it can be moved as students adjust their ideas, and how multiple paths might be represented. If using yarn is logistically challenging, drawing light paths with a yellow marker or crayon is an equally effective way for students to represent and reason about how light travels from the source to objects and into the eye. The key is providing a clear, manipulable reference that supports students' understanding of the relationship between light and visibility." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6 Broadening Access Sidebar: "Some students may find it challenging to turn the written information about sense receptors into visual models. If you notice this barrier where students may need more support in developing their models, consider reading about and co-modeling one of the sense receptors as a class and then having students read about and model the other in pairs. Additionally you can provide model stems: "sound enters…", "the receptor sends…". If you notice that students may need less support in developing their models, consider having them develop their sense receptor model independently." (Lesson 9, Teacher Guide)
- Lesson 11, Synthesize, Step 7 Broadening Access Sidebar: "It is important that all students in your class feel that their contributions are valuable. There are many ways to notice and recognize students' ideas beyond asking to hear from each student in the class. For instance, you might share something you overheard while moving around the class, display a students' drawn observations, or shed light on the ways a student group engaged in the investigation." (Lesson 11, Teacher Guide)
- Lesson 12, Lesson 12 Assessment Tool, "If you notice…Students are struggling to develop a claim about the function of the structures (Part 1). Possible Next Steps: If this applies to most or all of the class: If students have selected claim 1 to work with and need support in identifying the function, have students return to the " How the Lima Bean Plant System Works chart" and look for parts on the model that are similar to the roots and shoots. Use prompts and questioning to support the student in making the connection that the shoots are similar to the stems. Then prompt students to identify the functions, using the model, of the stem and roots. If students have selected claim 2, focus students' attention on the observations they made during the lima bean investigation and the Lima Bean Stages Cards that show the seed pod. Ask students to describe the properties of both and follow up with questioning to support students in describing how the seed coat and seed pod help to keep water and other living things away from the seed." (Lesson 12, Teacher Guide)

iii. Extensions for students with high interest or who have already met the performance expectations to develop deeper understanding of the practices, disciplinary core ideas, and crosscutting concepts.

The current extensions provide advanced learners with additional tasks or the option to skip activities.

- Lesson 4, Lesson 4 Assessment Tool, "If you notice: Students are showing a secure understanding of how multiple structures function together as a system to support the animal landing safely. Possible Next Steps: If this applies to a few students in your class: Challenge them to extend their reasoning by comparing how the same functions (slowing down, grabbing) are achieved with different structures in bats versus flying squirrels. If this applies to most or all of your class: Consider shortening the Synthesize [1] and Synthesize [2] in Lesson 5.
- Lesson 7, Lesson 7 Assessment Tool, "If you notice: Students are representing the direction and amount of light shining onto an object and into an eye. Possible Next Steps: If this applies to a few students in your class: In a small group, ask students to model how human eyes see differently with different amounts of light. Encourage students to choose an animal that interests them and develop a model to explain how their eyes see in different amounts of light. If this applies to most or all of your class: Consider skipping the gallery tour in this lesson. In Lesson 9, consider having students take the lead in updating the initial consensus model. The suggested guidance for students who have already met the performance expectation is to skip the activity rather than develop a deeper understanding of the practice of modeling.
- Lesson 9, Lesson 9 Assessment Tool, "If you notice Students are demonstrating a secure understanding of how to represent the flow of information through the system. Possible Next Steps: If this applies to a few students in your class: Invite students to work independently or with a partner to research an animal of their choice and model how one or more of their sense receptors helps them make sense of their world. If this applies to most or all of your class: Consider skipping the gallery tour in this lesson. In Lesson 10, consider bypassing the class demonstration of the "Choosing Food" situation card and having students work directly on using their set of Sense Situation cards to model how sense receptors and information from them help flying squirrels care for their babies. In Lesson 10, consider having students take the lead in updating the initial consensus model." (Lesson 9, Lesson Assessment Tool) The suggested guidance includes researching an additional animal and does not provide clear guidance on how this report can be structured to more deeply develop the understanding of the three dimensions. The suggested guidance for students who have already met the performance expectation includes skipping the gallery tour rather than developing a deeper understanding of the practice of modeling.
- Lesson 12, Lesson 12 Assessment Tool, "If you notice: Shows a secure understanding of how to make and support claims with evidence and science ideas. Possible Next Steps: If this applies to some of your class: Challenge students to write, draw, or orally share a rebuttal against a given claim, for example, provide students with a claim like, "The seed coat and seed pod help the plant to move water around the plant." If this applies to most or all of your class: Consider pushing the students to select both claims to work with, or encourage students to write their own claim based upon other structures found on the How the Lima Bean Plant System works chart. (Lesson 12, Lesson 12 Assessment Tool)
- Lesson 13, Synthesize, Step 4 Sidebar: "Optional Extension: Invite students to construct arguments about the structures the hummingbird has that function to help it survive, too. Students can use their observations of the photos of hummingbirds as evidence to support their claims about how the hummingbird's beak, tongue, wings/muscles, etc. help it gather the nectar it needs as food. Consider providing additional data from hummingbird videos for students to use as evidence to support their argument, such as __LINKS COMING SOON__. Encourage them to construct models to support their arguments about hummingbird structures and functions." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure: "Suggestions are provided for adaptations if students begin the lesson with significantly higher or lower levels of prior proficiency than expected for the grade level in any of the three dimensions." (Detailed Guidance, p.28)
  - Consider including ideas/activities within lessons that challenge students with higher proficiency, in addition to the optional extension opportunities.

II.F. Teacher Support for Unit Coherence

EXTENSIVE

Supports teachers in facilitating coherent student learning experiences over time by:

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

The reviewers found **extensive** evidence that the materials support the teacher in maintaining unit coherence from the student's perspective. The "Navigate" component, consistently embedded at the beginning and end of every lesson, provides a clear structure for students to "take stock" of their progress and co-construct the "next step" in their learning journey. Additionally, the teacher guide includes high-quality sidebar callouts that explain the "why" behind the three-dimensional progression, explicitly linking current tasks to prior learning from earlier grades (e.g., 3rd-grade modeling experiences) and upcoming lessons within the unit. These features ensure the teacher can facilitate a storyline in which student agency and knowledge-building are central, rather than simply following a list of disconnected activities.

i. Providing strategies for linking student engagement across lessons (e.g. cultivating new student questions at the end of a lesson in a way that leads to future lessons, helping students connect related problems and phenomena across lessons, etc.).

- Open SciEd Elementary Teacher Handbook (p. 17): Components within Lessons, Navigate Component.
  - What is the instructional purpose of this component? The Navigate component directly supports coherence for students from lesson to lesson. This component generally happens at the beginning and end of each lesson and provides opportunities for the class to take stock of where they are in finding answers to their questions, remind themselves what they figured out last time, and decide where they want to go next. Often this navigation will come naturally from questions generated by students, but occasionally the teacher will "problematize" an idea or investigation result by asking a salient question or pushing the class to consider other situations or new directions.
  - What are the potential outcomes of this component? During the Navigate component, students ask questions, define problems, and make predictions. The class builds their sense of shared purpose, sees progress toward answering their questions, and takes ownership of their science work.

- Lesson 1, Synthesize, Step 5, "Navigate to next time's work. Close today's lesson by celebrating the work students have done with modeling their initial ideas. Point out that we will need to share our models with each other next time so we can begin to make sense of how flying squirrels use many of their parts together to meet all of their needs." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate, Step 6, "Consider where to go next. Display slide N and remind students that while we have been considering the questions, "How do flying squirrels use their parts to meet their needs?" and "How do other living things use their parts to meet their needs?" throughout this lesson, we have had a lot of wonderings. Point out that we have organized many of these questions on our DQB and even have ideas for how to investigate some of the questions. Tell students that there are so many places we could start, but it seems like a lot of us are really curious about how these squirrels are able to fly! We can start figuring this out in our next lesson." (Lesson 2, Teacher Guide)
- Lesson 3, Navigate, Step 1: "Motivate the need to look closer at the flying squirrel. Return to the Ideas for Investigation chart and point out ideas students had for investigations that relate to looking at videos and/or photos of the flying squirrel. If students did not specifically pose these ideas, then ask students how we might find out more about how the flying squirrel moves through the air. Look for students to suggest we observe them or watch videos of them." (Lesson 3, Teacher Guide)
- Lesson 4, Navigate, Step 6, "Brainstorm ideas. Display slide M and invite students to turn and talk with a partner about what new questions they have about flying squirrels' systems and their functions. If needed, consider prompting the students by asking something like, "Why might flying squirrels need to glide through the trees in the first place?" After students brainstorm with a partner, invite pairs to share out to the class. All ideas are valid for now. Tell students that we will return to these ideas in the next lesson." (Lesson 4, Teacher Guide) The materials do not refer back to the Driving Question Board (DQB) at this point.
- Lesson 5, Navigate, Step 5, "Consider saying something like, 'It sounds like both kinds of squirrels have similarities and differences in their system of structures that are really helpful for them to perform the tasks that they need to in order to find food, build shelter, and avoid predators." Point to the picture on the slide and ask students if they notice anything else that's different between the pictures of the two kinds of squirrels. If they do not point it out themselves, say something like, "However, I can't help but notice all of the pictures we've seen of flying squirrels have been taken at night and the pictures of tree squirrels have been taken during the day." Ask if anyone else has noticed that. Ask students to turn and talk quickly about how they think flying squirrels are able to glide around at night when it's so dark." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate, Step 1: "Facilitate a class discussion about what we figured out in the last lesson. Display slide A and remind students that we have been figuring out so much about flying squirrels. Refer back to our initial consensus model that we started in Lesson 1 and revised in Lesson 4. Facilitate a discussion about what we figured out about flying squirrels in the last lesson and what we were left wondering about." (Lesson 6, Teacher Guide) The teacher guide does not include guidance to reference the DQB questions on "seeing" during this section of the lesson.
- Lesson 6, Navigate, Step 7, "Discuss where to go next. Display slide P. Say something like "Since light needs to be shining on an object in order for it to be seen, how can flying squirrel eyes see their food at night when there is not very much light? Ideas to listen and look for: Maybe they have special eyes that help them see better than us. I am thinking that they can't really see them, there are just way less predators out at night when it is dark. I have heard that some animals have special vision that allows them to see in the dark, maybe they have that. Tells students that it sounds like we still have questions about how the flying squirrels are able to see their predators in the dark. We will need to continue to investigate those wonderings in our next lesson." (Lesson 6, Teacher Guide) The teacher guide does not include guidance to reference the DQB questions on "seeing" during this section of the lesson.

