EQuIP RUBRIC FOR SCIENCE EVALUATION

How does a nurse log help other things live and grow?

Developer: OpenSciEd

Grade 5 | July 2024

equip
Educators Evaluating Quality Instructional Products

nsta
National Science Teaching Association

CATEGORY I Rating			CATEGORY II Rating			CATEGORY III Rating		
A.	Explaining Phenomena/ Designing Solutions	**Extensive**	**A.**	Relevance and Authenticity	**Extensive**	**A.**	Monitoring 3D Student Performance	**Extensive**
B.	Three Dimensions	**Extensive**	**B.**	Student Ideas	**Extensive**	**B.**	Formative	**Extensive**
C.	Integrating the Three Dimensions	**Extensive**	**C.**	Building Progressions	**Extensive**	**C.**	Scoring Guidance	**Extensive**
D.	Unit Coherence	**Extensive**	**D.**	Scientific Accuracy	**Extensive**	**D.**	Unbiased Tasks/ Items	**Extensive**
E.	Multiple Science Domains	**Extensive**	**E.**	Differentiated Instruction	**Extensive**	**E.**	Coherent Assessment System	**Extensive**
F.	Math and ELA	**Extensive**	**F.**	Teacher Support for Unit Coherence	**Extensive**	**F.**	Opportunity to Learn	**Extensive**
			G.	Scaffolded Differentiation Over Time	**Adequate**			
	SCORE CAT I	**3**		**SCORE CAT II**	**3**		**SCORE CAT III**	**3**
				SUM CATEGORIES	**9**			
				RATING	**E**			

Summary Comments

This unit is strong in all three categories evaluated in the EQuIP Rubric. To figure out the highly engaging phenomenon of how a nurse log helps other things live and grow, students develop and use models to describe the nurse log system at different scales and over time. They have multiple opportunities to construct and evaluate scientific arguments about how to measure matter and the factors that plants need to grow. Performance tasks are provided for each learning segment (at the end of Lessons 7, 10, and 15), which require students to use the three dimensions to apply their understanding of the factors that plants, animals, and decomposers need to live and grow. Each lesson builds directly on prior lessons and makes the links between lessons explicit to the students. To understand how matter and energy flow in an ecosystem, students come to understand the physical science concepts that matter is particulate and can be tracked by weight and that energy is transferred from the Sun and stored in plants and is transferred to animals when they eat food. Students are provided a range of grade-appropriate informational texts (books, newspaper articles, infographics) to support them in making sense of the nurse log phenomenon. They use mathematics to graph points in the first quadrant, perform calculations, and make comparisons using decimals to aid in their developing understanding.

The unit provides extensive *NGSS* instructional supports. Students experience the nurse log phenomenon through videos, photographs, and excursions around their schools and neighborhoods. They connect energy transfer from the Sun to motion in solar toys to stored energy in plants. They investigate how animals use energy from food by planning and carrying out an investigation with pillbugs. To understand the role of decomposers in an ecosystem, students grow mushrooms and track changes by observing and weighing the mushroom box. Students are positioned as the central focus of classroom discussions, and teachers are supported in eliciting ideas and giving feedback on student thinking. The materials provide numerous opportunities for students to express, clarify, justify, interpret, and represent their ideas and to respond to peer and teacher feedback orally and in writing. Student artifacts include elaborations, reasoning, and reflections and show how their understanding has changed over time. The expected learning and how that learning will be enhanced are explicitly identified in the materials, including identifying potential student alternate conceptions and supporting learning that moves students toward more scientifically aligned ideas. A common learning sequence is provided for all learners, and multiple access points and modalities are included to make student thinking visible. The teaching materials include detailed guidance describing how individual students with a variety of needs can be supported to access and engage in each learning activity. Guidance and support are provided to recognize what students figure out in a lesson, what questions are left unanswered, and what new questions could be answered in the subsequent investigation. Teacher supports are provided to help all students, including those with special needs and abilities and emerging multilingual students, explicitly build an understanding in targeted elements of developing and using models and arguing from evidence over time through a variety of approaches. Scaffolding for some of the targeted SEPs is reduced throughout the unit, allowing students to become more independent in their use.

The materials contain a robust assessment system for monitoring student progress toward the three-dimensional learning objectives. The unit's assessment system offers many opportunities for assessments, including pre-assessments, formative assessments, summative assessments, peer assessments, and self-assessment. The formal assessments are driven by well-crafted, phenomenon-based scenarios that elicit rich student performances, integrate all three dimensions, and provide a window into students' understanding of all three dimensions of the *NGSS*. Students see assessments as connected to what they are learning and are similar in style and context to the learning activities. Formative assessment processes are embedded into instruction in every lesson and provide suggestions for adjusting instruction as necessary. All major assessment opportunities (e.g., exit tickets, major formative assessment opportunities, all summative assessments, etc.) include scoring or feedback guidance for teachers.

During revisions, the reviewers recommend paying close attention to the following areas:

- Using explicit teacher language to reference elements claimed for the DCIs and CCCs (i.e., weight, conservation of matter, closed system, etc.).
- Distinguishing that precision in measurement is a function of the measuring device and the user and that scientists use the SI system of measurement because it allows them to compare data and to communicate accurately with others across the globe.
- Adding element identifiers (e.g., MOD-E4) to identify prior learning at the element level in the Unit Overview.
- Providing support for developing the identified elements (MOD-E2 and MOD-E3; ARG-E1) and reducing scaffolding over time or removing these elements from the Unit Front Matter and the Alignment of the Three Dimensions of the *NGSS* Matrix.
- Providing student examples for each performance level on the scoring guide for key formative and summative tasks in lessons 7, 10, and 15.

Please note that in the feedback provided in this report, black text indicates either neutral comments or evidence that the criterion was met. Purple text signifies evidence that does not support the claim that the criterion was met. The purple text in these reports is specifically related to the criteria and aims to highlight areas with potential for improvement. It is important to note that *not all purple text affects the score or rating*; much of it is too minor to impact the overall rating. For instance, even criteria rated as "Extensive" may contain purple text intended to aid in continuous improvement processes. In such cases, the criterion was indeed met, and the purple text is simply not part of the justification for the "Extensive" rating.

CATEGORY I
NGSS 3D Design

I.A. Explaining Phenomena/Designing Solutions

I.B. Three Dimensions

I.C. Integrating the Three Dimensions

I.D. Unit Coherence

I.E. Multiple Science Domains

I.F. Math and ELA

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 a phenomenon drives student learning. Materials are organized so that students are figuring out the central phenomenon: how nurse logs help other things live and grow. Student questions and prior experiences related to the phenomenon extensively motivate sensemaking. Instruction is focused on supporting students to make sense of the phenomenon by exploring how nurse logs help plants, animals, and decomposers live and grow. At the beginning of each section, students use questions generated from their initial observations of nurse logs to drive the learning and return to those questions to add what they have figured out. The materials provide structured support for teachers to draw out student questions, prior experiences, and community/cultural connections related to the phenomenon. The purpose and focus of the materials are to support students in making sense of nurse logs. The entire instructional sequence drives toward this goal.

Related evidence includes the following:

i. Student questions and prior experiences related to the phenomenon or problem motivate sense-making and/or problem-solving.
Reviewers found a student-centered focus on the phenomenon throughout the unit. Students regularly returned to the phenomenon to add layers of explanation based on new learning to explain the science ideas. The materials provide opportunities for students to revisit the phenomenon in all stages of the lessons - navigate, explore, synthesize, and connect.
Evidence from the materials where the criterion was met,

- Unit Front Matter: Unit Overview: "Fifth graders were surveyed about their interest in three possible phenomena, and students were most interested in the nurse log phenomenon… During the pilot phase and field test, teachers reported high engagement with the phenomenon, with many of the students corresponding with the design team's anticipated direction for the unit. Nurse logs represent a manageable and bounded system for students to consider the complex ecological dynamics that are the focus of this unit's standards, especially related to the conservation of matter and time/spatial scale. A nurse log system also encompasses producers, consumers, and decomposers that many students have some familiarity with: moss, ferns, seedlings, invertebrates such as termites, pillbugs, and beetles" (Unit Overview)
- Lesson 1, Explore Section, Step 1: Teachers are prompted to have students explore a new phenomenon, nurse logs, by having students make observations from a series of pictures and a video. After students have had a chance to make observations, they are given an opportunity to generate questions about the phenomenon. (Lesson 1, Teacher Guide)
- Lesson 7, Connect Section, Step 4: "Introduce the community connection activity. Use slide F to introduce the What helps plants grow in our community? Explain that now that we have figured out big ideas about how nurse logs help plants live and grow, we might be able to identify other things in our community that

help plants live and grow. Welcome students to complete the *What helps plants grow in our community?* handout outside of school." (Lesson 7, Teacher Guide)

- Lesson 9, Synthesize Section, Step 4, "Connect to the nurse log habitat. Use slide K to share the ideal temperature that isopods live in in nature: 72-73 °F. Contrast this to the temperature of the warm side of the system during the investigation. Elicit students' ideas about how this need limits where isopods can be found in the nurse log system, leading to the idea that they need to balance their temperature by primarily staying under the log." (Lesson 9, Teacher Guide)
- Lesson 12, Synthesize Section, Step 3: "Motivate exploring mushrooms and fungi in our own communities. Display slide L. As time allows, elicit students' ideas for what data they want to collect, as they recorded on the final question on the handout. Build on student ideas as possible and consider saying something like *We have figured out that mushrooms are not plants or animals. This means they are not making their matter and energy using the Sun or directly consuming other organisms, but we still have questions on where their matter and energy to grow comes from. I wonder if looking at different types of mushrooms (or living things that we think are similar to mushrooms) in our communities might help us."* (Lesson 12, Teacher Guide)

The learning is consistently student-driven, with students frequently given opportunities to use their questions or prior experiences to feel as if they are driving the learning sequence.
Evidence from the materials where the criterion was met,

- Lesson 1, Navigate Section, Step 4: "Write our questions about nurse logs. Display slide U. Distribute one sticky note to each student (or two if you have extra time or a small class). Direct students to look back at the work we have done thinking about how the fallen tree becomes a nurse log. 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 1, Teacher Guide)
- Lesson 6, Navigate Section, Step 8: "Review what we figured out to connect to the nurse log. Display slide O. Ask students to consider their models and Growing Ideas charts- what we can now explain about what plants need to grow? Consider saying something like: Now that we have figured out so many ideas about plants, let's return to our questions about moss on the nurse log. Let's start with this in the next lesson." (Lesson 6, Teacher Guide)
- Lesson 14, Synthesize Section, Step 4: "Develop a Consensus model. Gather the class in a Scientists Circle and display slide J. Facilitate a discussion inviting students to share ideas from their models about how a nurse log helps plants, animals, and decomposers to live and grow?" (Lesson 14, Teacher Guide)

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

There is a close match between the phenomenon and student learning objectives throughout the materials. Almost all the learning in the three dimensions targeted by the materials is in service of students making sense of the nurse log phenomenon.
Evidence from the materials where the criterion was met,

- Lesson 5, Navigate Section, Step 6: "Consider how plants use light. Display slide G to review with students how in Lesson 4 they figured out that plants need water, light, and air to grow. Now that they have evidence that shows that plants get their matter from water and air, ask students how they think light is used by plants. Add that in the next lesson, they will gather evidence to determine how plants use light to grow." (Lesson 5, Teacher Guide)
- Lesson 7, Lesson Overview: "We are ready to explain how a nurse log interacts with plants and revise our initial consensus model to include the new ideas, and evidence." (Lesson 7, Teacher Guide)

- Lesson 10, Lesson Overview, "We are ready to explain how a nurse log system supports animals to live and grow and revise our initial consensus model to include our new ideas and supporting evidence." (Lesson 10, Teacher Guide)
- Lesson 15, Synthesize Section, Step 2: "Celebrate the progress made on the consensus model. When students have added all of their ideas about how the bullfrog would change the nurse log food web to the class consensus model and everyone feels like they agree with the ideas and the way they were represented, take a moment to celebrate the completion of the class consensus model. Consider displaying the initial consensus model from Lesson 1 next to the consensus model that was just completed and inviting students to visualize the progress they have made in their thinking about the way matter and energy flow through the nurse log food web!" (Lesson 15, Teacher Guide)

Suggestions for Improvement: NA

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 give students opportunities to build an understanding of grade-appropriate elements of the three dimensions because students regularly engage in elements of all three dimensions to make sense of the anchoring or lesson-level phenomenon. The unit centers on students figuring out how a nurse log helps other things live and grow by building an understanding of and using elements of the Disciplinary Core Ideas from 5-PS1-1, 5-PS3-1, 5-LS1-1, and 5-LS2-1. To figure out how nurse logs help other living things, students use grade-appropriate elements of the Science and Engineering Practices of Developing and Using Models and Engaging in Argument From Evidence, and extensively use grade-appropriate elements of the Crosscutting Concepts of Systems and System Models, Energy and Matter, and Scale, Proportion, and Quantity. The targeted elements of all three dimensions are identified and addressed throughout the unit.

Rating for Criterion: SEP Extensive	i. Provides opportunities to *develop and use* specific elements of the SEP(s).

The reviewers found extensive evidence that the materials provide opportunities to develop and use specific elements of the SEPs. There is a close match between the claimed SEP elements and evidence of their development and use in the materials. Students use the SEP elements that are listed as key learning objectives to make sense of the nurse log phenomenon. Students are supported in developing deep competence in specific elements so that could be applied to more than one context. There are sufficient SEP elements and time for students to engage in the elements for the length of the materials. All of the SEPs focus on grade-appropriate elements.

MOD: Developing and Using Models

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 Lesson 11. Evidence was found in 11, examples include

- Lesson 11, Synthesize Section, Step 4: "Have students bring their completed copy of Evidence for Termite Matter and Energy and form a Scientist's Circle around the Termite Matter & Energy chart you prepared before class. Use the following prompts to lead a discussion and build a class model based on evidence and ideas from students." (Lesson 11, Teacher Guide)

MOD-E3: Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
Claimed in Lesson 14. Evidence was found in 14, examples include

- Lesson 14, Explore Section, Step 2: "Play another round of the Matter and Energy Flow game. Display slide F. Tell students that since we only modeled the flow of energy, we are going to play the game again, only this time, we will be representing how matter moves within the food web. Have the student playing the role of the air and water go to the center of the circle. Play the game following the same rules as the first round." (Lesson 14, Teacher Guide)

MOD-E4: Develop and/or use models to describe and/or predict phenomena.
Claimed in Lessons 1, 5, 6, 7, 10, 13, and 15. Evidence was found in 1, 5, 6, 7, 10, 13, and 15. Examples include

- Lesson 1, 5.1 Lesson 1 Handout Initial Model, students generate initial models to surface their initial ideas about the nurse log phenomenon. (Lesson 1, 5.1 Lesson 1 Handout Initial Model)
- Lesson 1, Synthesize Section, Step 2: "Introduce the idea of modeling to explain what we think might be going on with the nurse logs." (Lesson 1, Teacher Guide)
- Lesson 5, Explore Section, Step 4: "Model our new ideas about air. Display slide K. Direct students back to the class model of the beach ball, emphasizing that now we have figured out some new ideas about how to represent the air as matter." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5: "Part A: Model Your Ideas Use the box and lines below to explain and show: Where do plants get the matter they need to grow?" (Lesson 5, 5.1 Lesson 5 Handout Model to Explain Plants & Matter)
- Lesson 6, Synthesize Section, Step 6: "Develop a model to explain How does my plant use matter and energy to grow? Model with any plant of your choice. Refer to our completed models from Lesson 5 that explain where plants get the matter they need to grow" (Lesson 6, Slide M)
- Lesson 6, Synthesize Section, Step 6: "Frame our model of a plant as a system. As students model, support them in using systems thinking to identify how they should represent their thinking as they model what we have figured out about how plants get the matter and energy they need to grow." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Explain and/or show what you think happens on top of the log and underneath the log when plants are growing." (Lesson 7, 5.1 Lesson 7 Handout Revised Nurse Log Model)

- Lesson 10, Synthesize Section, Step 3: "Create a model to explain our new ideas: How does a nurse log help animals live and grow?" (Lesson 10, Slide D)
- Lesson 10, Synthesize Section, Step 6: "Read about the ensatina salamander. Then model to explain how the nurse log system meets its needs for matter and energy." (Lesson 10, Slide I)
- Lesson 13, Synthesize Section, Step 5: "Transition to modeling. Explain that we have figured out some big ideas in the past two lessons, and it's a good time to model to explain how fungi get and use matter and energy, and how they act as decomposers in natural systems. Use slide L to introduce the modeling task on the Model a Mushroom." (Lesson 13, Teacher Guide)
- Lesson 15, Synthesize Section, Step 2: "Facilitate a Consensus Discussion while adding the American Bullfrog to the class consensus model. Have students turn their attention to the class consensus model. Display slide B and explain that since we have made this important discovery about what could happen to the nurse log food web with the addition of a new species, it is important that we record our thinking by updating our consensus model. Ask students to add their ideas about how the flow of matter and energy would change in the nurse log food web with the presence of the bullfrog. Use the table below to support facilitation of a Consensus discussion while updating the class consensus model." (Lesson 15, Teacher Guide)

ARG: Engaging in Argument from Evidence

ARG-E1: Compare and refine arguments based on an evaluation of the evidence presented.
Claimed in Lesson 3. Evidence was found in 3, examples include

- Lesson 3, Synthesize Section, Step 6: "Let's decide if we have enough evidence to support the two big claims we have been trying to figure out: How to measure matter - What plants need to grow" (Lesson 3, Slide Q)
- Lesson 3, Synthesize Section, Step 6: Students answer claims with evidence and reasoning. Then, they consider the question, "Do you have enough evidence to fully support your claim? Explain why or why not" (Lesson 3, 5.1 Lesson 3 Handout Evaluate the Evidence). While students compare arguments within their small group and share with the class, there is no opportunity for arguments to be refined.

ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.
Claimed in Lessons 4, 7, and 10. Evidence was found in 4, 7, and 10. Examples include

- Lesson 4, Explore Section, Step 3: "Support students in writing a scientific argument. After students finish the gallery tour, ask them to go back to their seats to complete Part B of the Interpret Plant Data handout. This will be their first opportunity to write a full scientific argument (claim, evidence, reasoning) so it may be helpful to briefly review each part prior to them attempting to write on their own." (Lesson 4, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5: "Argue from evidence. Construct an argument about environments that support plant growth. Use evidence from your model, data we collected, and your Gotta- Have-It Checklist to support your ideas." (Lesson 7, Slide G)
- Lesson 10, Synthesize Section, Step 6: "Use evidence to write a claim that answers the question: When the young ensatina salamander eats food, does the total amount of matter in the food chain change? Include two pieces of supporting evidence from your model or investigations that you have done in class." (Lesson 10, 5.1 Lesson 10 Student Assessment 1 Ensatina Salamanders & Nurse Logs)

Criterion-Based Suggestions for Improvement

- Consider adding time for students to refine their arguments after discussion to fully meet the claimed element.

Rating for Criterion: DCI Extensive	ii. Provides opportunities to develop and use specific elements of the DCI(s).

The reviewers found extensive evidence that the materials provide opportunities to develop and use specific elements of the DCIs. These pieces of evidence were selected because there is a close match between the claimed DCI elements and evidence of their development and use in the materials. Students use the DCI elements that are claimed as key learning objectives to make sense of the nurse log phenomenon. For example, students apply their understanding of how plants get matter and energy in the moss transfer task in Lesson 7. Then they apply their understanding of how animals get matter and energy in the salamander transfer task in Lesson 10. They use their understanding of the transfer of matter and energy through a grassland ecosystem in the summative transfer task in the last lesson, Lesson 15.

PS1.A: Structure and Properties of Matter

PS1.A-E1: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.

Claimed in Lessons 5 and 7. Evidence was found in 5 and 7, examples include

- Lesson 5, Explore Section, Step 4: "Add a key to the model for air particle and gas. If you haven't already, define particle as a tiny piece of matter that is too small to be seen with our eyes and add to the Word Wall." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Look to see if students understand that plants take in matter in the form of air and water in order to grow. Air is taken in through leaves and water is taken in through roots. The matter particles are too small to see so students should use symbols to represent the particles and these symbols should be defined in the model key." (Lesson 7, Teacher Guide)

PS3.D: Energy in Chemical Processes and Everyday Life

PS3.D-E2: The energy released [from] food was once energy from the Sun that was captured by plants in the chemical process that forms plant matter (from air and water).

Claimed in Lessons 6, 7, 9, 10, and 13. Evidence was found in 6, 7, 9, 10, and 13, examples include

- Lesson 6, Connect Section, Step 5: "Review what we have figured out. Display slide K. Ask students to look at the image of the plant and Sun on the slide and consider how they would explain to someone how plants use energy from the Sun for growth. Prompt a student or two to explain their ideas using the image. For example, students can point to the Sun and trace its rays to the plant as they say that the Sun transfers energy to the leaves of the plant. Encourage students to use words, their bodies, gestures or other modalities to demonstrate and expand upon what they have figured out about how the plants then use the Sun's energy to combine matter from the air and water into sugar." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: In a Consensus Building discussion, the teacher prompts questions about how energy is used in the nurse log system. Students are recalling energy transferred from the sun and used to make sure in growing plants. (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: "Prepare for a Consensus Discussion. Organize students into a Scientists' Circle around a chart paper or board with a blank version of the chart shown below (a blank

version is provided in Isopod & Bird Comparison Chart- Sample and Blank). Direct students to bring their Investigate Isopods and Feathered Friends Evidence Table handouts. Explain that in order to figure out patterns from what they have learned about how isopods and birds use energy, the class will create a comparison chart using the prompts on the chart." (Lesson 9, Teacher Guide)

- Lesson 10, Explore Section, Step 2: "Matter moving as air and water particles from the environment into the plant, and energy being transferred from the Sun, to make sugar and then into animals as they eat plants or the nurse log" (Lesson 10, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6: During the class consensus discussion of the final model for the nurse log system, teachers prompt students to zoom out and trace the flow of matter and energy. The example model provided for teachers includes energy originating from the Sun. (Lesson 13, Teacher Edition)

LS1.C: Organization for Matter and Energy Flow in Organisms

LS1.C-E1 Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.

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

- Lesson 8, Navigate Section, Step 7: "Prompt students to consider what else food provides to animals. Use slide U to ask students to think of what else food provides to humans and other animals, other than matter. Direct students to record their ideas or questions on the back of their Growing Ideas chart or in science notebooks. As time permits, elicit a few ideas or questions from students." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 4: "Share one more way that isopods use energy. Display slide L. Use the information on the slide to provide information that animals use energy and matter: to repair their bodies. Elicit other examples from students for how they have observed or experienced this with other animals (including humans!)" (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 4: "Facilitate a Consensus Building discussion. Use the following prompts to facilitate a Consensus Building discussion about how a nurse log helps animals live and grow, inviting students to share their modeling ideas on Revised Nurse Log Model and referencing the Gotta-Have-It checklist for important ideas that we need to include and ways to represent those ideas." (Lesson 10, Teacher Guide)
- Lesson 11, Connect Section, Step 3: "As you re-watch the video (only 2:38-3:19) with the sound on, add any additional evidence to help explain how termites get matter and energy from wood." (Lesson 11, Slide H)
- Lesson 11, Navigate Section, Step 5: "Emphasize how we used evidence to model how termites are able to eat the wood and get matter and energy, because of the microscopic organisms in their guts." (Lesson 11, Teacher Guide)

LS1.C-E2: Plants acquire their material for growth chiefly from air and water.

Claimed in Lessons 3, 4, 5, and 7. Evidence was found in 3, 4, 5, and 7. Examples include:

- Lesson 3, Connect Section, Step 2: "Think about a time you have seen someone trying to grow a plant. It may have been inside or outside, in real life or in a video." (Lesson 3, 5.1 Lesson 3 Handout Growing Plants)
- Lesson 3 is where students begin to consider where a plant gets the matter to grow.
- Lesson 4, Explore Section, Step 3: "Based on our class data, which factors do plants need to grow? Write an argument using the data in Part A as evidence to support your claim." (Lesson 4, 5.1 Lesson 4 Handout Interpret Plant Data Part B)
- Lesson 4, Connect Section, Step 5: "Update our Growing Ideas charts. Conclude the read aloud and discussion by pointing out that we figured out how plants use soil, so we are ready to summarize the work we did in this lesson. If time allows, give students a few minutes to reflect on the investigation and the article." (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize Section, Step 5: "Use the box and lines below to explain and show: Where do plants get the matter they need to grow? Use the ideas we have figured out in Lessons 4 and 5 to explain and show where plants (like the giant pumpkin!) get the matter to grow." (Lesson 5, 5.1 Lesson 5 Handout Model to Explain Plants & Matter)
- Lesson 5, Navigate Section, Step 6: "Display slide O to review with students how in Lesson 4 they figured out that plants need water, light, and air to grow. Now that they have evidence that shows that plants get their matter from water and air, ask students what they think light provides to plants." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5: "Introduction: We have figured out that nurse logs are places that support plant growth. However, they are not the only places where plants can live and grow. Look at the images of the places listed below and read each description. Circle or underline information in the text that will help you figure out if plants can grow in this place." (Lesson 7, 5.1 Lesson 7 Handout Plants Growing in Different Places)

LS2.A: Interdependent Relationships in Ecosystems

LS2.A-E1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

Claimed in Lessons 1, 2, 8, 9, 10, 11, 12, 13, 14, and 15.

- In the 5 5.1 Ecosystems & Matter Cycling SEP-DCI-CCC-ELA-Math-Matrix, it states that in Lesson 1, "Students are introduced to organisms that are linked together through feeding relationships. They figure out key ideas of this DCI element throughout the unit." However, evidence of students using this DCI element was not found in Lesson 1.
- Lesson 2, Synthesize Section, Step 3: "Frame the nurse log as a system. Once all of the students' observations are added to the model, note that it sounds like students have identified many ways that the different parts are working together. Consider saying something like, As scientists, we can refer to the nurse log and what we have added to it as a system." (Lesson 2, Teacher Guide)
- Lesson 8, Connect Section, Step 4: "Read a book about animals in nurse log systems. Read the Nurse Logs: More than Meets the Eye book aloud to the class. Use the following discussion prompts (also found on the last page of the end of the book) to lead a brief class discussion in which students identify that the Pacific Dampwood termites are animals that eat the log." (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 6: "Identify a food chain in the nurse log system. Display slide S. Ask students to recall what animals eat the termites, like we read about in the book, leading to the bear. Tell students one way of showing what organisms eat each other is what scientists call a food chain." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: "Prepare for a Consensus Discussion. Organize students into a Scientists' Circle around a chart paper or board with a blank version of the chart shown below (a blank version is provided in Isopod & Bird Comparison Chart- Sample and Blank). Direct students to bring their Investigate Isopods and Feathered Friends Evidence Table handouts. Explain that in order to figure out patterns from what they have learned about how isopods and birds use energy, the class will create a comparison chart using the prompts on the chart." (Lesson 9, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: "A food chain shows how energy is originally transferred from the Sun to producers (plants), which use and also store the energy. The energy is released when consumers like

isopods eat the once-living plants. The energy then is transferred to the other consumers when they eat the isopods!" (Lesson 9, Teacher Guide)

- Lesson 10, Synthesize Section, Step 4: "Facilitate a Consensus Building discussion. Use the following prompts to facilitate a Consensus Building discussion about how a nurse log helps animals live and grow, inviting students to share their modeling ideas on Revised Nurse Log Model and referencing the Gotta-Have-It checklist for important ideas that we need to include and ways to represent those ideas." (Lesson 10, Teacher Guide)
- Lesson 11, Connect Section, Step 3: "As you re-watch the video (only 2:38-3:19) with the sound on, add any additional evidence to help explain how termites get matter and energy from wood." (Lesson 11, Slide H)
- Lesson 11, Navigate Section, Step 5: "Emphasize how we used evidence to model how termites are able to eat the wood and get matter and energy, because of the microscopic organisms in their guts." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate Section, Step 1: "Reorient to other organisms in the nurse log system. Display slide B. Remind students that we have previously observed some of these images of nurse logs over time. In Lesson 2, we were focused on what was happening at the beginning of a fallen tree becoming a nurse log. In Lesson 8, we figured out that eventually the parts of the nurse log seem to disappear, but actually the matter gets cycled into the system as it is eaten by termites. Ask students to observe and talk with a partner: What happens to the nurse log in between? What clues can we observe in these images?" (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6: "Let's zoom out and look at the whole nurse log system. Can someone come up and tell one part of the story of how matter and energy moves through the system between plants, animals, and decomposers? Then someone else will come tell the story of what happens next." (Lesson 13, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Introduce the idea of the American Bullfrog entering the nurse log food web. Tell students that you heard them saying that a new animal in a food web might make the web become unhealthy and unbalanced. We can test out this idea by adding a new organism to our food web." (Lesson 14, Teacher Guide)
- Lesson 15, Synthesize Section, Step 2: "Facilitate a Consensus Discussion while adding the American Bullfrog to the class consensus model. Have students turn their attention to the class consensus model. Display slide B and explain that since we have made this important discovery about what could happen to the nurse log food web with the addition of a new species, it is important that we record our thinking by updating our consensus model. Ask students to add their ideas about how the flow of matter and energy would change in the nurse log food web with the presence of the bullfrog. Use the table below to support facilitation of a Consensus discussion while updating the class consensus model." (Lesson 15, Teacher Guide)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

LS2.B-E1 Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

Claimed in Lessons 1, 5, 6, 9, 10, 11, and 13.

- In 5 5.1 Ecosystems & Matter Cycling SEP-DCI-CCC-ELA-Math-Matrix, it states that in Lesson 1, "Students are introduced to some of the organisms and other ecosystem components that interact in a nurse log system. They figure out key ideas of this DCI element throughout the unit." However, evidence of students using this DCI element was not found in Lesson 1.

- Lesson 5, Synthesize Section, Step 5: "Model our ideas about plants and matter. Display slide M. Walk through the parts of the Model to Explain Plants & Matter handout for students to model their ideas. Distribute the handout to students and circulate to support their individual modeling process. Press them to represent particles similarly to how we did in the class model. Note that the first question in Part B will require students to look back at the scientific argument they wrote in Lesson 4, at the end of the Interpret Plant Data handout." (Lesson 5, Teacher Guide)
- Lesson 6, Navigate Section, Step 8: "Review what we figured out to connect to the nurse log. Display slide O. Ask students to consider their models and Growing Ideas charts- what we can now explain about what plants need to grow? Consider saying something like: Now that we have figured out so many ideas about plants, let's return to our questions about moss on the nurse log. Let's start with this in the next lesson." (Lesson 6, Teacher Guide)
- Lesson 9, Navigate Section, Step 7: "Take stock of what we figured out. Refer to the class consensus model of the nurse log that students updated in Lesson 7 to add what they figured out about plants. As on slide S, suggest that the class is now ready to add what they have figured out about animals to the model, in the next lesson." (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 4: "Facilitate a Consensus Building discussion. Use the following prompts to facilitate a Consensus Building discussion about how a nurse log helps animals live and grow, inviting students to share their modeling ideas on Revised Nurse Log Model and referencing the Gotta-Have-It checklist for important ideas that we need to include and ways to represent those ideas." (Lesson 10, Teacher Guide)
- Lesson 11, Connect Section, Step 3: "As you re-watch the video (only 2:38-3:19) with the sound on, add any additional evidence to help explain how termites get matter and energy from wood." (Lesson 11, Slide H)
- Lesson 11, Navigate Section, Step 5: "Emphasize how we used evidence to model how termites are able to eat the wood and get matter and energy, because of the microscopic organisms in their guts." (Lesson 11, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6: "Let's zoom out and look at the whole nurse log system. Can someone come up and tell one part of the story of how matter and energy moves through the system between plants, animals, and decomposers? Then someone else will come tell the story of what happens next." (Lesson 13, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Consider noting that the claimed elements in Alignment With the Three Dimensions of *NGSS* matrix are introduced in Lesson 1, then developed and/or used in the other denoted lessons.

Rating for Criterion: CCC Extensive	iii. Provides opportunities to *develop and use* specific elements of the CCC(s).

The reviewers found extensive evidence that the materials provide opportunities to develop and use specific elements of the CCCs. These pieces of evidence were selected because lessons focus on helping students build or use specific grade-appropriate elements of CCCs to help explain the nurse log phenomenon throughout the learning process. There is a close match between the CCC elements that are claimed and evidence of their development and use. The students are supported to develop deep competence in specific elements such that

they could be applied to more than one context. There are sufficient CCC elements and sufficient time that students are engaged in those elements for the length of the materials.

EM: Energy and Matter

EM-E1: Matter is made of particles.

Claimed and found in Lessons 5 and 7. Examples include

- Lesson 5, Explore Section, Step 4: "Add a key to the model for air particle and gas. If you haven't already, define particle as a tiny piece of matter that is too small to be seen with our eyes and add to the Word Wall." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Look to see if students understand that plants take in matter in the form of air and water in order to grow. Air is taken in through leaves and water is taken in through roots. The matter particles are too small to see so students should use symbols to represent the particles and these symbols should be defined in the model key." (Lesson 7, Teacher Guide)

EM-E2: Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.