- Lesson 7, Navigate, Step 8: "Point out that it sounds like we are not sure if all animals that meet their needs in the dark rely only on eye structures to get around or if they have other ways to meet their needs. Invite students to talk to a friend or family member about any animals they know about that meet their needs in the dark and how they do it and suggest that we should continue to investigate this next time." (Lesson 7, Teacher Guide)
- Lesson 9, Navigate, Step 7: "Discuss where to go next. Invite students to connect the ideas we have been figuring out about sense receptors back to the flying squirrel. Display slide Q and point out that we have been figuring out about how ground squirrels and other animals use their sense receptors to make sense of their environments, but we have not considered how flying squirrels use their receptors. Ask students to consider if flying squirrels need to use senses other than their vision in order to make sense of their environment in the dark." (Lesson 9, Teacher Guide)
- Lesson 10, Navigate, Step 6: "Revisit the Driving Question Board to decide where to go next. Display slide K. Celebrate with students that we have figured out that animals have internal and external structures that work together as a system to help them perform the functions they need. Refer to the Driving Question Board and point out any questions about plants. Ask students if they think that plants also have special structures to help perform functions that meet their needs. Accept all ideas and elevate any uncertainties about what those structures might be or how they might work together as a system in a plant. Accept all student suggestions and add new questions to the DQB." (Lesson 10, Teacher Guide)
- Lesson 11, Navigate, Step 1:"Point out that it sounds like we are not really sure what structures plants have to help them to survive and grow, and how they use those structures to survive and grow since they stay in one place. Take a few minutes to revisit the DQB to surface any questions that students had about plants In Lesson 2 that have not yet been answered. Use this and the uncertainty surrounding the structures plants use to survive and grow to motivate a need to investigate plant structures." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate, Step 7, "Consider where to go next. Display slide Q and have students share what they notice and wonder about the image. Use the sample prompts below to support students in figuring out what to investigate in the next lesson...Add new questions to the Driving Question Board and close the lesson by suggesting we carry out some of these investigations during our next science class." (Lesson 12, Teacher Guide)

ii. Providing strategies for ensuring student sense-making and/or problem-solving is linked to learning in all three dimensions.

- Lesson 1, Synthesize, Step 5: "Organize students into pairs and ask students to choose one question that they would like to develop the model for and distribute Initial Model. Make sure that at least one pair is working on each of the questions. Remind students that the models that we are developing explain one of the questions that we are wondering about." (Lesson 1, Teacher Guide)
- Lesson 2, Navigate, Step 6: "Consider where to go next. Display slide N and remind students that while we have been considering the questions, "How do flying squirrels use their parts to meet their needs?" and "How do other living things use their parts to meet their needs?" throughout this lesson, we have had a lot of wonderings. Point out that we have organized many of these questions on our DQB and even have ideas for how to investigate some of the questions. Tell students that there are so many places we could start, but it seems like a lot of us are really curious about how these squirrels are able to fly! We can start figuring this out in our next lesson." (Lesson 2, Teacher Guide)
- Lesson 3, Synthesize, Step 6, Engaging in Argument From Evidence Sidebar, "Students who have experienced Unit 4.2 have had an opportunity to practice engaging in argument from evidence, and this unit provides multiple supports and opportunities for students as they develop this practice. This practice was also intentionally developed in Units 3.2 and 3.4, so students may have experiences from those units to connect with and build on." (Lesson 3, Teacher Guide)

- Lesson 4, Navigate, Step 1: "Discuss where we left off. Display slide A and facilitate a discussion about what we figured out about flying squirrels in our last lesson, and how they move through the air by gliding (not flying). Re-model the phenomenon we figured out last class, by using the glider from L2. Release the glider by aiming toward a wall so that it crashes or falls to the ground. Invite students to share their observations about why it could not stick to the wall, and what parts or structures it might need to help it land safely." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate, Step 8: "Consider saying something like, "It sounds like both kinds of squirrels have similarities and differences in their system of structures that are really helpful for them to perform the tasks that they need to in order to find food, build shelter, and avoid predators." Point to the picture on the slide and ask students if they notice anything else that's different between the pictures of the two kinds of squirrels. If they do not point it out themselves, say something like, "However, I can't help but notice all of the pictures we've seen of flying squirrels have been taken at night and the pictures of tree squirrels have been taken during the day." Ask if anyone else has noticed that. Ask students to turn and talk quickly about how they think flying squirrels are able to glide around at night when it's so dark." (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize 5, Cause and Effect Sidebar: "Cause and Effect is intentionally developed in each of the other 4th grade units, so students have multiple opportunities across the year to use this crosscutting concept in a variety of contexts different from life science of this unit (e.g. Earth processes, energy transfer) (Lesson 6, Teacher Guide)
- Lesson 7, Navigate, Step 8: "Ask questions about other animals to motivate where to go next. Display slide DD and point out that today we figured out that flying squirrels and moths have eye structures that help them see in the dark. Ask them to consider if this means that all animals that meet their needs in the dark have large or special eye structures." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "An important element of this practice is to respectfully provide and receive critiques from peers by citing relevant evidence and posing specific questions. Students will have another formal opportunity to give and receive peer feedback in Lesson 13." (Lesson 9, Teacher Guide)
- Lesson 10, Navigate, Step 1: "Navigate to today's work. Summarize that we wanted to investigate whether flying squirrels use more of these senses, too (other than only sight). Use our uncertainties around the questions and ideas students propose to move into investigating more about the connection between the sense receptors and memory of flying squirrels, and tell students you have a resource that can offer us some more information about that." (lesson 10, Teacher Guide)
- Lesson 12, Synthesize, Step 6, Engaging in Argument From Evidence Sidebar, "Students will have a final individual opportunity to construct an argument and support it with evidence (in the form of a model) in Lesson 13." (Lesson 12, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure that "[f]requent guidance or tools are provided to teachers to support linking student engagement across lessons. For example, guidance may be provided to: … support navigation routines that help make the connections between lessons explicit to students" [Detailed Guidance, p. 30]
  - For example, in Lessons 4 and 5, when students are navigating to new ideas, ensure they are prompted to return to the Driving Question Board to physically check off questions they have answered and add new layers to the "umbrella" question. This helps students see how the "smaller phenomenon" of bat landing gear builds toward the "broader topic" of how systems of parts function together for survival.

– There are missed opportunities to leverage tools, like the Driving Question Board, to support navigation routines that make the connections between lessons explicit to students. In Lessons 6 and 11, instead of the teacher "telling" students that they need to explore light or plant structures, consider using the Driving Question Board (DQB) to identify specific student questions that haven't been answered yet.

II.G. Scaffolded differentiation over time

EXTENSIVE

Provides supports to help students engage in the practices as needed and gradually adjusts supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems.

The reviewers found **extensive** evidence that supports are provided to help students engage in the practices as needed and for teachers to gradually adjust supports over time so that students are increasingly responsible for making sense of phenomena and/or designing solutions to problems for all the intentionally developed SEP elements. Scaffolding is gradually reduced over time to support the use of the SEP elements, which are stated as targeted learning objectives, enabling students to become more independent in their use of the SEP elements over the course of the learning experience.

MOD: Developing and Using Models

Claimed Element: **MOD E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**

Claimed in Lessons 7, 8, 9, 10, and 11.

- Lesson 7, Synthesize, Step 3, "Tell students that it sounds like we have some ideas about what to revise on this model. Display slide H and the chart paper labeled "How does the amount of light shining on an object impact how much we can see?" and invite students to work together as a class to develop a model that explains how the amount of light impacts what we can see. Encourage students to use the "Do squirrels need light to see their food?" model from the last lesson as a reference, as having a concrete example of how to represent light on paper can help make the task of modeling more complex ideas about light and visibility more accessible." (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize, Step 5, "Lead a Building Understanding Discussion to revise the model for smelling. Display slide I and lead a discussion to revise the model to include smell receptors and functions. An example revised model can be seen below." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)
- Lesson 10, Explore, Step 2, "Develop a model to explain the Choosing Food card. Suggest that we build a model similar to the Model for Smelling the World. Ask students to give you a thumbs up or a thumbs down to show agreement. Display slide D. Pass out 1 copy of the Video Observations handout to each student. Direct students to the space for recording the Choosing Food model. Ask partners to work together to model the information on the Choosing Food

card. Make sure to have the Model for Smelling the World displayed so students can reference it while they work. Let students know that each partner should record the model on their own handout." (Lesson 10, Teacher Guide)

- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide) In this lesson, the modeling is done collaboratively as a class again as students work together to model the plant structures together in this lesson at the beginning of a new lesson set focused on expanding sensemaking from animals to plants.