Claimed and present in Lessons 3, 4, 5, 7, 8, 10, 11, 12, 13, and 14. Examples include

- Lesson 3, Synthesize Section, Step 6: "Share our ideas. Have one member from each group report back about their discussion and conclusions. If time is limited, focus on the evaluation of evidence about what plants need to grow. While students share, record and organize their ideas about what plants need to grow, and what evidence is still needed. As you have done throughout the lesson, emphasize mentions of light, water, soil, and/or air. Revise and add themes to the What We Think Plants Need to Grow chart from the beginning of the lesson." (Lesson 3, Teacher Guide). In this lesson, students begin to think about how matter can be tracked by measuring weight as the plant grows. Other parts of the element will be addressed later in the unit.
- Lesson 4, Explore Section, Step 2: "Ask, "Based on the investigation setups, how would you define open and closed systems?" Push to establish that an open system can consistently let things (like air) move in and out, while a closed system does not. An example of an open system would be a plant growing in the wild. Things move freely in and out of the location where the plant is growing. Bugs, air, water, and other things can come and go. If you took that same plant and put it in a jar with a lid then you'll have created a closed system because nothing can go in or out of the jar." (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 3: "If plants did not have air, water, or light, they did not grow/gain weight. Plants that had air, water, and light grew/gained weight. Plants that had soil also grew, but since plants without soil also grew, plants do not seem to need soil to get the matter they need to grow." (Lesson 4, Teacher Guide).
- Lesson 5, Synthesize Section, Step 5 Energy and Matter callout: "Students continually engage with this crosscutting concept throughout this unit, across different kinds of systems. Use this discussion and the modeling activity to emphasize how matter (air and water particles) is transported into, out of, and within systems- both physical (beach ball and syringe) and living systems (pumpkin and other plants). Students will return and engage more deeply with the idea that water is made of particles in the Water Unit unit." (Lesson 5, Teacher Guide)
- Lesson 7, Navigate Section, Step 1: "By weighing plants as they grow, we can figure out how much matter they have grown and what they need from their environment to grow. By weighing air, water, and light, we figured out that plants must use air and water for matter, since light does not have weight." (Lesson 7, Teacher Guide)

- Lesson 8, Synthesize Section, Step 6: "Provide scientific name for what we have figured out. Display slide Q. Tell students that they have figured out an important science idea that scientists call the conservation of matter. Matter does not simply appear or disappear; it moves around from one part of a closed system to another. The total amount of matter in a closed system does not increase or decrease, because it is closed! Ask students when they have heard or used the word "conserve" or "conservation" and what they think it means." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize Section, Step 4: "Matter moves from the nurse log, plants, other animals, or once-living organisms into the animal when the animal eats it." (Lesson 10, Teacher Guide)
- Lesson 11, Navigate Section, Step 5: "Emphasize how we used evidence to model how termites are able to eat the wood and get matter and energy, because of the microscopic organisms in their guts." (Lesson 11, Teacher Guide) Students do not use the CCC element to measure weight or track matter in this part of the system.
- Lesson 12, Navigate Section, Step 1: "Ask students to observe and talk with a partner: What happens to the nurse log in between? What clues can we observe in these images?" (Lesson 12, Teacher Guide)
- Lesson 13, Explore Section, Step 4: "Show a time-lapse video of leaf litter without decomposers. Display slide I. Explain that this video does not include all of the animal decomposers that we noticed in the first video. Prompt students to use the second row of the table on Notice and Wonder: Decomposers and Matter to record what they notice and wonder in this video, still focusing on the same two questions. Then show the second segment of the Bioturbation with and without soil fauna video (1:18-1:37) as linked on slide I, and elicit and record students' observations and questions as you did previously." (Lesson 13, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Play the Matter And Energy Flow game. Display slide E to introduce students to the rules of the game. Tell them that we will first play the game showing how energy flows from one organism to the other…Play another round of the Matter and Energy Flow game. Display slide F Tell students that since we only modeled the flow of energy, we are going to play the game again, only this time, we will be representing how matter moves within the food web." (Lesson 14, Teacher Guide)
- Lesson 14, Explore Section, Step 4: "Facilitate a discussion about the balance and health of the food web we created. Once several paths of energy flow have been created, have students pause the game and participate in a discussion about the health and balance of the food web they created…Do you think the food web would look healthy if we played a matter round of the game?" (Lesson 14, Teacher Guide)

EM-E3: Energy can be transferred in various ways and between objects.

Claimed and present in Lessons 6, 7, 9, 10, 11, 12, 13, and 14. Examples include

- Lesson 6, Connect Section, Step 5: "Review what we have figured out. Display slide K. Ask students to look at the image of the plant and Sun on the slide and consider how they would explain to someone how plants use energy from the Sun for growth. Prompt a student or two to explain their ideas using the image. For example, students can point to the Sun and trace its rays to the plant as they say that the Sun transfers energy to the leaves of the plant. Encourage students to use words, their bodies, gestures or other modalities to demonstrate and expand upon what they have figured out about how the plants then use the Sun's energy to combine matter from the air and water into sugar." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: In a Consensus Building discussion, the teacher is prompting questions about how energy is used in the nurse log system. Students are recalling energy transferred from the sun and used to make sure in growing plants. (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 4: "Facilitate a Building Understandings discussion about our investigation findings. Organize the class into a Scientists' Circle to elicit students' interpretations of the investigation and connect to ideas about energy, temperature, and food." (Lesson 9, Teacher Guide)

- Lesson 10, Synthesize Section, Step 6: "Develop a model to explain how an ensatina salamander gets and uses matter and energy from the nurse log system." (Lesson 10, 5.1 Lesson 10 Student Assessment 1 Ensatina Salamander & Nurse Logs)
- Lesson 11, Connect Section, Step 3: "As you re-watch the video (only 2:38-3:19) with the sound on, add any additional evidence to help explain how termites get matter and energy from wood." (Lesson 11, Slide H)
- Lesson 11, Navigate Section, Step 5: "Emphasize how we used evidence to model how termites are able to eat the wood and get matter and energy, because of the microscopic organisms in their guts." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate Section, Step 5: "Determine where to go next. Display slide P. Reaffirm with students that we have figured out that mushrooms and fungi grow on living and once-living things (like we observed on images of the nurse log), but they do not get their matter and energy like plants and animals, so we still have questions about if fungi can break down the nurse log like microscopic organisms do." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize Section, Step 6: "Use the model to explain how the system works. As on slide N and in the following prompts, transition from building the model to using the model to explain how matter and energy move through the nurse log system." (Lesson 13, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Introduce the Matter And Energy Flow game. Display slide C and tell students that we are going to play a game in which we each play the part of one of the components of the nurse log system and that the goal of the game is to trace the flow of matter and energy in the nurse log food web." (Lesson 14, Teacher Guide)

SPQ: Scale, Proportion, Quantity

SPQ-E1: Natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.

Claimed and present in Lessons 1, 3, 5, 7, 8, 10 and 11. Examples include

- Lesson 1, Explore Section, Step 1 Scale, Proportion, and Quantity callout: "For the image on slide E, note with students how big the tree is, using the people next to the fallen and standing trees to get a sense of spatial scale. For the image on slide F, note with students how the picture shows a different perspective of a fallen tree: it is tipped over and we are seeing a side view of the bottom of the tree!" (Lesson 1, Teacher Guide)
- Lesson 1, Explore Section, Step 1: Make Observations: "Let's see if we can get any clues about what is going on here by thinking about the size of the different things we noticed. How big is the log/fallen tree? How can you tell?" (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 3 "Motivate the need for time-lapse videos. Use slide D to connect to students' experiences with growing plants by asking if they were able to actually see the plants growing as they watched. Elicit or explain why this is not possible: plants grow at a scale that is too slow for humans to actually see in real time." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 3 Scale, Proportion, and Quantity callout: "An important element of the Scale, Proportion, and Quantity crosscutting concept is the idea that observable phenomena happen over different time scales, from very short (less than a second) to very long (thousands or millions of years). The explicit discussion of time-lapse technology supports students' understanding of the concept that changes occur, and can be observed, over many different time scales." (Lesson 3, Teacher Guide)
- Lesson 5, Explore Section, Step 4: "We can't see air but we agreed from our investigation that it is made of matter. Imagine we were looking at the air with zoom-in goggles or a really strong microscope. What do you think we would see?"

- Students are using a scale to determine if water, light, and air are matter.
- Lesson 7, Synthesize Section, Step 3: "Look to see if students understand that plants take in matter in the form of air and water in order to grow. Air is taken in through leaves and water is taken in through roots. The matter particles are too small to see so students should use symbols to represent the particles and these symbols should be defined in the model key." (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section, Step 2: "Introduce two sources of evidence. Display slide B. Tell the class that you have two sources of evidence to observe regarding nurse logs changing over time: our Nurse Log in a Box, and a series of images showing nurse logs of different ages in a forest in Washington State. Use the Nurse Logs Over Time handout on the slide to walk through the investigation." (Lesson 8, Teacher Guide)
- Lesson 11, Synthesize Section, Step 4: "That is true, termites are really tiny, it is hard to see their whole body, so it would be really hard to see what is going on in their mouths. We could create a zoom in circle like in the book we read about termites so that we can zoom really close to show the details of the jaws chomping up the wood." (Lesson 11, Teacher Guide)
- Lesson 11, Synthesize Section, Step 4 Scale, Proportion, and Quantity callout: "This discussion and modeling process provides key opportunities for students to connect to this crosscutting concept that they have been building on throughout this unit, related to natural objects existing at different spatial scales (in this case, at very small scales). Modeling with the zoom-in circles emphasizes the different spatial scales between the termite and the microscopic organisms. Additionally, prompt students to consider the even smaller scale of the particles and sugars when tracking matter that is digested and released by the microscopic organisms, the termite, and back into the environment." (Lesson 11, Teacher Guide)

SYS: Systems and Systems Models

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 Lesson 13. Evidence was found in 13, examples include

- Lesson 13, Navigate Section, Step 8: "Generate new ideas. Use the updated class model to celebrate all that we have figured out about the nurse log system. Display slide Q. Transition to the next lesson by saying something like: Every organism we've studied in the nurse log system is really important in helping other organisms in the system grow and to keep matter and energy moving. We saw the effects when decomposers were removed from the system. What do you think happens when other organisms besides decomposers are either removed or added to ecosystems?" (Lesson 13, Teacher Guide)

SYS-E2 system can be described in terms of its components and their interactions.

Claimed and present in Lessons 2, 4, 6, 8, 9, 10, 14, and 15. Examples include

- Lesson 2, Synthesize Section, Step 3: "Ask students to help you know where to draw a big line or circle around the log and all of the things that students think are found in, on, or around it. Write the word "System" above the line or circle. Transition to focusing on the parts of the system: the things that students observed in, on, and around the nurse log. Identify these parts as components of the system and add the term "component" to the model." (Lesson 2, Teacher Guide).
- Lesson 4, Explore Section, Step 2: "Point out that we have talked about the nurse log as a system, and the parts (components) of that system include the factors we want to investigate today. Explain that it sounds like we could set up systems with the inch plants to test each of those factors by removing them." (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 2: "Ask, "Based on the investigation setups, how would you define open and closed systems?" Push to establish that an open system can consistently let things (like air) move in and out, while a closed system does not. An example of an open system would be a plant growing in the wild.

Things move freely in and out of the location where the plant is growing. Bugs, air, water, and other things can come and go. If you took that same plant and put it in a jar with a lid then you'll have created a closed system because nothing can go in or out of the jar." (Lesson 4, Teacher Guide)

- Lesson 6, Synthesize Section, Step 6: "Frame our model of a plant as a system. As students model, support them in using systems thinking to identify how they should represent their thinking as they model what we have figured out about how plants get the matter and energy they need to grow." (Lesson 6, Teacher Guide)
- Lesson 8, Explore Section, Step 5: "Define a closed system. Use slide N to show the nurse log and termites in a closed system. Explain that in order to get precise numbers, this data came from a small-scale system similar to our Nurse Log in a Box, but with termites! This termite colony, along with the wood they are eating, was enclosed in an airtight box to observe and measure the weight of the components and the whole system." (Lesson 8, Teacher Guide)
- Lesson 9, Explore Section, Step 3: "My prediction about what will happen to the isopods' movement when we add heat and light to the system" (Lesson 9, 5.1 Lesson 9 Handout Investigating Isopods)
- Lesson 10, Explore Section, Step 2: "What components & interactions will we need to include as we model? If we're modeling to explain our new ideas about "How does a nurse log help animals live and grow?" what else should we include?" (Lesson 10, Slide B)
- Lesson 14, Navigate Section, Step 1: "Display slide B and explain that it sounds like we are thinking that decomposers are a really important component of the nurse log system. Ask students if they think it is the most important component?" (Lesson 14, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Introduce the Matter And Energy Flow game. Display slide C and tell students that we are going to play a game in which we each play the part of one of the components of the nurse log system and that the goal of the game is to trace the flow of matter and energy in the nurse log food web." (Lesson 14, Teacher Guide)
- Lesson 15, Synthesize Section, Step 2: "Facilitate a Consensus Discussion while adding the American Bullfrog to the class consensus model. Have students turn their attention to the class consensus model. Display slide B and explain that since we have made this important discovery about what could happen to the nurse log food web with the addition of a new species, it is important that we record our thinking by updating our consensus model. Ask students to add their ideas about how the flow of matter and energy would change in the nurse log food web with the presence of the bullfrog. Use the table below to support facilitation of a Consensus discussion while updating the class consensus model." (Lesson 15, Teacher Guide)

Criterion-Based Suggestions for Improvement

- Consider adding explicit teacher language to reference elements being claimed (i.e., weight, conservation of matter, closed system, etc.).

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 sensemaking of the phenomenon of nurse logs requires student performances that integrate elements of the SEPs, CCCs, and DCIs. In the unit, students are expected to

synthesize observations and revise their models of how a nurse log helps plants, animals, and decomposers live and grow using data from a variety of sources, and argue from evidence about how plants grow, where isopods get their energy, and the role of decomposers through class consensus discussions and transfer tasks, which require them to use grade-appropriate elements of the three dimensions simultaneously.

These pieces of evidence were selected because they demonstrate how grade-appropriate elements of the three dimensions are used together throughout the learning process in the classroom, group, and individual activities. This integration is in service of figuring out something about the nurse log phenomenon. The three dimensions are generally learned and used in tandem, with each dimension supporting understanding of the others. All three dimensions are necessary for sensemaking and work together to help students answer the driving question of how nurse logs help other things live and grow.

Learning is integrated because students must use grade-appropriate elements of matter and energy, systems and system models, and scale, proportion, and quantity crosscutting concepts to accurately figure out and explain how nurse logs support plants, animals, and decomposers to live and grow.

- Lesson 4, Synthesize Section, Step 4: "Facilitate a Building Understandings discussion. Display slide N Gather students in a Scientists Circle with their Interpret Plant Data handout for a Building Understandings Discussion. Explain to students that our goal in a Building Understandings Discussion is to consider how the plant investigation data can serve as evidence to help us figure out what plants need to grow." (Lesson 4, Teacher Guide) SEP 4.E2: Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation, LS1.C-E2: Plants acquire their material for growth chiefly from air and water, CCC 4.E2: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. CCC 4.E3: A system can be described in terms of its components and their interactions.
- Lesson 7, Synthesize Section, Step 5, "Construct an argument about environments that support plant growth." (Lesson 5, Slide G) SEP 6.E4 Construct and/or support an argument with evidence, data, and/or a model., PS1.A-E1: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. LS1.C-E2: Plants acquire their material for growth chiefly from air and water, CCC 5.1: Matter is made of particles. CCC 5.2 Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.
- Lesson 9, Synthesize Section, Step 4: "Facilitate a Building Understandings discussion about our investigation findings. Organize the class into a Scientists' Circle to elicit students' interpretations of the investigation and connect to ideas about energy, temperature, and food." (Lesson 9, Teacher Guide) SEP 8.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. 8.E4: Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. PS3.D-E2: The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). CCC 5.E3 Energy can be transferred in various ways and between objects.
- Lesson 10, Synthesize Section, Step 6: "Use evidence to write a claim that answers the question: When the young ensatina salamander eats food, does the total amount of matter in the food chain change? Include two pieces of supporting evidence from your model or investigations that you have done in class." (Lesson 10, 5.1 Lesson 10 Student Assessment 1 Ensatina Salamanders & Nurse Logs) SEP 6.E4 Construct

and/or support an argument with evidence, data, and/or a model, LS2.A-E1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem., CCC 5.2 Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.

- Lesson 13, Synthesize Section, Step 5 "Facilitate a discussion about fungi. Display slide E. Use the prompts below and sentence starters on the slide to facilitate a brief discussion about what students figured out about fungi from the article. Remind students to use the evidence that they recorded on the Fungi Evidence Collector handout to support their answers." (Lesson 13, Teacher Guide) SEP 8.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. 8.E4: Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. LS2.A-E1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. CCC 5.E3 Energy can be transferred in various ways and between objects.

The three dimensions are integrated to support sense-making over time because the dimensions are not used in isolation and are necessary for students to figure out the phenomenon. In most activities in the unit, students are expected to figure out something that requires the use of three dimensions working together at grade level.

- Lesson 4, Synthesize Section, Step 4: "Facilitate a Building Understandings discussion. Display slide N Gather students in a Scientists Circle with their Interpret Plant Data handout for a Building Understandings Discussion. Explain to students that our goal in a Building Understandings Discussion is to consider how the plant investigation data can serve as evidence to help us figure out what plants need to grow." (Lesson 4, Teacher Guide) SEP 4.E2: Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation, LS1.C-E2: Plants acquire their material for growth chiefly from air and water, CCC 4.E2: A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. CCC 4.E3: A system can be described in terms of its components and their interactions.
- Lesson 7, Synthesize Section, Step 5, "Construct an argument about environments that support plant growth." (Lesson 5, Slide G) SEP 6.E4 Construct and/or support an argument with evidence, data, and/or a model., PS1.A-E1: Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. LS1.C-E2: Plants acquire their material for growth chiefly from air and water, CCC 5.E1: Matter is made of particles. CCC 5.E2 Matter flows and cycles can be tracked in terms of the weight of the

substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems.

- Lesson 10, Synthesize Section, Step 6: "In this task, use what you have figured out during this unit to develop and use a model that explains how animals use matter and energy from food. To help you do this, you will first identify how one animal's needs are met by a nurse log system, then develop a model. Finally, you will use the model to explain where the matter goes in the system." (Lesson 10, 5.1 Lesson 10 Student Assessment 1 Ensatina Salamanders & Nurse Logs) SEP 2.E3: Develop and/or use models to describe and/or predict phenomena. LS1.C-E1: Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. CCC 5.E1: Matter is made of particles. CCC 5.E2 Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems. CCC 5.E3 Energy can be transferred in various ways and between objects.
- Lesson 13, Synthesize Section, Step 5: "Transition to modeling. Explain that we have figured out some big ideas in the past two lessons, and it's a good time to model to explain how fungi get and use matter and energy, and how they act as decomposers in natural systems. Use slide L to introduce the modeling task on the Model a Mushroom." (Lesson 13, Teacher Guide) SEP 2.E3: Develop and/or use models to describe and/or predict phenomena. LS2.A-E1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. CCC 5.E3 Energy can be transferred in various ways and between objects.
- Lesson 15, Synthesize Section, Step 2: "Facilitate a Consensus Discussion while adding the American Bullfrog to the class consensus model. Have students turn their attention to the class consensus model. Display slide B and explain that since we have made this important discovery about what could happen to the nurse log food web with the addition of a new species, it is important that we record our thinking by updating our consensus model. Ask students to add their ideas about how the flow of matter and energy would change in the nurse log food web with the presence of the bullfrog." (Lesson 15, Teacher Guide) SEP 6.E1: Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard). 6.E2: Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem., LS2.A-E1: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem., CCC 1.E2: Patterns of change can be used to make predictions. CCC 4.E2 A system can be described in terms of its components and their interactions. CCC 5.2 Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. The total weight of the substances does not change. This is what is meant by conservation of matter. Matter is transported into, out of, and within systems

Suggestions for Improvement: NA

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 reviewers found extensive evidence that the lessons fit together coherently to target a set of performance expectations because lessons are sequenced logically in a way that is coherent from the students' perspectives. Students can see how what they are trying to figure out in one lesson builds on previous lessons and fits into the larger goal for the unit. Students are supported to build toward all of the three-dimensional learning goals. Questions that arise from one investigation are often used as the focus of the next investigation. Students have regular opportunities to ask questions based on what they have learned so far and revisit their questions in subsequent lessons. Each lesson contains a navigation section to begin and end the lesson, which focuses on what questions students have been addressing, what they have figured out, what additional questions they have, and what they might need to investigate next. In the three main lesson segments, students revisit the DQB and add answers to the questions they figured out in that segment. Students are reminded that they can add questions to the DQB at any time.

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.

- Every lesson contains a Navigate section to begin the lesson and to end/transition the lesson to the next one, which arises from questions that arose during the lesson. At the end of the three main learning segments, students are provided an opportunity to revisit the DQB to determine what they have figured out and what new questions they might have. Examples of this include:
- Lesson 2, Navigate Section, Step 1: "Recall our questions from last time. Revisit students' investigation ideas and the Driving Question Board from the end of Lesson 1. Focus on ideas and questions related to looking closer at the nurse log, or identifying some of the organisms that students think live in, on, or around a nurse log." (Lesson 2, Teacher Guide)
- Lesson 5, Navigate Section, Step 6: "Revisit the DQB. Display slide N. Direct students to the DQB and consider saying something like *We have figured out a lot of important ideas in these last few lessons! Let's see if we can check off any of our questions from the beginning of the unit.* Either lead the class or Invite students to come up to the DQB and select questions that they think we have answered, especially related to plants and how they grow. Add check marks to those sticky notes. Notice if there are questions on the Driving Question Board about how plants use light, or if students had questions about light on the last question of the *Model to Explain Plants & Matter*. As time allows, have students add new questions to the DQB." (Lesson 5, Teacher Guide)
- Lesson 11, Navigate Section, Step 1: "Discuss where we left off. Display slide A. Ask students what we have figured out so far about how nurse logs help animals live and grow. Direct students to the updated DQB and Consensus Model from the previous lesson as needed. Decide where to go next. Display slide B and consider saying something like, *We figured out that termites are eating the wood from the nurse log and using the matter to grow and produce eggs. Can you eat wood and use it to gain matter or energy? Of course not! So how do you think termites do it?* Accept all student responses." (Lesson 11, Teacher Guide)

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

5-PS1-1: Develop a model to describe that matter is made of particles too small to be seen.

- Lesson 5, Explore Section, Step 4: "Model our new ideas about air. Display slide K. Direct students back to the class model of the beach ball, emphasizing that now we have figured out some new ideas about how to represent the air as matter." (Lesson 5, Teacher Guide)
- Lesson 5, Explore Section, Step 4: "Add a key to the model for air particle and gas. If you haven't already, define particle as a tiny piece of matter that is too small to be seen with our eyes and add to the Word Wall." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5: "The following discussion and students' models on Model to Explain Plants & Matter provide an opportunity to formatively assess students' modeling practice and understanding that particles of air and water moving through the pumpkin plant provide the matter needed to grow, as in Learning Goal 5.B." (Lesson 5, Teacher Edition)
- This is reinforced throughout the rest of the unit whenever students create a model of the movement of matter at the particle level.

5-PS3-1: Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.

- Lesson 6, Explore Section, Step 3: "Conduct sunlight investigation. Lead the class to either go outside or to a window with ample sunlight streaming through. Students should place their solar toys into the light and use their Investigate Sunlight handouts to document the changes that they observe." (Lesson 6, Teacher Guide)
- Lesson 6, Connect Section, Step 5: "Review what we have figured out. Display slide K. Ask students to look at the image of the plant and Sun on the slide and consider how they would explain to someone how plants use energy from the Sun for growth." (Lesson 6, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: "A food chain shows how energy is originally transferred from the Sun to producers (plants), which use and also store the energy. The energy is released when consumers like isopods eat the once-living plants. The energy then is transferred to the other consumers when they eat the isopods!" (Lesson 9, Teacher Guide)
- Lesson 11, Connect Section, Step 3: "As you re-watch the video (only 2:38-3:19) with the sound on, add any additional evidence to help explain how termites get matter and energy from wood." (Lesson 11, Slide H)

5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.

- Lesson 4, Connect Section, Step 5: "Update our Growing Ideas charts. Conclude the read aloud and discussion by pointing out that we figured out how plants use soil, so we are ready to summarize the work we did in this lesson. If time allows, give students a few minutes to reflect on the investigation and the article. Display slide P and distribute My Growing Ideas, unless students are keeping these ideas in a science notebook. Possible sample responses are shown below." (Lesson 4, Teacher Guide)
- Lesson 5, Navigate Section, Step 6: "Display slide O to review with students how in Lesson 4 they figured out that plants need water, light, and air to grow. Now that they have evidence that shows that plants get their matter from water and air, ask students what they think light provides to plants." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Look to see if students understand that plants take in matter in the form of air and water in order to grow. Air is taken in through leaves and water is taken in through roots. The matter particles are too small to see so students should use symbols to represent the particles and these symbols should be defined in the model key." (Lesson 7, Teacher Guide)

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

- Lesson 8, Synthesize Section, Step 6: "Provide scientific name for what we have figured out. Display slide Q. Tell students that they have figured out an important science idea that scientists call the conservation of matter. Matter does not simply appear or disappear; it moves around from one part of a closed system to another. The total amount of matter in a closed system does not increase or decrease, because it is closed! Ask students when they have heard or used the word "conserve" or "conservation" and what they think it means." (Lesson 8, Teacher Guide)
- Lesson 10, Synthesize Section, Step 6: "Read about the ensatina salamander. Then model to explain how the nurse log system meets its needs for matter and energy." (Lesson 10, Slide I)
- Lesson 11, Synthesize Section, Step 4: "Have students bring their completed copy of Evidence for Termite Matter and Energy and form a Scientist's Circle around the Termite Matter & Energy chart you prepared before class. Use the following prompts to lead a discussion and build a class model based on evidence and ideas from students." (Lesson 11, Teacher Guide)
- Lesson 12, Navigate Section, Step 1: "Reorient to other organisms in the nurse log system. Display slide B. Remind students that we have previously observed some of these images of nurse logs over time. In Lesson 2, we were focused on what was happening at the beginning of a fallen tree becoming a nurse log. In Lesson 8, we figured out that eventually the parts of the nurse log seem to disappear, but actually the matter gets cycled into the system as it is eaten by termites. Ask students to observe and talk with a partner: What happens to the nurse log in between? What clues can we observe in these images?" (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize Section, Step 5: "Transition to modeling. Explain that we have figured out some big ideas in the past two lessons, and it's a good time to model to explain how fungi get and use matter and energy, and how they act as decomposers in natural systems. Use slide L to introduce the modeling task on the Model a Mushroom." (Lesson 13, Teacher Guide)

Suggestions for Improvement: NA

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 reviewers found extensive evidence that links are made across the science domains when appropriate because the unit requires more than one science domain to fully address the nurse log phenomenon. Grade-appropriate DCI connections from life science and physical science are required for students to figure out how a nurse log supports other living things to live and grow. In addition, grade-appropriate elements of the CCC Matter and Energy are used with different science domains to make sense of the nurse log phenomenon. Consistently using the terms *matter* and *energy* to discuss physical and living systems helps students link these ideas across domains.

i. Disciplinary core ideas from different disciplines are used together to explain phenomena.
Evidence from the materials where the criterion was met was found in lessons 5, 6, 10, and 13.

- Lesson 5, Synthesize Section, Step 5, Teachers are prompted to connect how students modeled air particles in the inflated beach ball (physical system) to how they might model air particles intake in plants (living system). This discussion and modeling is then applied to considering water in a syringe (physical system) to water intake in plants (living system). (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize Section, Step 4, Teachers are prompted to lead a discussion of the changes that sunlight causes in the solar toys to other changes that sunlight can cause (e.g., move, grow, heat, electricity, light) in physical and living systems. "*It sounds like we have figured out that the sun's light has energy and can transfer that energy to other things to cause changes. That is such an interesting idea, I am now wondering how the Sun's light changes plants?*" (Lesson 6, Teacher Guide)
- Lesson 10, Explore Section, Step 2, Teachers are prompted to elicit components and interactions for the class "Gotta-Have-It Checklist" for their model that explains how a nurse log helps animals live and grow that includes considering matter and energy in physical and living systems. (Lesson 10, Teacher Guide)
- Lesson 13, Explore Section, Step 4, Teachers are prompted to lead a discussion about fungi as decomposers. "What was the original source for the matter in the dead leaves and other stuff? *The leaves used to be part of a living tree or plant, so they must have the stored sugars that were made by the plant using the Sun's energy left in them. The leaves have air and water particles in them, from when the living plant used air and water for matter to grow.*" (Lesson 13, Teacher Guide)

ii. The usefulness of crosscutting concepts to make sense of phenomena or design solutions to problems across science domains is highlighted.
Evidence from the materials where the criterion was met with respect to EM-E1, EM-E2, and EM-E3 was found in lessons 5, 6, 7, 10, and 13.

- Lesson 5, Navigate, Step 1: "*We figured out through the pumpkin judging investigation that weight (or mass) is the most accurate way to measure matter, or how much "stuff" is in an object.*" (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize, Step 5, Call Out "Students continually engage with this crosscutting concept throughout this unit, across different kinds of systems. Use this discussion and the modeling activity to emphasize how matter (air and water particles) is transported into, out of, and within systems- both physical (beach ball and syringe) and living systems (pumpkin and other plants). Students will return and engage more deeply with the idea that water is made of particles in the *Water Unit* unit." (Lesson 5, Teacher Edition)
- Lesson 6, Synthesize, Step 7: Suggested ideas to include in students' Growing Ideas Chart prompt teachers to help students consider how sunlight is energy. "How does light help plants grow? Sunlight causes observable changes that are evidence of energy transfer. Plants can transfer energy from sunlight, which they can use to combine the matter from air and water to produce sugar." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize, Step 3, Teachers are prompted to remind students about what they know about the matter that plants need to grow and live and how they represent it as particles when developing a Gotta-Have-It Checklist to use to revise their nurse log model. Additionally, they are prompted to remind students about how they know plants use energy from the sun and relate back to their investigation of solar toys as evidence. (Lesson 7, Teacher Guide)
- Lesson 10, Explore, Step 2 Teachers are prompted to have students include matter and energy interactions in their Gotta-Have-It Checklist. "What interactions will we need to include as we model? *Animals getting matter and energy from their food. Matter moving as air and water particles from the environment into the plant, and energy being transferred from the Sun, to make sugar and then into animals as they eat plants or the nurse log.*" (Lesson 10, Teacher Guide)

- Lesson 13, Synthesize, Step 5, "Transition to modeling. Explain that we have figured out some big ideas in the past two lessons, and it's a good time to model to explain how fungi get and use matter and energy, and how they act as decomposers in natural systems." (Lesson 13, Teacher Guide)

Suggestions for Improvement: NA

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 reviewers found extensive evidence that the materials provide grade-appropriate connections to the Common Core State Standards in Mathematics and/or English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects because the materials explicitly state the Mathematics and ELA standards that are used in the unit and support students to see the connections between content areas. These pieces of evidence were selected because students' learning is connected to the use and learning of mathematics and ELA, and students see where these disciplines are useful within their sensemaking. Student reading materials include several different formats, such as narrative stories, articles, and infographics. The Matrix Document explicitly claims the Mathematics and ELA standards that are used in the unit, and evidence was found in those areas. Additional guidance was provided in callout boxes for teacher reference.

ELA

CCSS-ELA-LITERACY.L.5.4A Use context (e.g., cause/effect relationships and comparisons in text) as a clue to the meaning of a word or phrase. Claimed in Lessons 2 and 11. Evidence was found in 11, examples include

- Lesson 2, Synthesize Section, Step 3: "Ask students to help you know where to draw a big line or circle around the log and all of the things that students think are found in, on, or around it. Write the word "System" above the line or circle. Transition to focusing on the parts of the system: the things that students observed in, on, and around the nurse log. Identify these parts as components of the system and add the term 'component' to the model." (Lesson 2, Teacher Guide)

Evidence was found in 11, examples include

- Lesson 11, Connect Section, Step 3: "As students finish reading, ask students to share new words that they circled, or words that seem important to figuring out how termites can use the wood for matter and energy. Document any words that students identify. Students can use the context of the article to identify words and phrases that help explain the meaning of words in the text. Students can also use their prior knowledge to help define the words. For digest and microscopic organism, use the word wall cards to support defining with words and pictures, and add them to the Word Wall." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.L.5.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
Claimed in Lesson 3. Evidence was found in 3, examples include

- Lesson 3, Explore Section, Step 4: "Introduce a scientific term. Display slide L. Build the ideas that students shared to explain that when we weigh a pumpkin, we are measuring how much "stuff" is inside the pumpkin. Scientists would say that we are measuring the amount of matter, or the mass, of the pumpkin." (Lesson 3, Teacher Guide)

CCSS.ELA-LITERACY.RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
Claimed in Lesson 8. Evidence was found in 8, examples include

- Lesson 8, Connect Section, Step 4: "Page 18: How does the nurse log help different animals meet their needs?" (Lesson 8, Teacher Guide)
- Lesson 8, Connect Section, Step 4: Let's read to figure out more about if animals are eating the nurse log. Questions to consider: How do animals interact with the nurse log? Could animals be the reason that nurse logs seem to disappear from the forest?" (Lesson 8, Slide M)

CCSS-ELA-LITERACY.RI.5.6 Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.
Claimed in Lessons 4 and 9. Evidence was found in 4 and 9, examples include

- Lesson 4, Connect Section, Step 5 Literacy Supports callout: "Prompting students to compare information from the article to their investigation findings is an opportunity to connect to RI.5.6, as they analyze multiple accounts of the same topic and note similarities and differences between the author's point of view in the Soil article and student's point of view from their investigation work." (Lesson 4, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6: "How are consumers different from the producers we focused on in the first part of our unit?" (Lesson 9, Slide R)

CCSS-ELA-LITERACY.RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).
Claimed in Lesson 11. Evidence was found in 11, examples include

- Lesson 11, Connect Section, Step 3: "Read the Termite Guts article with your partner. Then use the boxes and lines below to write or draw at least three pieces of evidence that explain how termites get matter and energy from wood. Be sure to describe or show the scale of the termite compared to the wood and other important parts." (Lesson 11, 5.1 Lesson 11 Handout Evidence for Termite Matter and Energy)

CCSS-ELA-LITERACY.RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
Claimed in Lesson 10. Evidence was found in 10, examples include

- Lesson 10, Synthesize Section, Step 6: "In this task, use what you have figured out during this unit to develop and use a model that explains how animals use matter and energy from food. To help you do this, you will first identify how one animal's needs are met by a nurse log system, then develop a model. Finally, you will use the model to explain where the matter goes in the system." (Lesson 10, 5.1 Lesson 10 Student Assessment 1 Ensatina Salamanders & Nurse Logs)

CCSS-ELA-LITERACY.SL.5.1B Follow agreed-upon rules for discussions and carry out assigned roles.
Claimed in Lessons 1 and 3. Evidence was found in 1 and 3, examples include

- Lesson 1, Synthesize Section, Step 2 Community Connections callout: "If this is your first science unit of the year, plan to spend about 30 minutes building classroom agreements using the Establishing Classroom Agreements teacher reference for how we figure things out in science, before engaging in the next component of this lesson. Establishing agreements for your classroom community now will allow students

to practice them during the upcoming discussion. If you have already established classroom agreements for science, take this opportunity to review them with students and add examples of how the agreements look, sound, and feel in your class." (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 4 Literacy Supports callout: "Establishing and returning to the classroom agreements provides an opportunity for students to develop and follow agreed-upon rules for discussion and connect to SL.5.1B. Students' use of the classroom agreements, specifically as they listen to others with care and speak one at a time about the topics and texts under discussion in each lesson, allows them to learn pragmatic rules for discussion and how to communicate in large and small group settings." (Lesson 3, Teacher Guide)

CCSS-ELA-LITERACY.SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence. Claimed in Lesson 12. Evidence was found in 12, examples include
- Lesson 12, Synthesize Section, Step 3: "Facilitate a Building Understandings discussion. Elicit groups to share the comparisons that their group decided on in Part D of the Investigate Mushrooms handout. As groups share their ideas, press them for their evidence from the different data sources in the investigation. Ask other groups if they think something similar or different, reminding them that they do not need to reach consensus on all ideas shared. Prompt them to use the sentence starters on the slide to support discussion, as they have practiced in previous lessons." (Lesson 12, Teacher Guide)
- Lesson 12, Synthesize Section, Step 3 Literacy Supports callout: "As students engage in discussion, remind students to compare how each groups' ideas are similar and different from their own. When and if students' ideas differ, encourage students to summarize their classmates' ideas and explain how each claim is supported by evidence. This work helps students figure out where mushrooms get matter and energy to grow and supports SL.5.3 as they summarize the points a speaker makes and explain how each claim is supported by evidence." (Lesson 12, Teacher Guide)