Claimed Element: **MOD E4: Develop and/or use models to describe and/or predict phenomena.**

Claimed in Lessons 1, 2, 6, 10, and 13

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize, Step 2, "Begin the initial consensus model. Display slide C. Title a piece of chart paper or a shared digital space with the question we're trying to explain: "How do flying squirrels use their parts to meet their needs?" Include the outline of a flying squirrel body on the chart as well, found on the Flying Squirrel Illustration reference." (Lesson 2, Teacher Guide)
- Lesson 6, Connect, Step 6: "We are all going to have a chance to develop models of a time when we were first not able to see something because there was no light and then being able to see it because a source of light became available. Distribute Our Experiences with Reflected Light and display slide L. Encourage students to use the model we created as a class as a guide for creating their model. Give students time to complete their models." (Lesson 6, Teacher Guide)
- Lesson 10, Explore, Step 2, "Develop a model to explain the Choosing Food card. Suggest that we build a model similar to the Model for Smelling the World. Ask students to give you a thumbs up or a thumbs down to show agreement. Display slide D. Pass out 1 copy of the Video Observations handout to each student. Direct students to the space for recording the Choosing Food model. Ask partners to work together to model the information on the Choosing Food card. Make sure to have the Model for Smelling the World displayed so students can reference it while they work. Let students know that each partner should record the model on their own handout." (Lesson 10, Teacher Guide)
- Lesson 13, Synthesize, Step 4, "This is an opportunity to assess Learning Goal 13 with the purpose of determining how well students can apply their ideas to construct an argument supported by a model about flower structures' functions in reproduction." (Lesson 13, Teacher Guide)

ARG: Engaging in Argument from Evidence

Claimed Element: **ARG E3: Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions.**

Claimed in Lessons 9 and 13.

- Lesson 9, Synthesize, Step 6, "Share our models with another pair. Display slide O and group students with a pair who developed a model for the other sense receptor. Encourage students to take turns reading and explaining their model to the other pair. Invite the other pair to respectfully listen and provide supportive feedback using the prompts on

slide O. Remind students that helpful feedback should focus on science ideas in the model, include celebrations and questions, and be kind, specific, and aimed at helping their classmates strengthen their thinking. When both pairs have had time to share their models with each other, give students time to revise their models based on the feedback if they gained new ideas or clarifications from the discussion."

- Lesson 13, Synthesize, Step 5, "Give and receive feedback. After students have completed their Flower Pollination Model assessment, display slide H and distribute the Peer Feedback handout. Pair students to give and receive feedback about their arguments supported by models." (Lesson 13, Teacher Guide)

Claimed Element: **ARG E4: Construct and/or support an argument with evidence, data, and/or a model.**

Claimed in Lessons 3, 4, 5, 12, and 13.

- Lesson 3, Synthesize, Step 6: "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book. Help students to make the connection that these observations can serve as evidence to support our arguments. Give students time to complete the handout. When students are ready, invite them to bring the Does the flying squirrel actually fly? handout and form a Scientists Circle." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system). Give students time to construct and revise their arguments with their partners." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Step 5, "Summative assessment: Students' work on the Arguments About Tree Squirrel System of Body Structures assessment and the surrounding discussions provide an opportunity to gather evidence about Learning Goal 4, with the purpose of providing feedback to students and guiding instruction in upcoming lessons." (Lesson 5, Teacher Guide)
- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

CATEGORY III

Monitoring NGSS Student Progress

III.A. Monitoring 3D Student Performance

EXTENSIVE

Elicits direct, observable evidence of three-dimensional learning; students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions.

The reviewers found **extensive** evidence that materials elicit direct, observable evidence of three-dimensional learning and that students are using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions. Teachers are prompted to assess student performance using individual formative assessments in Lessons 4, 7, 9, and 12, while they provide students with summative assessments in Lessons 5, 10, and 13. The inclusion of the "Lesson 6 Assessment Tool: Following Student Sensemaking" provides a robust system for teachers to document individual progress toward PEs 4-LS1-2, 4-PS4-2, and 4-LS1-1 by tracking specific indicators like "using arrows to show relationships" or "gesturing to indicate information flow" throughout lessons 6-10.

Formal tasks in the materials are driven by well-crafted phenomena- and problem-based scenarios that can elicit rich student performances.

The unit materials identify the formative assessments in Lessons 4, 7, 9, and 12 as key assessments and identify three summative assessments in Lessons 5, 10, and 13. In Lesson 5, students construct an argument about how tree squirrels use their system of structures to grow, survive, and build a shelter. In Lesson 10, students are asked to develop a model to explain how flying squirrels use their many sense receptors to take care of their babies in the dark. In Lesson 13, students are asked to explain how a flower's structures work together to get pollen moved by a hummingbird so the plant can reproduce

- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system)." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Step 7: "Pass out the Arguments About Tree Squirrel System of Body Structures assessment. Give students a few moments to silently read over this task and ask them to think about what it's asking them to do. Let students know that they are going to identify 2 different tree squirrel structures and explain how they work together as a system to help the tree squirrel grow, survive, or have shelter. Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize, Step 6, "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and

the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)

- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)
- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

Student performances produce artifacts of integrating the three dimensions in service of sense-making or problem-solving.

- Lesson 3, Synthesize, Step 6, "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book." (Lesson 3, Teacher Guide) **SF-E2: Substructures have shapes and parts that serve functions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**
- Lesson 5, Synthesize, Step 7: "Pass out the Argument About Tree Squirrel System of Body Structures assessment. Give students a few minutes to silently read over this task and ask them to think about what it's asking them to do. Let students know that they are going to identify 2 different tree squirrel structures and explain how they work together as a system to help the tree squirrel grow, survive, or have shelter." (Lesson 5, Teacher Guide) **SYS-E1: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.** Lesson 6, Connect, Step 6, "Distribute Our Experiences with Reflected Light and display slide L. Encourage students to use the model we created as a class as a guide for creating their model. Give students time to complete their models." (Lesson 6, Teacher Guide) **CE-E1: Cause and effect relationships are routinely identified, tested, and used to explain change. PS4.B-E1:An object can be seen when light reflected from its surface enters the eyes. MOD-E4: Develop and/or use models to describe and/or predict phenomena.**
- Lesson 7, Synthesize, Step 6, "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference." (Lesson 7, Teacher Guide) **CE-E1:**

Cause and effect relationships are routinely identified, tested, and used to explain change. PS4.B-E1:An object can be seen when light reflected from its surface enters the eyes. MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.

- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide) **SYS-E2 A system can be described in terms of its components and their interactions. LS1.D-E1: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. MOD-E2: Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.**
- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide) **SYS-E2 A system can be described in terms of its components and their interactions. LS1.A-E1: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.**

Students routinely produce artifacts with evidence of using the grade-appropriate elements of SEPs, CCCs, and DCIs that are targeted as learning objectives

Lesson 1 Learning Target **Develop a model to describe** how a flying squirrel's **structures work together** to **meet its needs.**

- Lesson 1, Synthesize, Step 5, "Develop initial models to explain how flying squirrels' parts work in order to meet their needs. Remind students that we are pretty sure that flying squirrels are using their eyes, brains, and wings to meet their needs, but we are not exactly sure how they work. Display slide T and let students know that we are going to be working with a partner to develop a model that explains the answer to one of the questions about flying squirrel parts that has emerged." (Lesson 1, Teacher Guide)

Lesson 2 Learning Target **Develop a model to describe** how an animal and/or plant's **structures work together** to **meet its needs.**

- Lesson 2, Explore, Step 4, "Read and model in pairs. Distribute 1 infographic card and the coordinating page from the Other Living Things Needs Model handout to each pair, and give pairs time to read and develop their models. Be sure at least one pair develops a model for each organism." (Lesson 2, Teacher Guide)

Lesson 4 Learning Target **Construct an argument** about how **different animals' internal and external structures function together as a system to carry out the function of landing safely on trees in order to support their survival.**

- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the

sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system)." (Lesson 4, Teacher Guide)

Lesson 5 Learning Target **Construct an argument from evidence** that **tree squirrels can also meet their needs for survival, growth, and reproduction in the trees with the system of structures they have**.

- Lesson 5, Synthesize, Step 7, "Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide)

Lesson 8 Learning Target **Develop and revise a model to describe how receptors are part of a larger system that allow living things to sense the world around them**

- Lesson 8, Synthesize, Step 5, "Lead a Building Understanding Discussion to revise the model for smelling. Display slide I and lead a discussion to revise the model to include smell receptors and functions. An example revised model can be seen below." (Lesson 8, Teacher Guide)

Lesson 10 Learning Target **Develop a model to describe** how flying squirrels use their **system of sense receptors to perform behaviors that aid in reproduction**.

- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)

Lesson 11 Learning Target **Develop a model to describe** that **plants have structures that function** to **support survival and growth**.

- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)

Lesson 13 Learning Target **Construct an argument supported by evidence in the form of a model that flowers have internal and external structures (a system of interacting components) that function to support reproduction.**

- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement:

- Ensure that, "Student artifacts that require grade-appropriate elements of all three dimensions to be used together are used frequently, including to evaluate targeted learning objectives. Many of these artifacts may be from group activities if there is evidence that the teacher has recorded evidence from individual students (e.g., through video or notes)" Detailed Guidance, 35
  - While the materials offer high-quality "If you notice…/Possible Next Steps" guidance for these lessons, consider further strengthening support for teachers to capture or document individual student understanding from collaborative products to ensure every student is meeting the targeted 3D elements.

III.B. Formative

EXTENSIVE

Embeds formative assessment processes throughout that evaluate student learning to inform instruction.