CCSS-ELA-LITERACY.W.5.2D Use precise language and domain-specific vocabulary to inform about or explain the topic.
Claimed in Lessons 14 and 15. Evidence was found in 14 and 15, examples include
- Lesson 14, Synthesize Section, Step 5: "Check in about students' new understandings with an exit slip. Display slide M and explain to students that since we have figured out some big ideas about how a newly introduced species can disrupt the balance of a food web, now would be a good time to check in with ourselves about how we are understanding the health and balance of food webs." (Lesson 14, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6: "Introduce the Grassland ecosystem task. Display Slide H, and explain to students that now that we have had an introduction to the Grassland ecosystem, we are going to use what we know about the ways matter and energy flow through an ecosystem to think about how this happens in the Grassland ecosystem." (Lesson 15, Teacher Guide)

CCSS-ELA-LITERACY.W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
Claimed in Lesson 7. Evidence was found in 7, examples include
- Lesson 7, Synthesize Section, Step 3 Literacy Supports callout: "Encourage students to add details to their model to explain what they have found in their investigations throughout the unit. Also, help students consider their audience right now - their classmates - to support W.5.4. Students can write clearly and coherently to ensure their classmates understand their model and their sensemaking." (Lesson 7, Teacher Guide)

CCSS-ELA-LITERACY.W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
Claimed in Lesson 13. Evidence was found in 13, examples include

- Lesson 13, Connect Section, Step 2 Literacy Supports callout: "Students reading the article and drawing evidence from the text to support their explanation of how fungi get matter and energy and help other organisms is an opportunity to connect with W.5.9. As students draw evidence from informational texts to support analysis and reflection, they identify key details in a text which supports their explanations and their sensemaking." (Lesson 13, Teacher Guide)

Mathematics

CCSS-MATH-Practice.MP4 Model with mathematics.
Claimed in Lesson 4 and 8. Evidence was found in 4 and 8, examples include

- Lesson 4, Explore Section, Step 3: "What do you notice about the data for plants A, B, C? Are there other ways to represent the data to better help us see patterns? How would graphing this data be helpful?" (Lesson 4, Slide J)
- Lesson 4, Explore Section, Step 3 Math Supports callout: "As students analyze this lesson's graphs to determine patterns in the growth of plants in each environment, they are interpreting data in the first quadrant of the coordinate plane. Ask students to identify what key features of the graph mean in the context of the situation to support students' interpretation of the data." (Lesson 4, Teacher Guide)
- Lesson 8, Explore Section, Step 5: "Display slide O and distribute the Analyze Data of a Termite Colony handout and the graph in Weight of a Termite Colony in a Closed System. Use the slide to walk through the data table at the top of the handout and the graph in Weight of a Termite Colony in a Closed System. Clarify that Week 0 is the starting point of the data set (like the starting line of a race) and explain that a gram is approximately the weight of one paperclip, with 100 grams being about the same weight as the nurse log in your classroom's Nurse Log in a Box. Pause to orient students toward the graph and identify how the data from the table are also represented in the stacked bar graph, a visual representation that may be unfamiliar to students." (Lesson 8, Teacher Guide and Slide O)

CCSS-MATH-Practice.MP6 Attend to precision.
Claimed in Lesson 3. Evidence was found in 3:

- Lesson 3, Explore Section, Step 4: "Explain why this method of judging is the fairest…Were there any methods or measurements your group talked about, but then decided NOT to use? If so, why did you decide against them?" (Lesson 3, Handout 5.1 Investigate How to Fairly Measure Pumpkins)

CCSS-MATH-5.G.A.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).
Claimed in Lesson 4. Evidence was found in 4, examples include

- Lesson 4, Explore Section, Step 3 Math Supports callout: "As students analyze the graphs for Plants A, B, and C as a class, press students to point to specific elements of the graph as they describe what they notice in the discussion. For example, press students to connect that each data point on the graph links to two pieces of information: one number that indicates the number of weeks on the x-axis and a second number that indicates the plant's weight in grams on the y-axis." (Lesson 4, Teacher Guide).

CCSS-MATH-5.G.A.2 Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
Claimed in Lesson 4. Evidence was found in 4, examples include

- Lesson 4, Explore Section, Step 3: "What do you notice about the graph for Plants A, B, C? How does what we see on the graph compare to the data on p. 1 on our Plant Data handout?" (Lesson 4, Slide K)
- Lesson 4, Explore Section, Step 3 Math Supports callout: "As students analyze this lesson's graphs to determine patterns in the growth of plants in each environment, they are interpreting data in the first quadrant of the coordinate plane. Ask students to identify what key features of the graph mean in the context of the situation to support students' interpretation of the data." (Lesson 4, Teacher Guide)

CCSS-MATH-5.NBT.A.3b Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
Claimed in Lesson 8. Evidence was found in 8, examples include

- In Lesson 8, Explore Section, Step 5: "Notice patterns in the weight of the log. Is it going up, going down, or staying the same?" (Lesson 8, 5.1 Lesson 8 Handout Analyze Data of a Termite Colony)

CCSS-MATH-5.NBT.B.7 Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.
Claimed in Lesson 8. Evidence was found in 8, examples include

- Lesson 8, Explore Section, Step 5: "Calculate the weight of the entire closed system in Week 0. Add up the weights of all the system components (log, queen, other termites, and poop) without rounding, and write your answer in the column of the table marked "Total Closed System". What is the total weight of the closed system in Week 0?" (Lesson 8, 5.1 Lesson 8 Handout Analyze Data of a Termite Colony)
- Lesson 8, Explore Section, Step 5: "Do the same for weeks 1-10. What do you notice about the total weight of the system every week? Why do you think this happens?" (Lesson 8, 5.1 Lesson 8 Handout Analyze Data of a Termite Colony)

Suggestions for Improvement: NA

CATEGORY II
NGSS Instructional Supports

II.A. Relevance and Authenticity

II.B. Student Ideas

II.C. Building Progressions

II.D. Scientific Accuracy

II.E. Differentiated Instruction

II.F. Teacher Support for Unit Coherence

II.G. Scaffolded Differentiation Over Time

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.

The reviewers found extensive evidence that the materials engage students in authentic and meaningful scenarios that reflect the practices of science and engineering as experienced in the real world because students experience the nurse log phenomenon firsthand and through photos, videos, and an actual nurse log. The phenomena, problems, and classroom activities used are engaging for students and reflect grade-appropriate, realistic scenarios that students are authentically motivated to figure out or solve.

The materials include suggestions for connecting instruction to the students' homes, neighborhoods, communities, and cultures. Students have multiple opportunities to relate the phenomena they figure out to their own prior experiences or communities.

The materials provide support to teachers for connecting instruction to all students' homes, neighborhoods, communities, and cultures as appropriate, with a particular emphasis on making connections for students from underserved communities, including flexibility to enable adaptations to fit students' local contexts. Teachers are supported in cultivating student questions and ideas that connect to students' experiences and community. The materials provide opportunities for students to connect their explanation of a phenomenon and/or their design solution to questions from their own experiences when they debrief their "outdoor tours" to look for moss or similar plants and decomposers in their schoolyard and/or community.

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

- Lesson 1, Explore Section, Step 1: "Observe a variety of pictures." (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2: "Introduce the nurse log exploration stations. (pictures, video, and nurse log components." (Lesson 2 Teacher Guide)
- Lesson 8, Connect Section, Step 4: Read a book: "Consider saying something like Since we can't observe termites eating our nurse log directly, let's look at data about termites and logs to figure out if they are really able to eat the entire log until all the matter is gone.) (Lesson 8, Teacher Guide)
- Lesson 12, Explore Section, Step 3: Students are observing the mushroom grow kits and analyzing the data over time. "Purpose: Give students an opportunity to observe mushrooms, so they can begin to gather evidence about how they get matter and energy from the nurse log." (Lesson 12, Teacher Guide)
- Lesson 15, Connect Section, Step 4: "Introduce a new ecosystem. Display slide D, and tell students that we are going to get the opportunity to continue exploring ecosystems. We are going to explore a different ecosystem called the Grasslands. Remind students that we have been deeply exploring the organisms in the nurse log food web, and now we will get a chance to explore the organisms in a different food web. We will have a chance to think about how all of the organisms in the Grasslands meet their needs for survival.

Explain that in order to figure out about the types of organisms that live in the Grasslands, we are going to watch a video, and it will be important to observe and record the types of organisms that live there." (Lesson 15, Teacher Guide)

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

- Lesson 2, Explore Section, Step 2, Broadening Access Callout: "As noted in Lesson 1, students may attempt to identify the things they see as living or nonliving. These characterizations depend on cultural perspectives. (e.g., Indigenous cultures focus on the interconnected relationships among all things, so youth from Indigenous backgrounds may identify more components as living, in comparison to more binary Western perspectives). Additionally, nurse logs contain more biomass than when they were standing trees, so there are many living and growing aspects to this once-living tree. Instead, focus students on observable characteristics, such as movement, size, color, shape, and texture." (Lesson 2, Teacher Guide)
- Lesson 2, Connect Section, Step 4: "Give instructions for going outside. Outside of class, students can tour any kind of accessible, safe outdoor space: playground or play area, around a city block, in a park, in a natural area, etc. Distribute the Nurse Logs Components in Our Community...Prompt students to share their observations. As on slide F, students share what they observed on their nature tour with a partner and then with the class, focusing especially on their observations of moss." (Lesson 2, Teacher Guide)
- Lesson 7, Connect Section, Step 4: "Introduce home connection activity. Welcome students to complete the Nurse Logs Claim handout outside of school, as shown on slide F." and "Use the handout to help you evaluate a claim about nurse logs and think about other situations where something might be acting as a nurse log. Talk with other people in your family or community to gather some of their ideas, too." (Slide F) (Lesson 7, Teacher Guide)
- Lesson 8, Connect Section, Step 4, Read a Book, Broadening Access callout: "In some cultures, owls may represent a bad omen and students may carry negative ideas, experiences, or stories around them. To reduce threats and create a safe space prior to reading the book, express that animals present in this book may represent various symbols and significance in different cultures, and that they are all important and valid. Invite students to share any stories and follow these 3 steps: 1) Be Curious (e.g., what was that like for you?), 2) Validate (e.g., it makes a lot of sense why that would be scary.), and 3) Thank the student (e.g., thank you for sharing with us.)." (Lesson 8, Teacher Guide).
- Lesson 12, Connect Section, Step 4: "With a trusted grownup, take a 10-minute tour of an outdoor space, such as: playground, park, around a city block, natural area. Look for any decomposers that might be in the area. Look for any evidence that decomposers have been in the area. Use the table below to write/draw the decomposers and/or evidence of decomposers that you saw." (Lesson 12, 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.

Evidence from the materials where the criterion was met,

- Lesson 7, Navigate Section, Step 6: "Prompt students to ask more questions. Display slide K as you pass out 1-2 blank sticky notes to each student. Give students a few minutes to think and write on their own. Then direct them to share new questions and ideas with their group. Any question that the group agrees is still not answered can be added to the Driving Question Board. After adding new questions, congratulate students on the ideas they have figured out so far and tell them we still have time to explore some of our new questions. Note if students have questions (added at this time or earlier in the unit) about how long it takes a fallen tree to become a nurse log, to refer back to in Lesson 8." (Lesson 7, Teacher Guide)
- Lesson 10, Navigate Section, Step 7: "Prompt students to ask more questions. Display slide K as you pass out 1-2 blank sticky notes to each student. Give students a few minutes to think and write on their own.

Then direct them to share new questions and ideas with their group. Any question that the group agrees is still not answered can be added to the Driving Question Board." (Lesson 10, Teacher Guide)

- Lesson 10, Navigate Section, Step 7, Broadening Access callout: "Returning to the DQB and asking questions promotes meaningful investigations for students because they understand how their investigations are grounded in their questions about the lesson phenomenon. Additionally, these questions can focus students on making sense of different aspects of the nurse log system that they are most curious about, supporting their engagement and optimizing relevance for them." (Lesson 10, Teacher Guide)

Suggestions for Improvement: NA

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 the materials provide students with opportunities to share ideas with peers directly, to elicit ideas from others, and to use others' ideas to improve or change their own thinking. Students are positioned as the central focus of classroom discussions through teacher facilitation directions, and discourse focuses on explicitly expressing and clarifying student reasoning. Students have frequent opportunities to share ideas and feedback with one another directly and to use others' ideas to improve or change their own thinking. Student artifacts include elaborations—which may be written, oral, pictorial, or kinesthetic—of reasoning behind their answers and show how students' thinking has changed over time. The teacher's guide provides supports for eliciting student ideas and giving feedback on student thinking. All students are supported in making productive contributions to classroom discourse in a variety of ways.

Classroom discourse includes explicitly expressing, clarifying, and justifying student reasoning. The teacher has enough support to act as an expert facilitator and draw out individual student ideas and multiple perspectives in an identity-affirming way. The support is specifically customized to the lesson materials. The students have opportunities to share ideas with peers directly, to elicit ideas from others, and to use others' ideas to improve or change their own thinking.

- Each lesson provides teachers with prompts and listen fors for class, small group, and partner discussions. Many of the lessons provide follow-up or challenging questions for the teacher to use to help students clarify, justify, or build upon their ideas. Often, a slide displays sentence starters to support student's thinking and sharing of their ideas.
- The resource, Discussion Type Prompts, provides teachers with discussion prompts to use during OSE routine classroom discussions and can be used to provide opportunities for students to express, clarify, justify, interpret, and represent their ideas (Lesson 1, Teacher Reference Discussion Type Prompts).
- Lesson 1, Explore Section, Step 1, Teaching Tip callout: "The purpose of an Initial Ideas Discussion is to provide an opportunity for students to share and make sense of their observations and ideas, starting toward an explanation even while the ideas are new and tentative or uncertain. Use talk moves like *revoicing* and *Say more* to help clarify the ideas so that others can work with them. The goal is to surface multiple ideas, so avoid privileging some ideas over others. Draw out possible competing ideas to motivate

students at the end of the lesson to propose investigation ideas for those areas of uncertainty." (Lesson 1, Teacher Guide)

- Lesson 2, Synthesize Section, Step 7, Teaching Tip callout: "A Building Understandings Discussion is a useful kind of discussion following an investigation because the purpose is to focus students on drawing conclusions based on evidence. Your role during the discussion is to invite students to share conclusions and claims and to push them to support their conclusions and claims with evidence. Students can disagree with each other and the class does not need to reach consensus on all ideas shared, but areas of disagreement can motivate future investigations." (Lesson 2, Teacher Guide)
- Lesson 8, Explore Section, Step 2: "Facilitate a brief discussion to share ideas. Use the prompts on the handout and slide I to lead a brief discussion to elicit students' observations, predictions, and questions. Document themes across their Noticings and Wonderings on a class chart as shown below.." (Lesson 8, Teacher Guide)
- In Lesson 10, Synthesize Section, Step 4: "Facilitate a Consensus Building discussion. Use the following prompts to facilitate a Consensus Building discussion about how a nurse log helps animals live and grow, inviting students to share their modeling ideas on Revised Nurse Log Model and referencing the Gotta-Have-It checklist for important ideas that we need to include and ways to represent those ideas." (Lesson 10, Teacher Guide)
- In Lesson 13, Synthesize Section, Step 3: "Facilitate a discussion about fungi. Display slide E. Use the prompts below and sentence starters on the slide to facilitate a brief discussion about what students figured out about fungi from the article. Remind students to use the evidence that they recorded on the Fungi Evidence Collector handout to support their answers." (Lesson 13, Teacher Guide)

Student artifacts include elaborations, reasoning, and reflection and show how students' reflective thinking has changed over time. Descriptions of student thinking include written, oral, pictorial, kinesthetic, or models.

- Throughout the unit, students record important ideas they have figured out on their Growing Ideas chart, which may change or be revised as new evidence arises. They are provided several opportunities to develop, use, and revise a model to help them explain how a nurse log helps other living things live and grow independently in small groups, as well as a class consensus model. Additionally, they engage in argumentation throughout the unit and are supported to use new evidence or new science ideas in their arguments. Informal and formal assessment opportunities throughout the unit provide opportunities for students to show changes in their thinking over time.
- Lesson 4, Explore Section, Step 3: "Support students in writing a scientific argument. After students finish the gallery tour, ask them to go back to their seats to complete Part B of the Interpret Plant Data handout. This will be their first opportunity to write a full scientific argument (claim, evidence, reasoning) so it may be helpful to briefly review each part prior to them attempting to write on their own." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5: "Model our ideas about plants and matter. Display slide M. Walk through the parts of the Model to Explain Plants & Matter handout for students to model their ideas. Distribute the handout to students and circulate to support their individual modeling process. Press them to represent particles similarly to how we did in the class model. Note that the first question in Part B will require students to look back at the scientific argument they wrote in Lesson 4, at the end of the Interpret Plant Data handout." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Facilitate a Consensus Building Discussion. Display slide E. Gather the class in a Scientists Circle around the chart paper you prepared before class. You may also want to have the initial consensus model within view so students can use it as a starting point and reflect on how their ideas have changed and grown. Use the prompts below to facilitate a Consensus Building discussion to support the class in modeling to explains how a nurse log helps plants live and grow, inviting students to share their ideas that they modeled on *Revised Nurse Log Model*." (Lesson 7, Teacher Guide)

- Lesson 8, Synthesize Section, Step 6: "Update our Growing Ideas charts. Display Slide T. Point out that we figured out really big ideas about the nurse log and animals, so this is a good time to summarize the work we did in this lesson." (Lesson 8, Teacher Guide)
- Lesson 14, Synthesize Section, Step 5: "Check in about students' new understandings with an exit slip. Display slide M and explain to students that since we have figured out some big ideas about how a newly introduced species can disrupt the balance of a food web, now would be a good time to check in with ourselves about how we are understanding the health and balance of food webs. Explain that we are going to do that by individually completing an exit slip. Let students know that the exit slip is a way for you to check in with each students' understanding of the new ideas we figured out." (Lesson 14, Teacher Guide)

Support is provided to guide constructive feedback to students from both the teacher and peers. The feedback is based on displayed student thinking related to the classroom task and is framed to support improvement in how students reason about the phenomenon or problem. Students have opportunities to reflect on and respond to the feedback they receive, when appropriate, using multiple modalities of expression.

- Lesson 6, Synthesize Section, Step 6 Assessment Opportunity: "Key formative assessment: Students' Model to Explain Plants & Energy models and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 6.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to model and explain in their own words in combination with key terminology (e.g., energy, transfer, matter, particle), and use evidence from their discussion and gestures with peers to assess their thinking. Refer to the Instructional Guidance for Lesson 6 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3 Assessment Opportunity: "Formative assessment: You can provide feedback to students about learning goal 7. A after collecting Revised Nurse Log Model or when you model as a class during the Consensus Discussion. Look to see if students understand that plants take in matter in the form of air and water in order to grow. Air is taken in through leaves and water is taken in through roots. The matter particles are too small to see so students should use symbols to represent the particles and these symbols should be defined in the model key." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3: "Formative and peer feedback: Use students Revised Nurse Log Model with the purpose of providing feedback and supporting students in Learning Goal 10.A. If students are not yet explaining or representing how matter and energy move through the system as animals eat food, encourage them to review the Gotta-Have-It checklist and key artifacts from Lessons 8 and 9. Additionally, explaining their model ideas to a peer verbally and using gestures provides an opportunity for students to figure out what they are representing and how to explain their ideas to others. This can be another moment to circulate and formatively assess. Finally, providing feedback to their partner supports them in improving their modeling practice and with better understanding of ideas about matter and energy. Students will have an opportunity to use the feedback from their partners when they revise their models before moving to a Consensus Discussion in the next part of the lesson." (Lesson 10, Teacher Guide)
- Lesson 12, Synthesize Section, Step 3: "The following discussion and Investigate Mushrooms provide an opportunity to gather evidence about Learning Goal 12, with the purpose of providing feedback and supporting students in using evidence to explain how mushrooms are different from plants and animals in terms of how they use energy. Use the following suggestions to provide feedback and determine next steps before moving on to the Connect." (Lesson 12, Teacher Guide)
- Lesson 13, Synthesize Section, Step 5: "Key formative assessment: Students' models and explanations on Model a Mushroom, as well as the Consensus Discussion that follows, provide opportunities to gather evidence about Assessment Statement 13.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to explain in their own words and use

gestures as they demonstrate their ideas about decomposers' role as a key component for matter cycling in the nurse log system. Refer to the Instructional Guidance for Lesson 13 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 13, Teacher Guide)

Suggestions for Improvement: NA

II.C. Building Progressions — Extensive

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 extensive evidence that the materials identify and build upon students' prior learning in all three dimensions because the materials explicitly state the expected level of prior proficiency students should have with all three dimensions for the core learning in the materials. A progression of learning toward the targeted three dimensions is clearly described for teachers for each section of the materials. Learning progresses logically throughout the materials. Explicit 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, along with guidance for how to help students negotiate their understandings. The support to teachers explains how the prior learning will be built upon.

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

- In the Front Matter document, the Unit Overview section details the Performance Expectations the unit builds towards and specifically details the elements of each dimension that are intentionally developed. (Front Matter)
- In the Front Matter document, the Unit Overview section addresses the question, "What ideas and experiences will students bring that can help them in this unit?" This section details prior learning students may have with relevant science concepts, SEPs, and CCCs intentionally developed in the unit. Possible misconceptions are addressed as well. (Front Matter) This information covers the three dimensions but does not provide information about learning in the specific elements of the dimension.
- In the Front Matter document, the Unit Overview section contains a chart that identifies the SEPs and CCCs intentionally developed in the grades 3-5 OpenSciEd materials. If OSE materials were used prior to 5th grade, then students would have had opportunities to develop all of the SEPs and all of the CCCs except structure and function and stability and change, which are not targeted in this unit. (Front Matter)
- In the Front Matter document, the Unit Overview section addresses "What ideas and experiences will students bring that can help them in this unit?" with respect to energy, how plants use matter and energy to produce food, how animals get and use matter and energy, argumentation, and systems and system models. Some examples of alternate conceptions identified in this section are: "Additionally, students may conceptualize that energy in food disappears once it is eaten by consumers. Use the focus on decomposers in Lessons 12 and 13 and build on the ideas of conservation of matter that students figured out in Lesson 8 to emphasize how energy also does not disappear but instead is continually transferred between organisms

and the environment." "Students may consider soil a major contributor of matter to plant growth." "Students may consider argumentation to be negative. They may bring ideas about everyday arguments to the classroom." (Front Matter)

- In the About the Science document, there is a "What are recommended adult-level learning resources for the science concepts in this unit?" section that provides resources "recommended to help build your understanding of the phenomena and Performance Expectations bundle for this unit. The level of understanding presented in these resources goes beyond what would be expected of your students' learning." (About the Science)
- The Assessment Opportunity section for each lesson provides teachers with ideas for what to look and listen for, as well as possible areas that students may be unclear about.
- Lesson 4, Explore Section, Step 2, Evaluate an Investigation in a Planning and Carrying Out Investigations callout: "Students who participated in the OpenSciEd Unit 4.1: Why does an object's motion change? (Sports & Games Unit) unit spent time intentionally developing this practice, especially by using fair tests in which variables are controlled and the number of trials considered. If your students did not engage with that unit, they will have fewer ideas to share at this moment, but they will build these ideas after watching the video in this step." (Lesson 4, Teacher Edition)This information does not specify which SEP element is being addressed.
- Lesson 6, Synthesize Section, Step 4: "Energy and Matter The Sports & Games Unit and Electricity Unit units may help students connect to the crosscutting concept related to energy transfer, and how energy could cause all these changes. If students don't bring up the idea of energy, introduce the concept by saying something like, We've all used the term energy before to describe things like if someone is acting very energetic or turning off lights to save energy. Energy is also an important idea in science. In 4th grade, you might have learned about evidence of energy transfer when we observe movement, light, sound, heat, or electrical currents." (Lesson 6, Teacher Guide)This information does not specify which DCI element is being addressed.

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

- 5.1 Unit Overview, Heading: "How is the unit structured?" provides a synopsis of each lesson and the order that learning is built upon.
- The Alignment with the Three Dimensions of NGSS matrices provides the element of the dimension being developed and details how students will be engaged in the element by lesson number.
- The Alignment with the Three Dimensions of NGSS matrices provides the element of the dimension being developed and details how students will be engaged in the element by lesson number.
- Lesson 2, Synthesize Section, Step 3: Systems and System Models callout: "OpenSciEd units Balanced Art Unit, 3.4, and Sports & Games Unit leverage the crosscutting concept of Systems and System Models. Even if students have not experienced those units, this unit will build their understanding. Students name system components, define open and closed systems (Lesson 4), and identify system interactions (Lesson 6). By the end of the unit, students will have practiced using systems thinking to explain the nurse log phenomenon and will show evidence of their understanding of systems on their final model." (Lesson 2, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5 Energy and Matter callout: "Students continually engage with this crosscutting concept throughout this unit, across different kinds of systems. Use this discussion and the modeling activity to emphasize how matter (air and water particles) is transported into, out of, and within systems- both physical (beach ball and syringe) and living systems (pumpkin and other plants). Students will return and engage more deeply with the idea that water is made of particles in the Water Unit unit." (Lesson 5, Teacher Guide)
- Lesson 14, Explore Section, Step 4 Systems and System Models callout: "Students have worked on describing a system in terms of its components and their interactions throughout this unit, here they build

on that use by thinking about how the interactions of components within a system will change when one of the components changes." (Lesson 14, Teacher Guide)

Suggestions for Improvement

- Consider adding element identifiers (e.g., MOD-E4) to the discussion of prior learning in the Unit Overview.

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 students use scientifically accurate and grade-appropriate scientific information, phenomena, and representations to support students' three-dimensional learning. The student-facing materials have precise, grade-appropriate wording to help students scaffold their understanding of concepts in all three dimensions, avoiding creating misconceptions. Science ideas and representations are accurate. Students are encouraged to express their scientific ideas in light of new evidence.

- In the document titled "About the Science", there is evidence supporting the use of scientifically accurate and grade-appropriate
- scientific information, phenomena, and representations to support students' three-dimensional learning.
- Lesson 3, Explore Section, Step 4, Teaching Tip callout: "In this unit, weight and mass are used interchangeably since these are not distinguished in NGSS until middle school. For this unit, the estimate of mass (the amount of matter contained in an item, which will remain constant in different gravitational forces) that is provided by measuring weight (a measure of how strongly gravity pulls on an item, will vary in different gravitational fields) by a common digital scale will be accurate enough. An example of the difference is that an object would have a different weight on the moon but the mass would stay the same as it is on Earth." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 4, Carry Out an Investigation, Math Supports callout: "and explain that scientists use grams to be more precise in their measurements during their investigations." (Lesson 3, Teacher Edition) Precision is a function of the use of measuring devices, not a function of units used. There are other reasons that scientists use SI units, including the desire to make global communication/ collaboration easier.
- Lesson 5, Explore Section, Step 4, Teaching Tip callout: "Students often think about representing air with wavy lines. If this idea is suggested to represent particles, emphasize how moving air (wind) could be represented by wavy lines, but use the evidence from the syringe exploration to emphasize how representing air that is still as dots or small circles with space in between them may be a more accurate way to show them." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5, Develop a Model to Explain callout: "Extension opportunity: Plants take air into their leaves through tiny holes called stomata. This concept is beyond 5th-grade level expectations in the NGSS, but students could view leaves under a microscope to observe stomata, or even observe air (oxygen) coming out of the stomata) by submerging the leaf in water." (Lesson 5, Teacher Guide)

- Lesson 6, Synthesize Section, Step 4: "Note that although heat is evidence of energy transfer for a sunburn, it is actually caused by UV radiation, which is beyond grade band. If this change comes up, students may identify the cause as heat. Acknowledge that idea and note that there is something slightly more complicated to actually cause sunburns." Identification of misconception and focus on grade-appropriate scientific information. (Lesson 6, Teacher Guide).
- Lesson 6, Connect Section, Step 5, Teaching Tip callout: "While the details of the process of photosynthesis are in the middle and high school grade bands of the NGSS, students may name the process that they just figured out as photosynthesis. If they do, consider providing extension opportunities for those students to understand more about the process and inputs/outputs, or acknowledge that scientists call this process photosynthesis, but that we do not need to figure out the details at this point." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3, Teaching Tip callout: "While the details of the process of photosynthesis are in the middle and high school grade bands of the NGSS, students may want to label some of the model interactions as photosynthesis. If they do, you can allow those students to do so, but we do not need to add that information to our class consensus model at this point." (Lesson 7, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5, Broadening Access callout: "The term glacier for Place D might be unfamiliar to students. To minimize threats, ask for students to share their experiences about what they know about glaciers and make sure the class agrees on a definition prior to taking the assessment on their own." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6, Teaching Tip callout: "Students may use the terms "cold-blooded" and "warm-blooded" to describe the difference. Connect to how organisms use energy to either move around their environment or internally balance temperature to emphasize that the temperature of their blood may be similar or different relative to their environment." (Lesson 9, Teacher Guide)

Suggestions for Improvement

- Consider distinguishing that precision in measurement is a function of the measuring device and the user. Scientists use the SI system of measurement because it allows them to compare data and communicate accurately with others across the globe.

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 for teachers to support differentiated instruction because the materials explicitly clarify how they anticipate the needs of students who might struggle with any of the three dimensions within a particular activity. The materials supply multiple and varied individualized learning strategies that support

three-dimensional sensemaking throughout a majority of the materials. The teaching materials provide detailed guidance describing how individual students with a variety of needs can be supported to access and engage in each specific learning activity. The materials provide a common learning sequence for all learners, ensuring students with diverse needs and abilities can access instruction. Materials suggest that teachers should provide multiple modalities for students to learn. The materials provide guidance describing how individual students with a variety of needs can be supported to access and engage in some learning activities, including extra supports for students who are struggling to meet the targeted expectations and extensions for students with high interest or who have already met the performance expectation in the three dimensions.

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.

- Unit Front Matter, Unit-Specific Strategies for Differentiation "In this unit, many opportunities to make sense of the phenomenon and investigations rely upon visual interpretation of photos, videos, or graphs. For students who have visual impairment, leverage the opportunities to tactically explore materials such as the Nurse Log in a box in Lesson 2 and Grow your own mushroom kit in Lesson 12. For graphs and other data interpretation, consider how to have class members orally describe the trends and outcomes so students can make sense of them and draw conclusions." (Unit Front Matter)
- Unit Front Matter, Unit-Specific Strategies for Differentiation "A key science practice that students undertake in this unit is modeling to explain progressing ideas about the nurse log system, including abstract concepts such as matter being made of particles and energy transferring between objects. All students, in accordance with their varying abilities to do so, can benefit from having opportunities to explain their models and represent their thinking across different forms of communication, such as verbally, using gestures, and by referencing and incorporating materials from prior lessons (e.g., nurse log photos, specimens that were examined, etc.). These opportunities are often built into the relevant sections of the lessons, but consider adding additional opportunities as needed so that students are fully supported in holistically expressing their sensemaking and evolving understanding around this unit's hard-to-visualize concepts." (Unit Front Matter)
- Additional Accessibility Resources provide seven specific accessible learning strategies to address students who may need extra support--multiple ways to communicate; extended time; repeat orally words that are written on shared representations; utilize text-to-speech and speech-to-text; utilize descriptive transcripts, alt text, and closed captioning; adjusting color; and accessing alternative formats of student files. (Additional Accessibility)
- Lesson 1, Explore Section, Step 1, Broadening Access callout: "The Notice and Wonder chart should capture not only students' ideas, but also the rich ways that students express their ideas. This is especially important for multilingual students because their language resources and practices are not always noticed or valued in school spaces. If a student shares an idea using words or phrases in a named language other than English (e.g., in Spanish, Arabic, Mandarin), record their idea exactly as they shared it and then add a translation in English next to it. If possible, have students record ideas onto the chart themselves." (Lesson 1, Teacher Guide)
- Lesson 3, Connect Section, Step 5 Broadening Access callout: "The terms in this book (such as argumentation, claim, evidence, and reasoning) are abstract concepts that may be difficult for students to grasp at first. While reading this book aloud, use nonverbal cues like gestures, facial expressions, and tonal inflection to help make these abstract concepts more tangible and memorable for students of all language backgrounds." (Lesson 3, Teacher Guide)
- Lesson 6, Explore Section, Step 2 Broadening Access callout: "Support multiple means of comprehension by prompting students to act out what they observed in the video. This promotes information processing

through visualization and embodiment, and provides multiple means of action and expression. Use the beach ball from Lesson 5 to represent the Sun or source of light, and have students move their bodies in the ways that they think plants would move. Note any movements or gestures that show how the plants move or turn towards the Sun, such as moving their arms or head/neck up towards the sun, or opening their arms towards the Sun while keeping their feet grounded in place. Then encourage student pairs as they share their ideas about how light helps plants grow to use whatever modalities of expression they choose: gestures, demonstrations, dance/movement, visual arts, named languages other than English, etc., including both scientific and everyday language." (Lesson 6, Teacher Guide)

- Lesson 11, Connect, Step 3, Broadening Access callout: "Support your students' access to the information in this video by turning on captions and varying the playback speed if needed. These strategies can help multilingual students, students developing their literacy skills and practices, and students whose processing preferences are not auditory." (Lesson 11, Teacher Guide)

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

- Lesson 2, Lesson Assessment Guidance: "Use this formative assessment opportunity to determine whether students need more support in asking testable questions. The questions that they ask about moss and other nurse log components can also be used to gauge their understanding about the nurse log as a system made up of components. You can support students by revisiting these practices (via the DQB) and concepts (via the modeling they will do of plants and particles) in the subsequent lessons that focus on plants. Students will return to testable questions in Lesson 8." (Lesson 2, Teacher Guide)
- Lesson 4, Lesson Assessment Guidance: "If many students are confused about why this investigation qualifies as a fair test, go back through the video together, pausing to point out the repeated trials and controlled variables and discussing why they are important. If only a few students are unsure about the investigation's reliability, ask them why during the small group work time and review what makes a fair test, connecting to other investigations they have carried out in the past." (Lesson 4, Teacher Guide)
- Lesson 8, Lesson Assessment Guidance: "Support students by actively monitoring their group work on Analyze Data of a Termite Colony. Balance leading questions with plenty of productive group struggle time. Rounding decimals and annotating the data table and graph may be another way to help students conceptualize the relationship between the weight of the log and the weight of the termite colony." (Lesson 8, Teacher Guide)
- Lesson 6 and Lesson 13, Instructional Guidance: Teachers are provided with possible next steps for instruction based on a student's response to a "key" formative assessment.

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.