The reviewers found **extensive** evidence that the materials embed formative assessment as a frequent and varied process to monitor student progress and inform instruction. Explicit assessment guidance is provided across multiple lessons (e.g., Lessons 3, 4, 6, 8, and 11), featuring 3D learning goals and specific criteria for interpreting student models and verbal explanations. Notably, the materials address the 'what do I do next?' requirement by providing specific instructional scaffolds, such as using physical string models for light reflection or utilizing word walls, tailored to different levels of student proficiency. Furthermore, the assessment process routinely attends to equity by offering multimodal ways for students to demonstrate understanding, including sketching, gesturing, and the responding in any language, ensuring that the assessment system is accessible to all learners.

Materials include explicit, frequent, and varied supports for formative assessment processes.

Formative assessment opportunities are highlighted for each lesson, with connections to all three dimensions indicated in separate colors. These include a "How can I use the information I gather from this assessment?" section in the assessment instructions at the beginning of each lesson, often in a clear if-then format. For example,

- Lesson 6, Teacher Guide Lesson Assessment Guidance: "Use the Following Student Sensemaking (Lesson 6-10) tool to track evidence of student growth in understanding of key science ideas and practices. In the next lesson, students will build on this idea by thinking about the structures of eyes that allow for seeing with different amounts of light. If students need more support in grasping the idea that light reflects off of objects, consider making physical models of light reflecting by using string to represent the light traveling from its source, to an object, to an eye." (Lesson 6, Teacher Guide)
- Lesson 11, Teacher Guide Lesson Assessment Guidance: "As you look and listen for students' ideas, notice how they describe how the structures of a lima bean plant work together to bring water throughout the plant. Students should be at a secure understanding that both the roots and the xylem are needed in order to pull water into the plant and carry it throughout the plant. When needed, probe students for more accurate observations and for evidence supporting their ideas about how the structures carry water throughout the plant. Use the Following Student Sensemaking (Lessons 11-13) tool to track evidence of student growth in understanding of key science ideas and practices. In Lessons 12 and 13, students will have an opportunity to work in pairs and then independently to develop models that describe how plant structures work together to support survival, growth and reproduction." (Lesson 11, Teacher Guide)

Key formative assessments are labeled separately from other formative assessment opportunities, and include more specific support in the Assessment Overview document, as well as more support in the Teacher Guide for that lesson. For example:

- Lesson 4, Synthesize, Step 5, Assessment Opportunity callout box: "Key formative assessment: Students' Construct an argument explanations and the surrounding discussions provide an opportunity to gather evidence about Learning Goal 3, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Refer to the Instructional Guidance for Lesson 4 tool and the Assessment Guidance at the beginning of the lesson. Encourage students to use their flying squirrel (glider) models and sketches on Flying Squirrel Landing Investigation to support their thinking while writing their arguments." (Lesson 4, Teacher Guide)
- Lesson 9, Synthesize, Step 6, Assessment Opportunity callout box: "Key formative assessment: Students' Taste or Hearing Receptors Model models and the surrounding discussions provide an opportunity to gather evidence about Learning Goal 9), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Refer to the Instructional Guidance for Taste or Hearing Receptors Model tool and the Assessment Guidance at the beginning of the lesson." (Lesson 9, Teacher Guide)
- Lesson 12, Synthesize, Step 6, Assessment Opportunity callout box: "Key Formative and self-reflection assessment: Students' individual work on the Plant Structures Claim handout provides an opportunity to gather evidence about Learning Goal 12, with the purpose of providing feedback and supporting students in supporting claims about the functions of certain structures. Refer to the Instructional Guidance for Lesson 12 tool and the Assessment Guidance at the beginning of the lesson. Students' use of the Self Reflection assessment provides an opportunity for them to reflect on how they are doing with supporting claims with evidence. Use the information from both artifacts to determine how much support students will need before taking the summative assessment in the next lesson." (Lesson 12, Teacher Guide)

Formative assessment processes routinely provide varied support for student thinking across all three dimensions.

Each formative assessment includes a three-dimensional learning goal, what the teacher can look for in student responses, and ideas on how to use the assessment information.

- Lesson 8, Lesson Assessment Guidance
  - **Three-Dimensional Learning Goal: Develop and revise a model to describe how receptors are part of a larger system that allow living things to sense the world around them.**
  - **Where to Check for Understanding:** During the Building Understandings Discussion in the Synthesize (slide I)
  - **What to look and listen for:** Students drawing, writing, verbally explaining, acting out, and/or gesturing about **models describing:**
  - **Eyes have receptors** that **receive reflected light**.
  - **Noses or tongues or other parts can have receptors** that **receive different smells or tastes**.
  - **Arrows and labels show the relationship between information, receptors, and functions**.
  - **Receptors pass information to the brain** that **helps animals to make decisions**.
  - **How can I use this assessment information?**: Use the information you gather in two ways: (1) to guide follow-up questions during the discussion in the Synthesize and as the class works to revise the The Model for How Senses Help Animals, and/or (2) to reinforce 4th-grade concepts. If you notice that students need additional support in understanding that receptors are part of a system that helps animals to gather and make

sense of information then return to the book and re-read pages 1-3. If students need support around making connections between receptors, memory, and decisions then return to the results from the Smell Investigation and support students in making the connection between what they thought the smell was and if they thought it was food. Use the Following Student Sensemaking (Lessons 6-10) tool to track evidence of student growth in understanding of key science ideas and practices. (Lesson 8, Teacher Guide)

Formative assessment processes routinely attend to multiple aspects of student equity.

- Lesson 1, Explore, Step 4, Broadening Access callout box: "The goal of these Flying Squirrel Challenges is not for students to fully complete each task, but rather to notice what our human bodies can and cannot do compared to flying squirrels. For students with mobility or fine-motor impairments, provide accessible ways to engage that still highlight these differences. Examples are described in the Preparing for the Flying Squirrel Challenges." (Lesson 1, Teacher Guide)
- Lesson 3, Synthesize, Step 6, "Before students write, consider briefly revisiting a key piece of evidence using a picture or a short video clip. Use gestures, simple language, and quick sentence starters to support recall. Invite students to talk with a partner in any language to rehearse their claim and which evidence supports it before the whole group. As needed, provide a small word bank and let students point to images if speaking or writing is hard. As students complete the handout, allow multiple ways to show thinking—circling, sketching, using labels, or giving a brief oral explanation—to help all learners, especially multilingual learners, express their ideas clearly." (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5, "Give students time to construct and revise their arguments with their partners. Remind students that they can use resources around the classroom—like the Bat Structures chart and their earlier flying squirrel sketches Construct an argument to help them get ideas for their arguments. Encourage students to refer back to these visual models as evidence, using them to explain how different body parts interact as a system. These shared representations can serve as scaffolds for organizing thinking and language, supporting students as they connect observations across investigations to construct well-supported claims. As students are writing their arguments, consider circulating the room and asking the following questions: What did you see happen when you added each part? How did one part help another part do its job? How does this help the animal land safely? As students are writing their arguments, consider also circulating and formatively assessing students in multimodal ways. For example, in addition to students writing their ideas with these sentence-stems, the teacher can have students handle or manipulate the model gliders to express their ideas and complement their writing. This can pair writing with gesture or demonstration and doesn't rely on one source of data to assess student thinking. (Lesson 4, Teacher Guide)
- Lesson 9, Synthesize, Step 6, "challenging to turn the written information about sense receptors into visual models. If you notice this barrier where students may need more support in developing their models, consider reading about and co-modeling one of the sense receptors as a class and then having students read about and model the other in pairs. Additionally you can provide model stems: "sound enters…", "the receptor sends…". If you notice that students may need less support in developing their models, consider having them develop their sense receptor model independently." (Lesson 9, Teacher Guide)
- Lesson 11, Explore, Step 5, Broadening Access callout box: "Honor multiple perspectives regarding dissections to minimize distractions to learning. Before beginning the dissection, frame the activity by acknowledging the lima bean or celery plant as a living teacher, expressing gratitude for what it provides, and inviting students to approach the plant with care and respect—honoring multiple perspectives, including those who view plants as relatives rather than objects to be cut. Offer multiple ways to engage with the plant, such as observing, drawing, or using magnifying tools, so all students can participate meaningfully regardless of comfort with cutting or handling the plant directly." (Lesson 11, Teacher Guide)

- Lesson 12, Lesson 12 Assessment Tool, "If you notice...Students are struggling with which evidence best supports the claim, or how to explain why they selected that evidence. (Part 2 and 3) Possible Next Steps: If this applies to one or a few students in your class: It may be helpful to have a student return to the claim that they selected and explain how the structures that are highlighted in the claim are seen in the evidence selected. Invite students to return to the observations they made on Lima Bean Observations, Celery Plant Investigation, and Lima Bean Stages Cards and encourage them to match the structures they see to the claim they have selected to work with. Prompt them to describe what makes them think the evidence they have chosen best supports the claim." (Lesson 12, Lesson 12 Assessment Tool)

Criterion-Based Suggestions for Improvement: N/A

III.C. Scoring Guidance

EXTENSIVE

Includes aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.

The reviewers found **extensive** evidence that the materials consistently provide teachers with specific guidance for interpreting student performance across all three dimensions of the NGSS. The "Lesson Assessment Guidance" sections explicitly define the three-dimensional learning goals (e.g., Lesson 7's focus on modeling the relationship between eye structure and light reflection), while the "What to look and listen for" sections offer concrete indicators of student proficiency in science practices, crosscutting concepts, and disciplinary core ideas. Furthermore, the materials include robust "Instructional Guidance" and "Assessment Tools" that provide actionable next steps based on varying levels of student understanding. By including specific prompts to address student misconceptions, such as using physical string models for light reflection or small-group modeling for information flow, the materials ensure that scoring guidance is not merely evaluative but serves as a functional tool for modifying instruction to support student progress toward the targeted DCI, SEP, and CCC.

Every lesson has a "Lesson Assessment Guidance" and "Assessment Opportunity" section that provides teachers with the three-dimensional learning goal and what to look for and listen to from students for the lesson. For example,

- Lesson 5, Lesson Assessment Guidance: **Construct an argument from evidence** that **tree squirrels can also meet their needs for survival, growth, and reproduction in the trees with the system of structures they have**.
- **Where to check for understanding:** In **Synthesize** when students are constructing their arguments on the Arguments About Tree Squirrel System of Body Structures handout. (**slide R**)
- **What to look and listen for:** Students drawing, writing, verbally explaining, acting out, and/or gesturing about their **arguments for**
  - **The systems of structures that tree squirrels have**
  - **How this system of structures allows tree squirrels to perform functions that they need to in order to survive and grow.**
  - The Lesson 5 Teacher Assessment Tool Teacher Rubric for Arguments About Tree Squirrel System of Body Structures, contains a color-coded, three-dimensional rubric for teachers to assess students' understanding during this individual performance assessment. Each element used in this assessment is identified in the NGSS Reference Table, and guidance on interpreting students' progress is included. There are row labels

(learning targets) and column labels (Beginning, Developing, Secure) that contain detailed descriptions of what the students should include for different questions on the assessment.

  - Suggestions for feedback are found in the Lesson Assessment Guidance section of the Teacher Guides for each lesson. This includes feedback for summative assessments, as seen in Lesson 5, Lesson Assessment Guidance: "This is a summative opportunity where you will take stock of students' progressing sensemaking, along with the evidence you have gathered using the Following Student Sensemaking (Lessons 3-5) tool to provide a more complete picture of student progress. Use the ideas from the arguments they constructed on the Arguments About Tree Squirrel System of Body Structures to determine if students would benefit from small group discussions or revisiting how squirrels use their system of body structures and circulate to support and assess their current thinking and use of arguing from evidence. See the Teacher Assessment Tool Teacher Rubric for Arguments About Tree Squirrel System of Body Structures tool for instructional guidance suggestions based on students' current sensemaking.." (Lesson 5, Teacher Guide)

- Lesson 7, Lesson Assessment Guidance: **Develop a model that explains** how a flying squirrel's **larger eyes cause more light to enter their eye, helping them to see with less light (effect).** (Lesson 7, Teacher Guide)
- **Where to check for understanding:** On the Modeling Flying Squirrel Sight handout in the **Synthesize** (**slide Y**).
- **What to look and listen for:** Students drawing, writing, verbally explaining, acting out, and/or gesturing about **models that explain how**
  - **light shines onto an object**
  - the **light reflects off of the object and into the eye**
  - large **eye openings allow all of the small amount of light into the eye, causing the object to be seen clearly**

Support for planning instruction

- Lesson 2, Lesson Assessment Guidance, "This is a pre-assessment opportunity; do not take a grade or score. Use this information to build upon students' initial ideas in upcoming lessons about how animals' structures (including brains and eyes and other sense receptors) and plants' structures (such as flowers and roots) function as a system to help them survive, grow, and reproduce. Use the initial consensus model as a collective record of student ideas. The ideas students raise can be used later to connect to concepts ideas students will build understandings around in later lessons." (Lesson 2, Teacher Guide)
- Lesson 4 includes a document called Instructional Guidance for Lesson 4. This document has a chart showing what the teacher may notice about what students are doing and then instructional strategies for addressing student ideas. "If you notice students are naming individual structures (e.g., wings, claws) but not describing how they work together as a system. If this applies to students in your class: Have students revisit their investigation notes and physically gesture or use their glider models to show how one part helps another (e.g., "the tail slows it so the claws can grab"). Encourage them to add arrows or connecting words ("helps," "so that") in their argument. If you notice students are showing a secure understanding of how multiple structures function together as a system to support the animal landing safely. If this applies to a few students in your class: Challenge them to extend their reasoning by comparing how the same functions (slowing down, grabbing) are achieved with different structures in bats versus flying squirrels. If this applies to most or all of your class: Consider shortening the Synthesize [1] and Synthesize [2] in Lesson 5." (Lesson 4, Instructional Guidance for Lesson 4)
- Lesson 6, Lesson Assessment Guidance, "This is a formative assessment opportunity where you can take note of how students are progressing in their understanding of the role that light has in sight. This is the first lesson that students are beginning to make sense of this process. In this lesson, students should grasp the concept that light needs to

reflect off of an object and into eyes in order for the object to be seen. Use the Following Student Sensemaking (Lessons 6-10) tool to track evidence of student growth in understanding of key science ideas and practices. In the next lesson, students will build on this idea by thinking about the structures of eyes that allow for seeing with different amounts of light. If students need more support in grasping the idea that light reflects off of objects, consider making physical models of light reflecting by using string to represent the light traveling from its source, to an object, to an eye." (Lesson 6, Teacher Guide)

- Lesson 7 includes a document called Instructional Guidance for Modeling LIght. "If you notice students are not yet representing the direction the light is traveling or how much light is traveling in their model. If this applies to a few students in your class: In a small group, gather an object and yellow yarn. Work together to physically model light shining onto the object and then into an eye. As you do this ask students prompting questions like: Where would the light go next? How could we represent that on paper? Once light is shining onto the object, how does it enter an eye? How could we represent that on paper? In Lesson 10, when students are revising and adding to the initial consensus model, refer back to the light models from lesson 6 and Lesson 7 to confirm and apply the idea of larger eyes letting in more light, allowing more to be seen. If this applies to most or all of your class: Consider returning to the "How does the amount of light shining on an object impact how much we can see?" model and using yellow yarn to think and talk through the direction light travels and the amount of light that is shining on an object at night." (Instructional Guidance for Modeling LIght)
- Lesson 9 includes a document called Instructional Guidance for Taste or Hearing Receptors Model. "If you notice students are demonstrating a secure understanding of how to represent the flow of information through the system. If this applies to a few students in your class: Invite students to work independently or with a partner to research an animal of their choice and model how one or more of their sense receptors helps them make sense of their world. If this applies to most or all of your class: Consider skipping the gallery tour in this lesson. In Lesson 10, consider bypassing the class demonstration of the "Choosing Food" situation card and having students work directly on using their set of Sense Situation cards to model how sense receptors and information from them help flying squirrels care for their babies. In Lesson 10, consider having students take the lead in updating the initial consensus model." (Lesson 9, Instructional Guidance for Taste or Hearing Receptors Model)
- Lesson 12 includes a document called Instructional Guidance for Lesson 12. " If you notice students are struggling with which evidence best supports the claim, or how to explain why they selected that evidence. (Part 2 and 3). If this applies to one or a few students in your class: It may be helpful to have a student return to the claim that they selected and explain how the structures that are highlighted in the claim are seen in the evidence selected. Invite students to return to the observations they made on Lima Bean Observations, Celery Plant Investigation, and Lima Bean Stages Cards and encourage them to match the structures they see to the claim they have selected to work with. Prompt them to describe what makes them think the evidence they have chosen best supports the claim." (Instructional Guidance for Lesson 12)

Support for ongoing feedback

The Lesson Assessment Guidance in each Teacher Guide offers suggestions on how to act on assessment information, and often includes individual feedback suggestions. For example:

- Lesson 2, Lesson Assessment Guidance, "This is a pre-assessment opportunity; do not take a grade or score. Use this information to build upon students' initial ideas in upcoming lessons about how animals' structures (including brains and eyes and other sense receptors) and plants' structures (such as flowers and roots) function as a system to help them survive, grow, and reproduce. Use the initial consensus model as a collective record of student ideas. The ideas students raise can be used later to connect to concepts ideas students will build understandings around in later lessons." (Lesson 2, Teacher Guide)