- Lesson 4, Explore Section, Step 3, Math Supports callout: "Extension Opportunity: If students have prior experiences graphing, they can work in groups to draw their own graphs for each set of plants using the Plant Data handout instead of using the provided graphs. You may use one of the provided graphs as a model." (Lesson 4, Teacher Guide)
- Lesson 5, Explore Section, Step 2, Teaching Tip callout: "Extension opportunity: If there is instructional time, students could deepen their practice with Engaging in Argument from Evidence by revising their argument about the factors that plants need to grow on Interpret Plant Data, using their investigation data as new evidence." (Lesson 5, Teacher Guide)
- Lesson 6, Connect Section, Step 5, Teaching Tip callout: "While the details of the process of photosynthesis are in the middle and high school grade bands of the NGSS, students may name the process that they just figured out as photosynthesis. If they do, consider providing extension opportunities for those students

to understand more about the process and inputs/outputs, or acknowledge that scientists call this process photosynthesis, but that we do not need to figure out the details at this point." (Lesson 6, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6, Teaching Tip callout: "Extension opportunity: Consider introducing the scientific terms "ectotherm" and "endotherm" if helpful for student sensemaking, and have students conduct independent research on local or interesting examples of these different organisms." (Lesson 9, Teacher Guide)
- Lesson 9, Explore Section, Step 3, Planning and Carrying Out Investigations callout: "Extension opportunity: If students brainstorm additional ideas that are accessible to carry out in your context and amount of instructional time you have available, consider adding them into the investigation steps." (Lesson 9, Teacher Guide)

Suggestions for Improvement: NA

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 of teacher support for unit coherence. The materials support teachers in facilitating coherent learning experiences over time by providing guidance to help students see how lessons fit together. Guidance and support are provided for how to recognize what students figure out in a lesson, what questions are left unanswered, and what new questions could be answered in the next investigation. Navigation routines are used to make explicit connections between lessons for students. Throughout the unit, teacher guidance and strategies are provided to ensure that students see their learning in all three dimensions as coherently linked to the progress they make toward explaining the nurse log phenomenon.

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.).

- Every lesson contains specific guidance for teachers to make explicit connections between lessons in the Navigation section. Each lesson (with the exception of Lesson 1) begins with a Navigate section that bridges one lesson to the next. Each lesson ends with a Navigate section that provides teachers with guidance on helping students wrap up the learning from the lesson and often foreshadows the learning for the next lesson.
- Every lesson contains support for teachers to prompt students' thinking and ideas to look for and listen to in responses.
- At the end of each learning segment (Lessons 7, 10, and 14), a specific navigation routine gauges which questions have been answered and which remain.
- 5.1 Lesson 1 Teacher Reference Discussion Type Prompts

- 5.1 Lesson 1 Teacher Reference Establishing Classroom Agreements
- Lesson 7, Navigate Section, Step 6: "Revisit our Driving Questions Board. Display slide J. Remove several questions from the DQB, enough to give at least 2-4 questions to each group of 3-4 students to discuss. Distribute questions from the DQB to each group. Each group should discuss their question(s) and be ready to sort them into one of three categories: answered, partially answered, or still need to be answered. Ask each group to share their question and their response, and invite the class to agree or disagree with that group's reasoning. As the class comes to a consensus on which questions have been answered or not, have them reattach the questions to the board in those categories." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 6 Community Connections callout, "The Consensus Discussion can be a good time to return to and remind students about your classroom agreements. When you hear/see students engaging well in one (or more) of the agreements, take a moment to reflect aloud and call out how that interaction supported our agreements." (Lesson 9, Teacher Guide)

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

- Throughout the unit, callouts indicate important aspects of each of the three dimensions that are the focus of the unit.
- Instructional Guidance documents are provided at key junctions in the unit and provide teachers with suggestions for supporting students who are struggling in any of the three dimensions that are focused on in that specific assessment task.
- Lesson 7, Navigate Section, Step 1: "Ask questions about what we have done so far. Present slide A. Have students turn and talk about each question, and then share ideas with the whole class. Prompts to use: How is moss able to grow on the nurse log? Is moss a plant? Why or why not? What other questions are we trying to answer in this unit? Where can we look to remind ourselves of what we have figured out so far? What investigations have we done to try to figure out answers to our questions? How has tracking the flow of energy and matter help us figure out answers to our questions?" (Lesson 7, Teacher Guide)
- Lesson 8, Explore Section Step 2, Scale, Proportion, and Quantity callout: "In Lesson 3, students observed how phenomena such as plant growth can happen on time scales too slow to observe with the human eye, but that time-lapse photography can help speed up the timescale of plant growth to be observable. Here, students build on the concept of scale in time by considering how scientists collect evidence on different timescales. The explicit discussion of longer-scale time supports students' understanding of the concept that phenomena occur, and can be observed, over many different scales." (Lesson 8, Teacher Guide)
- Lesson 10, Slide B: "What components & interactions will we need to include as we model? If we're modeling to explain our new ideas about "How does a nurse log help animals live and grow?" what else should we include?" (Lesson 10, 5.1 Lesson 10 Slides)
- Lesson 14, Navigate Section, Step 1: "Ask students to consider where we left off. Display slide A and the updated class model of the nurse log from Lesson 13. Say to students, "Think back on what we figured out about the nurse log system last time. What can you tell us about what we figured out? Consider saying something like, it sounds like we do not agree on which component of the nurse log system is the most important! Let's play a game that can help us think through how all of the components of the nurse log system interact, so we can see which one is the most important." (Lesson 14, Teacher Guide)

Suggestions for Improvement: NA

II.G. Scaffolded Differentiation Over Time — Adequate

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 adequate evidence that the materials show how scaffolds are in place to support a variety of student learners. The teaching prompts given in the lessons when facilitating discussions or building consensus models are explicit. Scaffolding is explicitly reduced over time for the use of one of the three elements for Developing and Using Models and one of two elements for Arguing From Evidence, which were identified in the Unit Front Matter.

MOD: Developing and Using Models

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 Lesson 11. Evidence was found in the claimed lesson, examples include

- Lesson 11, Synthesize Section, Step 4: "Use evidence to model an explanation of termite digestion. Display slide I. When students finish reading, prompt them to review evidence from both the termite article and the termite video. Remind them how we model for different reasons- in this case, it might be helpful to model what we think we have figured out from our observations and reading to answer the question: How are termites able to get matter and energy from wood?" (Lesson 11, Teacher Guide) No evidence was found that shows this element being developed over time or scaffolding being explicitly reduced.

MOD-E3: Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution.
Claimed in Lesson 14. Evidence was found in the claimed lesson, examples include

- Lesson 14, Explore Section, Step 2: "Play the Matter And Energy Flow game. Display slide E to introduce students to the rules of the game. Tell them that we will first play the game showing how energy flows from one organism to the other. Have the student who is playing the sun hold on to one end of the yarn and toss it to a student who uses energy directly from the sun for growth and survival. Continue modeling the flow of energy by holding onto your piece of the yarn and tossing the ball of yarn to the next organism." (Lesson 14, Teacher Guide)
- Lesson 14, Explore Section, Step 2: "Play another round of the Matter and Energy Flow game. Display slide F Tell students that since we only modeled the flow of energy, we are going to play the game again, only this time, we will be representing how matter moves within the food web. Have the student playing the role of the air and water go to the center of the circle. Play the game following the same rules as the first round. (Lesson 14, Teacher Guide) No evidence was found that shows this element being developed over time or scaffolding being explicitly reduced.

MOD-E4: Develop and/or use models to describe and/or predict phenomena.
Claimed in Lessons 1, 5, 6, 7, 10, 13, and 15. Evidence was found in claimed lessons, examples include

- Lesson 1, Synthesize Section, Step 2: "Briefly define models. Introduce the idea of modeling to explain what we think might be going on with the nurse logs. Use slide M to explain what we mean by modeling in science class. The scientific process of modeling is not simply making a drawing or diagram; modeling

helps us explain how or why something in the world happens. The prompts on the Initial Model handout ask students to consider what may be happening underneath and inside the log. You may need to reassure students that it's okay to not be able to explain exactly what is going on right now--scientists often model to help them understand what they haven't figured out yet! One way to reassure students about their uncertainty is to prompt them to add question marks to the places in their model where they're not sure how/whether something happens." (Lesson 1, Teacher Guide)

- Lesson 1, Synthesize Section, Step 2, Developing and Using Models callout: "This is the first time students model to describe and predict a phenomenon. They will advance in this element of Developing and Using Models throughout this unit when they revise these models and create new models at different scales ranging from particles to ecosystems." (Lesson 1, Teacher Edition)
- Lesson 1 Handout Initial Model provides students with text prompts and visuals to support them in developing their initial models. (Lesson 1, Handout: Initial Model)
- Lesson 5, Explore Section, Step 4: "Model our new ideas about air. Display slide K. Direct students back to the class model of the beach ball, emphasizing that now we have figured out some new ideas about how to represent the air as matter." (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5: "Part A: Model Your Ideas Use the box and lines below to explain and show: Where do plants get the matter they need to grow?" (Lesson 5, Lesson 5 Handout: Model to Explain Plants & Matter)
- Lesson 6, Lesson Assessment Guidance: "The discussion of the article in the Connect before students model provides a scaffold to help support their sensemaking." (Lesson 6, Teacher Guide)
- Lesson 6, Handout: Model to Explain Plants and Energy: Students create a model to "explain and show: How does my plant use matter and energy to grow?" They are scaffolded in this process by a provided model key and the class discussion (Lesson 6, Lesson 6 Handout: Model to Explain).
- Lesson 7, Handout: Revised Nurse Log, Students create a model "to explain: How does a nurse log help plants live and grow?" For this model, there is no key provided as a scaffold. Students engage in classroom discussion and create a Gotta-Have-It checklist before creating the model. (Lesson 7, Teacher Guide)
- Lesson 10, Handout: Student Assessment, Ensatina Salamanders & Nurse Logs: "Develop a model to explain how an ensatina salamander gets and uses matter and energy from the nurse log system." Students are not provided visual scaffolds for the model, nor are they provided suggestions for a key. They are given a list of things that should be shown/explained by the model. (Lesson 10, Student Assessment).
- Lesson 13, Synthesize Section, Step 5: "Transition to modeling. Explain that we have figured out some big ideas in the past two lessons, and it's a good time to model to explain how fungi get and use matter and energy, and how they act as decomposers in natural systems. Use slide L to introduce the modeling task on the Model a Mushroom." (Lesson 13, Teacher Guide)
- Lesson 15, Synthesize Section, Step 2: "Facilitate a Consensus Discussion while adding the American Bullfrog to the class consensus model. Have students turn their attention to the class consensus model. Display slide B and explain that since we have made this important discovery about what could happen to the nurse log food web with the addition of a new species, it is important that we record our thinking by updating our consensus model. Ask students to add their ideas about how the flow of matter and energy would change in the nurse log food web with the presence of the bullfrog. Use the table below to support facilitation of a Consensus discussion while updating the class consensus model." (Lesson 15, Teacher Guide)

ARG: Engaging in Argument from Evidence

ARG-E1: Compare and refine arguments based on an evaluation of the evidence presented.
Claimed in Lesson 3. Evidence was found in the claimed lesson, examples include

- Lesson 3, Synthesize Section, Step 6: "Display slide Q. Walk through the Evaluate the Evidence handout. Consider saying something like *Evidence is important because it helps us decide if we actually have support for a claim about the world. We have two big claims we have been working with in this lesson, about how to measure matter and what plants need to grow- let's determine if we actually have enough evidence to support our claims.* Distribute the *Evaluate the Evidence* handout and direct students to complete it in the same groups with whom they worked on the pumpkin investigation." (Lesson 3, Teacher Guide) No evidence was found that shows this element being developed over time or scaffolding being explicitly reduced.

ARG-E4: Construct and/or support an argument with evidence, data, and/or a model.
Claimed in Lessons 4, 7, and 10. Evidence was found in claimed lessons, examples include

- Lesson 4, Explore Section, Step 3: "Support students in writing a scientific argument. After students finish the gallery tour, ask them to go back to their seats to complete Part B of the Interpret Plant Data handout. This will be their first opportunity to write a full scientific argument (claim, evidence, reasoning) so it may be helpful to briefly review each part prior to them attempting to write on their own." (Lesson 4, Teacher Guide)
- Lesson 4, Handout: Interpret Plant Data, students are given a 3-column organizer to complete to support an argument with evidence. The chart has scaffolds to assist the student in identifying the claim, providing evidence (e.g., "My evidence to support this claim is. . ."), and giving reasoning (e.g., "Since the data showed. . . this means that. . .") (Lesson 4, Lesson 4 Handout Interpret Plant Data).
- Lesson 7, Synthesize Section, Step 5: "Argue from evidence. Construct an argument about environments that support plant growth. Use evidence from your model, data we collected, and your Gotta-Have-It checklist to support your ideas." (Lesson 7, Teacher Guide)
- Lesson 7, Handout: Student Assessment: Plants Growing in Different Places: Students are given a 3-row organizer to complete. They circle the appropriate claim, add evidence after the stem: "My evidence to support this claim is. . . ", and complete the reasoning sentence stem: "Since the data showed . . . , this means that . . . " (Lesson 7: Lesson 7 Student Assessment Plants Growing in Different Places).
- Lesson 10 Handout: Student Assessment, Ensatina Salamanders & Nurse Logs: "When the young ensatina salamander eats food, does the total amount of matter in the food chain change? Include two pieces of supporting evidence from your model or investigations that you have done in class." No scaffolding is provided for this assessment. Students are given only the directions and a place to construct their answers (Lesson 10, Lesson 10 Student Assessment Ensatina Salamanders & Nurse Logs).
- The Unit Overview section titled "Which Performance Expectations does this unit build toward?" details the SEPs that are intentionally developed and briefly describes how students' use changes over time. (Unit Overview)

Suggestions for Improvement

- Consider either providing support for the development of the identified elements (MOD-E2 and MOD-E3; ARG-E1) and reducing scaffolding over time for them or removing these elements from the Unit Front Matter and the Alignment of the Three Dimensions of the *NGSS* Matrix.

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 student artifacts show direct, observable evidence of using all three dimensions at a grade-appropriate level. Tasks require students to integrate all three dimensions as part of the learning performance, applying them to explain the nurse log phenomenon or other related phenomena. Assessments are similar in style and context to student learning activities. The focus is on using student sensemaking of the nurse log phenomenon to uncover student understanding of all three dimensions.

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

- Lesson 7, Synthesize Section, Step 5: "Summative assessment: In this summative assessment moment for learning goal 7.B, use the Plants Growing in Different Places and guidance from Scoring Guide for L7 Transfer Task to collect evidence about how well students can write an argument that applies ideas about matter and energy transfer as they relate to plant growth to a new context. The Scoring Guide for L7 Transfer Task can also be used to provide feedback to students about how well they are able to apply their ideas. While this is the final formal check for understanding about what plants need to live and grow, students will leverage these ideas and ways of representation throughout the rest of the unit." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize Section, Step 6: "Summative This transfer task is an opportunity to summatively assess students for Learning Goals 10.A and 10.B. Use the guidance in Scoring Guide for Lesson 10 Transfer Task to gauge where students are at in terms of their modeling and argumentation practices, and how they can apply ideas about conservation of matter and energy transfer to a new context. Use the range and breadth of students' responses to gauge if these key practices or ideas need to be revisited, either individually, in small groups, or as a class before building on them in Lesson Set 3." (Lesson 10, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6: "This is an opportunity to individually summatively assess the learning goal 15. Use the transfer task assessment and guidance to gauge how well students can apply ideas about the flow of matter and energy through an ecosystem to a new context." (Lesson 15, Teacher Guide)

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

- Lesson 7, Synthesize Section, Step 5: "Summative assessment: In this summative assessment moment for learning goal 7.B, use the Plants Growing in Different Places and guidance from Scoring Guide for L7 Transfer Task to collect evidence about how well students can write an argument that applies ideas about matter and energy transfer as they relate to plant growth to a new context. The Scoring Guide for L7 Transfer Task can also be used to provide feedback to students about how well they are able to apply their ideas. While this is the final formal check for understanding about what plants need to live and grow, students will leverage these ideas and ways of representation throughout the rest of the unit." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize Section, Step 6: "Summative This transfer task is an opportunity to summatively assess students for Learning Goals 10.A and 10.B. Use the guidance in Scoring Guide for Lesson 10 Transfer Task to gauge where students are at in terms of their modeling and argumentation practices, and how they can apply ideas about conservation of matter and energy transfer to a new context. Use the range and breadth of students' responses to gauge if these key practices or ideas need to be revisited,

either individually, in small groups, or as a class before building on them in Lesson Set 3." (Lesson 10, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6: "This is an opportunity to individually summatively assess the learning goal 15. Use the transfer task assessment and guidance to gauge how well students can apply ideas about the flow of matter and energy through an ecosystem to a new context." (Lesson 15, Teacher Guide)

Students routinely produce artifacts with evidence of using the grade-appropriate elements of SEPs, CCCs, and DCIs that are targeted as learning objectives.
- Lesson 2, Synthesize Section, Step 8: "Update our Growing Ideas charts. Distribute the My Growing Ideas handout to each student. Encourage students to write or draw one or two additional ideas or questions from this lesson. Make clear that the My Growing Ideas chart is theirs to write/draw their thoughts and ideas, not to copy from you or their classmates." (Lesson 2, Teacher Guide)
- Lesson 4, Connect Section, Step 5: "Update our Growing Ideas charts. Conclude the read aloud and discussion by pointing out that we figured out how plants use soil, so we are ready to summarize the work we did in this lesson. If time allows, give students a few minutes to reflect on the investigation and the article. Display slide P and distribute My Growing Ideas, unless students are keeping these ideas in a science notebook. Possible sample responses are shown below." (Lesson 4, Teacher Guide)
- Lesson 8, Synthesize Section, Step 6: "Update our Growing Ideas charts. Display Slide T. Point out that we figured out really big ideas about the nurse log and animals, so this is a good time to summarize the work we did in this lesson." (Lesson 8, Teacher Guide)

Suggestions for Improvement: NA

III.B. Formative	Extensive
Embeds formative assessment processes throughout that evaluate student learning to inform instruction.	