- Lesson 3, Lesson Assessment Guidance, "Use student responses on the Does the flying squirrel actually fly? handout to help you know how much you will need to review and scaffold student understanding of the connection between structure and function. In future lessons, students will have additional opportunities to figure out and apply the connections between these concepts. You can support student learning by continuing use of the word wall and encouraging students to use the science vocabulary in their conversations. Use the Following Student Sensemaking (Lessons 3-5) tool to track evidence of student growth in understanding of key science ideas and practices. You can give feedback to students by asking them to figure out, what body part allows the animal to do that, and what function that part does for the animal." (Lesson 3, Lesson Assessment Guidance)
- Lesson 4, Key Formative Instructional Guidance: This document provides teachers with support based on a range of possible student responses or levels of student proficiency. "If you notice: Students are naming individual structures (e.g., wings, claws) but not describing how they work together as a system. Possible Next Steps: If this applies to students in your class: Have students revisit their investigation notes and physically gesture or use their glider models to show how one part helps another (e.g., "the tail slows it so the claws can grab"). Encourage them to add arrows or connecting words ("helps," "so that") in their argument." (Lesson 4, Teacher Guide)
- Lesson 5 Rubric. The rubric includes an Assessment Statement, the SEP, CCC, and DCI being assessed, a general statement of the expected response and several examples of student work. Lesson 10 Assessment Tool. The scoring tool includes a learning goal, a NGSS reference table, three levels of student understanding, a listing of important ideas included or missing from the levels, and ideas for student feedback.
- Lesson 6, Lesson Assessment Guidance, "This is a formative assessment opportunity where you can take note of how students are progressing in their understanding of the role that light has in sight. This is the first lesson that students are beginning to make sense of this process. In this lesson, students should grasp the concept that light needs to reflect off of an object and into eyes in order for the object to be seen. Use the Following Student Sensemaking (Lessons 6-10) tool to track evidence of student growth in understanding of key science ideas and practices. In the next lesson, students will build on this idea by thinking about the structures of eyes that allow for seeing with different amounts of light. If students need more support in grasping the idea that light reflects off of objects, consider making physical models of light reflecting by using string to represent the light traveling from its source, to an object, to an eye." (Lesson 6, Teacher Guide)
- Lesson 9, Lesson 9 Assessment Tool, "If you notice Students are not representing the flow of information through the system. Possible Next Steps If this applies to a few students in your class: In a small group, gather an object that can make a sound. Ask students to listen to the sound and decide what the sound makes them want to do. For example, you could drop a book and the students could suggest picking it up. In the group, develop a model that represents the system the information would travel though in their body in order to lead them to make the decision that they did. As you do this ask students prompting questions like: What receptor did you use? What memory did the sound give you? Why did you make the decision that you did?" (Lesson 9, Teacher Guide)
- Lesson 11, Assessment Guidance: "Students should be at a secure understanding that both the roots and the xylem are needed in order to pull water into the plant and carry it throughout the plant. When needed, probe students for more accurate observations and for evidence supporting their ideas about how the structures carry water throughout the plant. Use the Following Student Sensemaking (Lessons 11-13) tool to track evidence of student growth in understanding of key science ideas and practices." (Lesson 11, Teacher Guide)
- Lesson 13 Assessment Tool. The scoring tool includes a learning goal, a NGSS reference table, three levels of student understanding, a listing of important ideas included or missing from the levels, and ideas for student feedback.

Criterion-Based Suggestions for Improvement: N/A

III.D. Unbiased Tasks/Items

EXTENSIVE

Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.

The reviewers found **extensive** evidence that the materials include unbiased tasks and items that support all students in demonstrating their proficiency. Across multiple lessons (e.g., Lessons 3, 4, 6, and 11), teacher guidance explicitly directs the use of "Broadening Access" strategies, such as providing sentence starters, allowing for home-language expression, and encouraging multimodal demonstrations through drawing, gesturing, and oral explanations. The unit does not include a summative assessment that provides students with a choice across multiple modalities.

Multiple modes of communication

Students are encouraged to show their understanding in a variety of ways. New vocabulary is introduced after students experience the science ideas. These words are then used to support the formative assessment within the lesson.

- In every lesson where academic language is encountered, there is guidance for the teacher on when to introduce the words and how to define them. These words are then used to support the formative assessment within the lesson.
  - Lesson 3, Lesson 3 Vocabulary: "Unit-Specific Science Ideas: These are words that students will use for sensemaking in this unit. We will continue using them throughout the unit, so post them on the Word Wall." "Science Practices and Concepts That Build over Time: These are words best learned as students engage with them over time. We will revisit them across units and grade levels." There is a table listing the steps in the lesson in which the word(s) are engaged. (Lesson 3, Teacher Guide)
- Lesson 3, Navigate, Step 8, Teaching Tip Sidebar, "The My Growing Ideas chart will be used multiple times throughout this unit. This is a space for students to write and/or draw what they have figured out in a lesson, and to see how their thinking changes over time. It is not intended to be graded. See the Teacher Handbook for more information. Have students keep this chart easily accessible so they can see how their ideas develop throughout the unit." (Lesson 3, Teacher Guide)
- Lesson 4, Lesson Assessment Guidance, "What to look and listen for: Students drawing, writing, verbally explaining, acting out, and/or gesturing about arguments for how flying squirrels' or bats' structures work together as a system to allow them to land safely." (Lesson 4, Teacher Guide)
- Lesson 4, Synthesize, Step 5: "As students are writing their arguments, consider also circulating and formatively assessing students in multimodal ways. For example, in addition to students writing their ideas with these sentence-stems, the teacher can have students handle or manipulate the model gliders to express their ideas and complement their writing. This can pair writing with gesture or demonstration and doesn't rely on one source of data to assess student thinking." (Lesson 4, Teacher Guide)
- Lesson 11, Synthesize, Step 7, Broadening Access Sidebar, "It is important that all students in your class feel that their contributions are valuable. There are many ways to notice and recognize students' ideas beyond asking to hear from each student in the class. For instance, you might share something you overheard while moving around the class, display a student's drawn observations, or shed light on the ways a student group engaged in the investigation." (Lesson 11, Teacher Guide)

Supports success for all students

The unit includes various ideas for supporting all students.

- Lesson 3, Synthesize, Step 6, Broadening Access Sidebar, "Before students write, consider briefly revisiting a key piece of evidence using a picture or a short video clip. Use gestures, simple language, and quick sentence starters to support recall. Invite students to talk with a partner in any language to rehearse their claim and which evidence supports it before the whole group. As needed, provide a small word bank and let students point to images if speaking or writing is hard. As students complete the handout, allow multiple ways to show thinking—circling, sketching, using labels, or giving a brief oral explanation—to help all learners, especially multilingual learners, express their ideas clearly." (Lesson 3, Teaching Guide)
- Lesson 5, Synthesize, Step 7: "Pass out the Arguments About Tree Squirrel System of Body Structures assessment. Give students a few moments to silently read over this task and ask them to think about what it's asking them to do. Let students know that they are going to identify 2 different tree squirrel structures and explain how they work together as a system to help the tree squirrel grow, survive, or have shelter. Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed.' (Lesson 5, Teacher Guide)
- Lesson 11, Explore, Step 4, Broadening Access Sidebar, "If time and resources allow, consider setting up the lima bean plants pictured in the slides for each small group so they can observe the plants directly. Hands-on access gives all learners an additional, concrete way to engage with the content and supports students who benefit from tactile, close-up exploration." (Lesson 11, Teacher Guide)

Multiple modalities and student choice

- Lesson 3, Synthesize, Step 6, Broadening Access Sidebar, "Before students write, consider briefly revisiting a key piece of evidence using a picture or a short video clip. Use gestures, simple language, and quick sentence starters to support recall. Invite students to talk with a partner in any language to rehearse their claim and which evidence supports it before the whole group. As needed, provide a small word bank and let students point to images if speaking or writing is hard. As students complete the handout, allow multiple ways to show thinking—circling, sketching, using labels, or giving a brief oral explanation—to help all learners, especially multilingual learners, express their ideas clearly." (Lesson 3, Teaching Guide)
- Lesson 4, Synthesize, Step 4, "As students are writing their arguments, consider also circulating and formatively assessing students in multimodal ways. For example, in addition to students writing their ideas with these sentence-stems, the teacher can have students handle or manipulate the model gliders to express their ideas and complement their writing. This can pair writing with gesture or demonstration and doesn't rely on one source of data to assess student thinking." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize, Step 7, "Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide) Students do not have a choice across modalities for this significant task.

- Lesson 6, Explore, Step 2, Broadening Access Sidebar, "Encouraging students to record their observations in a variety of ways gives students an opportunity to participate in the investigation and data collection using the mode that feels the most comfortable to them. Recording in multiple ways (e.g., words across languages, drawings, symbols) also supports students in capturing richer and more complete observations and can enhance scientific sensemaking. If time and materials allow, consider also offering an opportunity to record observations orally." (Lesson 6, Teacher Guide)
- Lesson 10, Synthesize Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide) Students do not have a choice across modalities for this significant task.
- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide) Students do not have a choice across modalities for this significant task.

Criterion-Based Suggestions for Improvement:

- Ensure that "[t]he materials include at least one significant task that provides students with a choice across multiple modalities." [Detailed Guidance, p. 43]
  - Consider including explicit prompts in the significant tasks found in Lessons 5, 10, and 13 that allow students to submit their final arguments as a narrated storyboard, a physical model demonstration, or a recorded oral explanation rather than just written text.

III.E. Coherent Assessment System

EXTENSIVE

Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.

The reviewers found **extensive** evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning. For example, the pre-assessments in Lessons 1 and 2 effectively establish a baseline for student understanding of how animal and plant structures function as a system. In contrast, the Lesson 10 summative task requires students to apply the Systems and System Models crosscutting concept to explain how sense receptors function in a new context. However, there are limited student self-assessment opportunities. While Lesson 12 includes a self-reflection on plant structures, there is no corresponding evidence of self-assessment for the animal-related topics covered in Lessons 1–10.

Matches three-dimensional learning objectives

Each lesson has a clearly identified Three-Dimensional Learning Goal that is explicitly aligned with the Lesson Assessment Guidance. For example:

Lesson 8, Lesson Assessment Guidance

- Three-Dimensional Learning Goal: **Develop and revise a model to describe how receptors are part of a larger system that allow living things to sense the world around them.**
- **Where to Check for Understanding:** During the Building Understandings Discussion in the Synthesize (slide I)
- **What to look and listen for:** Students drawing, writing, verbally explaining, acting out, and/or gesturing about **models describing:**
  - **Eyes have receptors** that **receive reflected light**.
  - **Noses or tongues or other parts can have receptors** that **receive different smells or tastes**.
  - **Arrows and labels show the relationship between information, receptors, and functions**.
  - **Receptors pass information to the brain** that **helps animals to make decisions**.
- **How can I use this assessment information?**: Use the information you gather in two ways: (1) to guide follow-up questions during the discussion in the Synthesize and as the class works to revise the The Model for How Senses Help Animals, and/or (2) to reinforce 4th-grade concepts. If you notice that students need additional support in understanding that receptors are part of a system that helps animals to gather and make sense of information then return to the book and re-read pages 1-3. If students need support around making connections between receptors, memory, and decisions then return to the results from the Smell Investigation and support students in making the connection between what they thought the smell was and if they thought it was food. Use the Following Student Sensemaking (Lessons 6-10) tool to track evidence of student growth in understanding of key science ideas and practices. (Lesson 8, Teacher Guide)

Pre-, formative, summative, and self-assessment

Pre-Assessment

- Lesson 1, Synthesize, Step 5, "Pre-assessment: When students develop initial models on the Initial Model handout, you have an assessment moment for Learning Goal 1 with the purpose of determining students' initial ideas about how squirrel parts work together to meet their needs, current use of the practice of modeling, and current understanding of systems as interacting components. Information from this preassessment can help you support students as needed in upcoming lessons. Accept all student ideas and refer to the Assessment Guidance at the beginning of the lesson." (Lesson 1, Teacher Guide)
- Lesson 2, Explore, Step 4, "Pre-assessment: When students develop models on the Other Living Things Needs Model handout, you have an assessment moment for Learning Goal 2 with the purpose of determining students initial ideas about how animal and/or plant parts work together to meet their needs, current use of the practice of modeling, and current understanding of systems as interacting components. Information from this preassessment can help you support students as needed in upcoming lessons. Accept all student ideas and refer to the Assessment Guidance at the beginning of the lesson." (Lesson 2, Teacher Guide)

Formative Assessment

At least one formative assessment is included in each lesson. (See III B for a specific analysis of formative assessment).

- Formative assessments occur ongoing in each lesson. Some of these formative assessments are identified as Key Formative assessments. See the formative assessment section IIB above for more information.

- Structure & Function Assessment System Overview: Ongoing Formative: As students engage in these lessons, there are multiple opportunities to gather formative evidence of students' ongoing and developing sensemaking. This evidence can be used to support students by providing individual and group feedback and/or making minor instructional modifications as suggested in unit materials. Ongoing formative assessment opportunities related to class discussions, handouts, and other student work are described in the front matter of each lesson and noted in the teacher guide with a yellow "Assessment Opportunity" box where they happen in the lesson." (Assessment System Overview)

Summative Assessment

- Lesson 5 Summative Assessment: "Lesson 5 provides a summative assessment opportunity where you will take stock of students' progressing sensemaking. Use the ideas from the arguments they constructed on the Arguments About Tree Squirrel System of Body Structures to determine if students would benefit from small group discussions or revisiting how squirrels use their system of body structures and circulate to support and assess their current thinking and explanations." (Assessment System Overview)
- Lesson 10 Summative Assessment: "By Lesson 10, students have had multiple opportunities in this unit to demonstrate their progress toward modeling how a system of external structures supports an animal's functions of survival, growth, and reproduction. After figuring out in the previous two lessons how sense receptors and other internal structures support an animal's functions of survival and growth, the Caring for Babies assessment is a formal opportunity to gather summative individual information about students' progress toward modeling how a system of internal structures support an animal's function of reproduction (raising young)." (Assessment system Overview)
- Lesson 13 Summative Assessment: "Lesson 13 is an opportunity to gather individual summative information about students' progress on constructing arguments supported by a model about plant structures and functions. You might choose to provide students with the optional Checklist for Flower Pollination Model handout as a support during the assessment. Students have had prior opportunities in Lessons 3-5 to construct arguments using evidence about animal and plant structures and functions, and Lessons 1-2 and 6-12 supported their work in developing models, so the Flower Pollination Model assessment can be used as a summative assessment along with the evidence you have gathered using the Following Student Sensemaking (Lessons 11-13) tool to provide a more complete picture of student progress." (Assessment system Overview)

Self Assessment

- Lesson 12, Synthesize, Step 6: "1. How successful am I at supporting a claim with evidence about the structures and functions of plants? (circle one) I need more help, please. I'm doing OK. I feel confident to do it on my own. 2. I need help with understanding..." (Lesson 12 Student Assessment, Student Reflection)
- Opportunities for self assessment are limited and do not occur in the first eleven lessons of the unit. This self-assessment only asks students about the structures and functions of plants.

Coherent three-dimensional assessment system rationale is clearly described.

- The rationale and flow of the assessment system are outlined in the document "Assessment System Overview," which describes the lesson learning goals, assessment types, purposes, and locations for each assessment throughout the unit. The document also provides information on what to look for and listen to with each assessment.

- Each lesson plan includes a "Lesson Assessment Guidance" section that echoes the information from the Overview about the Learning Goal, type and location of assessment, and what to look and listen for. This section also adds a "How Can I Use This Assessment Information?" column to help teachers understand how they might use their collected data to inform or adjust instruction for individuals or the whole class.
- The Elementary Teacher Handbook describes the desired assessment system in the unit. "The goal for assessment in OpenSciEd Elementary is to provide students with opportunities to share their ideas, experiences, and ways of making sense of the world and for these ideas, experiences, and sensemaking strategies to be welcomed, valued, and used to support ongoing learning. When this philosophy toward assessment is enacted in classroom communities that have built norms and routines to invite students to make their thinking visible and use this thinking to help make sense of science phenomena, students can see how their ideas drive science learning. All OpenSciEd Elementary curriculum units have assessment opportunities woven throughout the lessons to support teachers in being responsive to students' ideas and to support students in building their science understandings. These assessment opportunities encourage multimodal communication such that students have many different ways of demonstrating their ongoing sensemaking. Teaching tips and other educative features include prompts and questions to increase participation for traditionally minoritized learners within the whole class and cooperative learning groupings." (Elementary Teacher Handbook)

Criterion-Based Suggestions for Improvement:

- Ensure that, "assessment opportunities are found throughout the learning experience." [Detailed Guidance, p. 45]
  - Consider adding additional self-reflection opportunities throughout the unit.

III.F. Opportunity to Learn

EXTENSIVE

Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback

The reviewers found **extensive** evidence that the materials provide students with multiple, interconnected opportunities to learn and demonstrate their understanding of the targeted performance expectations (4-LS1-1, 4-LS1-2, and 4-PS4-2). Throughout the unit, students engage in diverse modalities, such as developing physical models, constructing oral and written arguments, and participating in gallery tours, ensuring that learning is accessible and progress can be demonstrated in various ways. For instance, in Lesson 7, the "Modeling Flying Squirrel Sight" activity allows students to collaborate in pairs to refine their understanding of light reflection. The unit incorporates feedback loops that explicitly support students in the revision process; in Lesson 13, students are encouraged to use peer feedback and different colored pencils to document how their arguments and models have changed. Teacher materials, such as the "Key Formative Instructional Guidance" in Lesson 4, provide specific "If you notice / Possible Next Steps" scenarios that empower the teacher to offer targeted support based on student sense-making, ensuring every student has the opportunity to reach proficiency.

Multiple, interconnected opportunities over time

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Lesson 3 Lesson Learning Goal **Construct an argument using a model and various media to support the claim that flying squirrels have internal and external structures, like bones and a patagium, that have specific shapes which function to help them glide through the air.**

- Lesson 3, Synthesize, Step 6, "Develop an argument individually. Display slide M and review the Does the flying squirrel actually fly? handout with students. Ask students to recall the evidence we have collected from the videos, pictures, investigation, and book." (Lesson 3, Teacher Guide)

Lesson 4 Lesson Learning Goal **Construct an argument** about how **different animals' internal and external structures function together as a system to carry out the function of landing safely on trees in order to support their survival.**

- Lesson 4, Synthesize, Step 5, "In pairs, construct an argument for how the animals' parts work together as a system, to help them land safely. Distribute Construct an argument. Invite students to write their own arguments using the sentence frame and notes from their investigation, and ideas from our discussion. Encourage them to include a claim (what they think about how the system works), evidence (what they saw during the investigation), and reasoning (how that evidence shows the parts work together to function as a system)." (Lesson 4, Teacher Guide)

Lesson 5 Lesson Learning Goal **Construct an argument from evidence** that **tree squirrels can also meet their needs for survival, growth, and reproduction in the trees with the system of structures they have**.

- Lesson 5, Synthesize, Step 7, "Point out that students will still have access to the model the class created while reading the Tree Squirrels: How They Meet Their Needs in the Forest book. Check for questions before they complete the assessment individually. Give students time to construct their arguments. Encourage students to write in their home language first if that helps them organize their ideas, then translate into English if needed. Provide additional visuals or diagrams of the squirrel structures and tasks to support connections between observations and arguments and clarify key vocabulary as needed." (Lesson 5, Teacher Guide)

Lesson 11 Lesson Learning Goal **Develop a model to describe** that **plants have structures that function** to **support survival and growth**.

- Lesson 11, Synthesize, Step 7, "Add to our How the lima bean plant system works model. Display slide AA and remind students that we started a model for how water gets throughout a lima bean plant earlier in the lesson. Point out that we have figured out more about this, so we can add to our model to explain. Encourage students to have their copy of Celery Plant Investigation accessible as a reference where they can annotate in their preferred language modality. As a class, add our ideas about xylem and their function to the model." (Lesson 11, Teacher Guide)

Lesson 12 Lesson Learning Goal **Support an argument** that **plants have structures that work together to help the plant grow, survive, and reproduce** with **evidence from various sources**.

- Lesson 12, Synthesize, Step 6, "Support an argument with evidence, then self-reflect. Display slide P. Remind students of the question we have been trying to answer: How do plant structures support growth, survival, and reproduction? Distribute a copy of Plant Structures Claim and Self Reflection to each student. Explain the directions to students, especially pointing out that they should select the evidence that best supports the claim that they chose." (Lesson 12, Teacher Guide)

Lesson 13 Lesson Learning Goal **Construct an argument supported by evidence in the form of a model that flowers have internal and external structures (a system of interacting components) that function to support reproduction.**

- Lesson 13, Synthesize, Step 4, "Individually construct arguments. Encourage students to refer to their copy of the New Garden Opens at Wide Creek Elementary article or any notes they made on their Flower Structures Investigation handout." (Lesson 13, Teacher Guide)

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Lesson 8 **Develop and revise a model to describe how receptors are part of a larger system that allow living things to sense the world around them**

- Lesson 8, Synthesize, Step 5, "Lead a Building Understanding Discussion to revise the model for smelling. Display slide I and lead a discussion to revise the model to include smell receptors and functions. An example revised model can be seen below." (Lesson 8, Teacher Guide)

Lesson 9 **Develop and revise models to describe how taste and hearing receptors are part of a system that allow living things to sense the world around them.**

- Lesson 9, Synthesize, Step 6, "In pairs, develop a model for taste or hearing receptors. Display slide N and invite students to work with their partners to develop a model that explains how the sense receptor they read about helps animals make sense of their world. Distribute Taste or Hearing Receptors Model to each pair. Encourage students to use the information they recorded on Part 1 of their handout, the Meet the Expert: Aide Macias Muñoz book and the "How senses help animals" model we have been developing as a class as references as they create their model." (Lesson 9, Teacher Guide)

Lesson 10 **Develop a model to describe** how flying squirrels use their **system of sense receptors to perform behaviors that aid in reproduction**.

- Lesson 10, Synthesize, Step 3, "Review the assessment. Display slide H and distribute the Caring for Babies assessment to each student. Ask students to read over it individually and then ask if anyone has clarifying questions, to make sure they feel comfortable with the task. Elevate that students will use the information on the Flying Squirrel Senses Situation Cards to develop a model for how flying squirrels use their system of sense receptors to care for their babies in the dark. Circulate to support students as they individually complete the transfer task." (Lesson 10, Teacher Guide)

4-PS4-2: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Lesson 6 **Use a model to describe how light reflects off of an object and into eyes causing** it to be **seen.**

- Lesson 6, Connect, Step 6, "Distribute Our Experiences with Reflected Light and display slide L. Encourage students to use the model we created as a class as a guide for creating their model. Give students time to complete their models." (Lesson 6, Teacher Guide)

Lesson 7 **Develop a model that explains** how a flying squirrel's **larger eyes cause more light to enter their eye, helping them to see with less light** (**effect**).

- Lesson 7, Synthesize, Step 6, "Develop a model in pairs. Display slide Y and explain that since we have figured out new things about how light affects what can be seen, we are going to work in pairs to develop a model that explains this. Distribute Modeling Flying Squirrel Sight to each student. Encourage them to work with a partner to discuss and agree on how to represent their ideas in the model. Remind students to use the models for light that we have developed as a class (Lesson 6 "Do squirrels need light to see their food?" model, "How does the amount of light shining on an object impact how much we can see?" model) as a reference." (Lesson 7, Teacher Guide)

Multi-modal feedback loops

The materials contain opportunities for teacher and peer feedback. Opportunities for teacher feedback are included in the "How can I use this assessment information?" section of the Lesson Assessment Guidance in some lessons or the body of the lesson. In these feedback experiences, students are given the opportunity to use this feedback to revise their work and adjust their thinking. The unit supplies teachers with strategies for responding to student work. For example:

- Lesson 3, Assessment Tool: "Throughout each lesson, keep track of students' sensemaking, remembering that students often use multiple means of communication at the same time to express their sensemaking. You can use the example table below, a seating chart, your class list, etc., as a record of how each student is making sense of the science ideas and practices that are the focus of this lesson set. Performance Expectation 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function (as a system) to support survival, growth, behavior, and reproduction. By Lesson 5, students should be making progress toward this performance expectation in regard to animal structures; plant structures will be addressed in Lesson Set 3. Use the lesson learning goals in the checklist here to make note of students' progress toward this performance expectation." (Lesson 3 Assessment Tool) In this document, teachers are provided lists of statements about what students may be communicating.
- Lesson 4, Key Formative Instructional Guidance: This document provides teachers with support based on a range of possible student responses or levels of student proficiency. "If you notice: Students are naming individual structures (e.g., wings, claws) but not describing how they work together as a system. Possible Next Steps: If this applies to students in your class: Have students revisit their investigation notes and physically gesture or use their glider models to show how one part helps another (e.g., "the tail slows it so the claws can grab"). Encourage them to add arrows or connecting words ("helps," "so that") in their argument." (Lesson 4, Teacher Guide)
- Lesson 4, Synthesize, Step 5: "Pairs provide peer feedback on each others' arguments. Display slide J and explain that scientists often review and strengthen each others' ideas by giving feedback. Tell students they will now use the checklist on the bottom of Construct an argument to provide feedback on their partners' argument. Remind them that when giving feedback, it is important to focus on the work, not the person. As pairs are giving feedback with the checklist, circulate around the room. Listen for students referring to their model for evidence and identifying connections among structures, and facilitated as needed. Allow students to refer to classroom charts, word wall cards, and other resources (e.g., word banks, bilingual glossaries, sentence stems, or checklists and their home language) as needed to organize their thoughts." (Lesson 4, Teacher Guide)
- Lesson 5, Lesson Assessment Guidance, "This is a summative opportunity where you will take stock of students' progressing sensemaking, along with the evidence you have gathered using the Following Student Sensemaking (Lessons 3-5) tool to provide a more complete picture of student progress. Use the ideas from the arguments they constructed on the Arguments About Tree Squirrel System of Body Structures to determine if students would benefit from small group discussions or revisiting how squirrels use their system of body structures and circulate to support and assess their current thinking and use of arguing from evidence. See the Teacher Assessment Tool Teacher Rubric

for Arguments About Tree Squirrel System of Body Structures tool for instructional guidance suggestions based on students' current sensemaking." (Lesson 5, Teacher Guide)

- Lesson 6, Assessment Tool: "Following Student Sensemaking (Lessons 6-10) Throughout each lesson, keep track of students' sensemaking, remembering that students often use multiple means of communication at the same time to express their sensemaking. You can use the example table below, a seating chart, your class list, etc., as a record of how each student is making sense of the science ideas and practices that are the focus of this lesson set." (Lesson 6 Assessment Tool) Teachers are provided a list of possible evidence of student sensemaking.
- Lesson 8, Lesson Assessment Guidance, "Use the information you gather in two ways: (1) to guide follow-up questions during the discussion in the Synthesize and as the class works to revise the The Model for How Senses Help Animals, and/or (2) to reinforce 4th-grade concepts. If you notice that students need additional support in understanding that receptors are part of a system that helps animals to gather and make sense of information then return to the book and re-read pages 1-3. If students need support around making connections between receptors, memory, and decisions then return to the results from the Smell Investigation and support students in making the connection between what they thought the smell was and if they thought it was food. Use the Following Student Sensemaking (Lessons 6-10) tool to track evidence of student growth in understanding of key science ideas and practices." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize, Step 6: "Share our models with another pair. Display slide O and group students with a pair who developed a model for the other sense receptor. Encourage students to take turns reading and explaining their model to the other pair. Invite the other pair to respectfully listen and provide supportive feedback using the prompts on slide O. Remind students that helpful feedback should focus on science ideas in the model, include celebrations and questions, and be kind, specific, and aimed at helping their classmates strengthen their thinking. When both pairs have had time to share their models with each other, give students time to revise their models based on the feedback if they gained new ideas or clarifications from the discussion." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize, Step 3, Assessment Opportunity, "The Scoring Guidance tool can also be used to provide feedback to students about how well they can apply their ideas." (Lesson 10, Teacher Guide)
- Lesson 11, Lesson Assessment Guidance, "As you look and listen for students' ideas, notice how they describe how the structures of a lima bean plant work together to bring water throughout the plant. Students should be at a secure understanding that both the roots and the xylem are needed in order to pull water into the plant and carry it throughout the plant. When needed, probe students for more accurate observations and for evidence supporting their ideas about how the structures carry water throughout the plant. Use the Following Student Sensemaking (Lessons 11-13) tool to track evidence of student growth in understanding of key science ideas and practices." (Lesson 11, Teacher Guide)
- Lesson 12, Synthesize, Step 5, "Updated our claims and model. Return to the list of claims on the whiteboard and allow students time to add new claims. Display the How the Lima Bean Plant System Works chart from last class (Refer to slide O) and suggest that we use our claims to add new ideas about how the seeds get water and how new seeds can form." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize, Step 5, "Revise arguments/models. After students have reviewed one another's work, give them a few additional minutes to improve their arguments/models based on this feedback. Consider having them show their revisions using a different color pencil to allow them and you to see how they used peer feedback" (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement: N/A

Category Ratings

CATEGORY I	**NGSS 3D Design** *(Criteria A–F)*	0	1	2	(3)
CATEGORY II	**NGSS Instructional Supports** *(Criteria A–G)*	0	1	2	(3)
CATEGORY III	**Monitoring NGSS Student Progress** *(Criteria A–F)*	0	1	2	(3)
TOTAL SCORE			**9**		

Overall Ratings

Overall ratings:

The score total is an *approximate* guide for the rating. Reviewers should use the evidence of quality across categories to guide the final rating. In other words, the rating could differ from the total score recommendations if the reviewer has evidence to support this variation.

E: Example of high quality NGSS design—High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)

E/I: Example of high quality NGSS design if Improved—Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)

R: Revision needed—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)

N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0–2)

Overall rating below:

E