The reviewers found extensive evidence that formative assessment processes are embedded into instruction. Students can use a range of modalities to demonstrate their thinking. Formative assessment opportunities are included for assessing students' thinking in each of the three dimensions—separately and together. Students are given the opportunity to revise their models, their growing ideas chart, and the DQB throughout the unit. The formative assessments take varied forms and are frequently built directly into instructional sequences rather than existing as a separate "assessment." Students are offered choices of modalities to demonstrate their thinking, ensuring that all learners have the opportunity to demonstrate their knowledge. Teachers are supported in adjusting instruction based on individual student difficulties with all three dimensions and their use together. Formative assessment opportunities are included for assessing students' thinking in each of the three dimensions—separately and together.

- The Assessment System Overview: The "unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons. These opportunities include pre-assessment,

formative assessment, summative assessment, peer assessment (called peer feedback with students), and/or self-assessment (called self-reflection with students)."

- The Assessment System Overview calls out the yellow section in each lesson titled "Assessment Opportunity", which identifies suggested assessments and often provides look fors and listen fors to support student thinking across the three dimensions.
- The Assessment System Overview contains two tables that provide a summary of the assessments. "The first table, Unit Assessment Plan by Assessment Type, lists the purpose, placement, and tools for each assessment type. The second table, Lesson-by-Lesson Assessment Opportunities, chronologically lists the assessment guidance for each lesson."

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

- In both Lesson 6 and Lesson 13, instructional guidance is provided to assist teachers in responding to student responses to formative assessment tasks. The if/then style assessment guidance is broken down to support teachers in each of the three-dimensions (Lesson 6, 5.1 Lesson 6 Teacher Assessment Tool Instructional Guidance for) and (Lesson 13, 5.1 Lesson 13 Teacher Assessment Tool Instructional Guidance for)
- As an example of formative assessment guidance found in each lesson, consider Lesson 2 Teacher Edition: "The questions that they ask about moss and other nurse log components can also be used to gauge their understanding about the nurse log as a system made up of components. You can support students by revisiting these practices (via the DQB) and concepts (via the modeling they will do of plants and particles) in the subsequent lessons that focus on plants. Students will return to testable questions in Lesson 8." (Lesson 2, Teacher Edition)
- Lesson 4, Assessment Opportunity: "Pre-assessment: You can collect the Investigation Setup handout as a formative pre-assessment of learning goal 4.A with the purpose of informing you of how much scaffolding to give the class when they are designing scientific investigations in the future and what students already think about where plant matter comes from." (Lesson 4, Teacher Guide)
- Lesson 6, Synthesize Section, Step 6 Assessment Opportunity: "Key formative assessment: Students' Model to Explain Plants & Energy models and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 6.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to model and explain in their own words in combination with key terminology (e.g., energy, transfer, matter, particle), and use evidence from their discussion and gestures with peers to assess their thinking. Refer to the Instructional Guidance for Lesson 6 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 6, Teacher Guide)
- Lesson 11, Connect Section, Step 3: "Formative: The evidence students collect on Evidence for Termite Matter and Energy and the Building Understandings discussion during the Synthesize provide an opportunity to gather evidence around Learning Goal 11." (Lesson 11, Teacher Guide)
- Lesson 13, Synthesize Section, Step 5: "Key formative assessment: Students' models and explanations on Model a Mushroom, as well as the Consensus Discussion that follows, provide opportunities to gather evidence about Assessment Statement 13.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to explain in their own words and use gestures as they demonstrate their ideas about decomposers' role as a key component for matter cycling in the nurse log system. Refer to the Instructional Guidance for Lesson 13 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 13, Teacher Guide)

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

- In each lesson, formative assessment opportunities are identified for each lesson-level learning objective. The objective is color-coded, with each of the three dimensions clearly identified. Look for/listen for guidance in the Lesson Assessment Guidance is also color-coded to allow teachers to identify the elements

of each of the three dimensions (e.g. Lesson 2: Three-Dimensional Learning Goal, Teacher Edition) and (Lesson 2: Lesson Assessment Guidance, Teacher Edition)

- Lesson 2, Explore Section, Step 6: Assessment Opportunity: "If students are challenged by asking questions that are testable, encourage them to consider how the question could be answered by investigation or observation (by themselves or others). If students do not identify other components in the system, use the updated class model to revisit components that may be related to moss that could help them answer their questions." (Lesson 2, Teacher Guide)
- Lesson 9, Lesson Assessment Guidance: "Use this formative assessment opportunity to see if students need more support in understanding key ideas about how energy moves through a system. Students will have additional opportunities in future lessons to emphasize how the Sun is the source of energy in ecosystems and to figure out that energy (and matter) cycle through the whole system (from animals through the environment back to plants) when they explore decomposers. Support students by ensuring they understand the differences between how animals and plants transfer and use energy, using the class model of the nurse log system (that they will revise in the next lesson) to review with groups or the whole class as needed." (Lesson 9, Teacher Guide)
- Lesson 10, Lesson Assessment Guidance: "If you find that students need additional opportunities to practice writing an evidence-based claim, consider adding those in during Lesson Set 3. Students will have additional opportunities to practice scientific argumentation in upcoming units, so you can use what you learn about students' use of that practice in this lesson to plan to give more examples, structured guidance, etc., in those lessons." (Lesson 10, Teacher Guide)
- Lesson 10, Synthesize Section, Step 6: Apply Ideas to Another Phenomenon, Assessment callout: "Summative This transfer task is an opportunity to summatively assess students for Learning Goals 10.A and 10.B. Use the guidance in Scoring Guide for Lesson 10 Transfer Task to gauge where students are at in terms of their modeling and argumentation practices, and how they can apply ideas about conservation of matter and energy transfer to a new context. Use the range and breadth of students' responses to gauge if these key practices or ideas need to be revisited, either individually, in small groups, or as a class before building on them in Lesson Set 3." (Lesson 10, Teacher Guide)

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

- Lesson 7, Synthesize Section, Step 3: Develop a Model to Explain, Broadening Access callout, "Students perceive color in different ways. To remove barriers while using color for meaning-making, add a secondary indicator so that the meaning is clear even when color information is removed. Use different patterns/textures (such as shapes, dashes, dots, and/or stripes) instead of (or in addition to) different colors to represent the different components in the nurse log system. You can also combine colors and symbols on models (e.g., black star, orange circle, blue square) and label information with text. This will add another layer of meaning to support all students." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 4: Participate in a Discussion: "Support students by asking questions and using gestures to show how the isopods used energy to move during the investigation. It could also help to prompt students to observe the isopods again in their terrarium, or watch the Isopod Energy Investigation video." (Lesson 9, Teacher Guide)
- Lesson 11, Lesson Assessment Guidance: "Support them [students] by spending more time on the discussion in the Synthesize, or consider having students create individual or small group models as a first step for students' sensemaking. Using manipulatives of different sizes to represent the different components of the system may be another way to help students visualize differences in spatial scales." (Lesson 11, Teacher Guide)

Suggestions for Improvement: NA

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 for this because the materials include explicit guidance on levels of student understanding and proficiency for all three dimensions and their use together. Scoring rubrics assign value to student use of the three dimensions for sensemaking, and teachers are supported to provide feedback (rather than scoring) for issues outside of the learning objectives, such as grammatical errors. Scoring guidance is provided for major formative assessments and summative assessments. Both teachers and students are supported in interpreting student progress over time.

Every lesson contains Lesson Assessment Guidance that indicates where to use the assessment within the lesson, what to look and listen for, and detailed guidance on how to use the information. Every lesson contains at least one Assessment Opportunity embedded in the lesson that provides guidance on what to look and listen for and how to use the information. Key formative assessment opportunities include an Instructional Guidance document that provides possible responses to help interpret student responses. The Instructional Guidance documents provide planning for instruction in response to student performances to move the learning forward.

- Lesson 6, Synthesize Section, Step 6, Assessment Opportunity: "Key formative assessment: Students' Model to Explain Plants & Energy models and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 6.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to model and explain in their own words in combination with key terminology (e.g., energy, transfer, matter, particle), and use evidence from their discussion and gestures with peers to assess their thinking. Refer to the Instructional Guidance for Lesson 6 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 6, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5, Assessment Opportunity: "Summative assessment: In this summative assessment moment for learning goal 7.B, use the *Plants Growing in Different Places* and guidance from Scoring Guide for L7 Transfer Task to collect evidence about how well students can write an argument that applies ideas about matter and energy transfer as they relate to plant growth to a new context. The *Scoring Guide for L7 Transfer Task* can also be used to provide feedback to students about how well they are able to apply their ideas. While this is the final formal check for understanding about what plants need to live and grow, students will leverage these ideas and ways of representation throughout the rest of the unit." (Lesson 7, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5, Assessment Opportunity: Sample student answers for each performance level are not provided. Including samples would provide additional scoring guidance for teachers.
- Lesson 7, Synthesize Section, Step 5, Assessment Opportunity: "Self-reflection: In this self-assessment moment for learning goal 7.B, students use the Self Evaluation Rubric with the purpose of evaluating and improving the accuracy and completeness of their arguments about where plants get the matter and energy they need to grow. Remind students to use the class's Gotta-Have-It Checklist and evidence list to support their thinking. Refer to the Assessment Guidance at the beginning of the lesson for more details." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3: "Give and receive feedback from peers. Display slide E. Remind students that it is important for scientists to share their ideas and the evidence they used to support their

ideas. Connect to related classroom agreements that students previously collaborated to develop. Have students take turns with partners to explain the components and interactions in their model. Each partner should share what they modeled on *Lesson 10 Gotta-Have-It Checklist* while their partner listens and observes. The listening partner should use the Gotta-Have-It checklist to check their partner's model and explanation for important ideas, as well as how they represented those ideas through modeling, spatial scales, and their verbal descriptions and gestures." (Lesson 10, Teacher Guide)

- Lesson 10, Synthesize Section, Step 6, Assessment Opportunity: Sample student answers for each performance level are not provided. Including samples would provide additional scoring guidance for teachers.
- Lesson 10, Synthesize Section, Step 6, Assessment Opportunity: "Summative This transfer task is an opportunity to summatively assess students for Learning Goals 10.A and 10.B. Use the guidance in Scoring Guide for Lesson 10 Transfer Task to gauge where students are at in terms of their modeling and argumentation practices, and how they can apply ideas about conservation of matter and energy transfer to a new context. Use the range and breadth of students' responses to gauge if these key practices or ideas need to be revisited, either individually, in small groups, or as a class, before building on them in Lesson Set 3.
- Lesson 13, Synthesize Section, Step 5, Assessment Opportunity: "Key formative assessment: Students' models and explanations on Model a Mushroom, as well as the Consensus Discussion that follows, provide opportunities to gather evidence about Assessment Statement 13.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to explain in their own words and use gestures as they demonstrate their ideas about decomposers' role as a key component for matter cycling in the nurse log system. Refer to the Instructional Guidance for Lesson 13 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 13, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6, Assessment Opportunity: "This is an opportunity to individually summatively assess the learning goal 15. Use the transfer task assessment and guidance to gauge how well students can apply ideas about the flow of matter and energy through an ecosystem to a new context." (Lesson 15, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6, Assessment Opportunity: Sample student answers for each performance level are not provided. Including samples would provide additional scoring guidance for teachers.

Suggestions for Improvement

- In addition to the descriptors for different performance levels, consider providing student examples for each performance level on the scoring guide for key formative and summative tasks in lessons 7, 10, and 15. Student examples may provide some clarity for teachers as they assess student work.

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 provide appropriate on-ramping for students to engage with and attend to the appropriate parts of the task. This includes providing potential scaffolds to make sure that students have the background they need to be successful with the task, such as additional contextual information when an idea might be unfamiliar to students. There are teaching tips to give guidance on how to bring in community backgrounds and when it's appropriate for students to use their own language rather than specific vocabulary. Task scenarios have connections to students' background knowledge and interests, which makes the task more engaging and interesting for students. Tasks provide opportunities for students to express their thinking through many different modalities and an opportunity to choose which modality works best for them. Student expectations are communicated in a variety of ways to ensure all students understand exactly what the task is asking them to do.

Tasks allow for multiple modes of communication.

- Lesson 3, Synthesize Section, Step 6: "Pre-assessment: Students' written and verbal responses in this Synthesize component provide an opportunity to gather evidence about Learning Goal 3, with the purpose of determining support students may need in upcoming lessons around the practice of argumentation, ideas around claims and evidence, and how to measure matter. Students will continue to develop these ideas and practices throughout this unit. Accept all student ideas for this pre-assessment. Students will likely identify their own experience and the time-lapse video as sources of evidence, but you can expect a range of ideas around what other types of evidence are still needed. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 3 Scale, Proportion, and Quantity callout: "An important element of the Scale, Proportion, and Quantity crosscutting concept is the idea that observable phenomena happen over different time scales, from very short (less than a second) to very long (thousands or millions of years). The explicit discussion of time-lapse technology supports students' understanding of the concept that changes occur, and can be observed, over many different time scales." (Lesson 3, Teacher Guide)
- Lesson 7, Student Assessment, contains words and pictures and is completed following a class discussion. It is also completed with reference to the class-developed Gotta-Have-It checklist. (Lesson 7, Lesson 7 Student Assessment)
- Lesson 9, Synthesize Section, Step 6: "Prepare for a Consensus Discussion. Organize students into a Scientists' Circle around a chart paper or board with a blank version of the chart shown below (a blank version is provided in Isopod & Bird Comparison Chart- Sample and Blank). Direct students to bring their Investigate Isopods and Feathered Friends Evidence Table handouts. Explain that in order to figure out patterns from what they have learned about how isopods and birds use energy, the class will create a comparison chart using the prompts on the chart." (Lesson 9, Teacher Guide)
- Lesson 10 Handout: The revised Nurse Log Model contains directions in text supported by a simple drawing of a log to help students begin their modeling task. (Lesson 10, Handout Revised Nurse Log)
- Lesson 15 Student Assessment: Grassland Ecosystems contains words and pictures and is introduced by discussion and a video clip. (Lesson 15, Student Assessment 1 Grassland Ecosystem)

Supports are provided to promote the success of all students.

- Lesson 2, Explore Section, Step 2: "Teaching Tip Students may identify observations as living or non-living. These characterizations depend on cultural perspectives (e.g., indigenous perspectives would identify more components as living in comparison to more narrow, binary Western perspectives). Additionally, nurse logs contain more biomass than when they were standing trees, so there are many living and growing aspects to this once-living tree. Instead, focus students on observable characteristics, such as movement, size, color, shape, and texture." (Lesson 2, Teacher Guide)

- Lesson 2, Synthesize Section, Step 3: "Teaching Tip Accept all ways of describing what students observed. They do not need to accurately identify what they see or how it might help a fallen tree become a nurse log. For example, moss may be "fuzzy green carpet" or fungi could be "weird thingies on the side of the log" that "turn the wood into dirt." Invite both familiar and scientific language along with any modalities of expression to meet students at their level, especially if you are teaching this unit during the first part of the school year." (Lesson 2, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Facilitate a Consensus Building Discussion. Display slide E. Gather the class in a Scientists Circle around the chart paper you prepared before class. You may also want to have the initial consensus model within view so students can use it as a starting point and reflect on how their ideas have changed and grown. Use the prompts below to facilitate a Consensus Building discussion to support the class in modeling to explains how a nurse log helps plants live and grow, inviting students to share their ideas that they modeled on Revised Nurse Log Model." (Lesson 7, Teacher Guide)
- Lesson 7, Synthesize Section, Step 3: "Teaching Tip: Students perceive color in different ways. To remove barriers while using color for meaning-making, add a secondary indicator so that the meaning is clear even when color information is removed. Use different patterns/textures (such as shapes, dashes, dots, and/or stripes) instead of (or in addition to) different colors to represent the different components in the nurse log system. You can also combine colors and symbols on models (e.g. black star, orange circle, blue square) and label information with text. This will add another layer of meaning to support all students." (Lesson 7, Teacher Guide)
- Lesson 15, Connect Step 4, Students watch a video, and record information about the new ecosystem being studied to prepare them for the transfer task (Lesson 15, Teacher Guide)

Students are provided opportunities to use multiple modalities for student choice.

- Lesson 10, Handout: Revised Nurse Log Model: "Use words and/or drawings to explain: How does a nurse log help animals live and grow?" (Lesson 10, Handout Revised Nurse Log)
- Lesson 13, Handout 1: Fungi Evidence Collector: "Use the table below to write or draw what you figure out from the article about how mushrooms and other fungi get matter and energy to grow" (Lesson 13, Handout 1 Fungi Evidence Collector).
- Lesson 13, Lesson Assessment Guidance "This is a key formative assessment opportunity where you will take stock of students' progressing sensemaking. Use their ideas that they modeled on the Model a Mushroom handout to determine if students would benefit from small group discussions or modeling to explain ideas before the whole class Consensus Discussion, and circulate to support and assess their current thinking and representations." (Lesson 13, Teacher Guide)

Suggestions for Improvement: NA

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 teachers are supported in understanding how student performance in each assessment fits together to reflect student learning across the unit. Various forms of assessment are used throughout the learning experience to monitor and support growth in student performance continually. The

assessments are connected to the lesson learning objectives and require students to apply grade-appropriate elements of the three dimensions to make sense of the nurse log phenomena. Teachers are supported in understanding how student performance in each assessment fits together to reflect student learning across the unit.

Evidence from the materials where the criterion of matching three-dimensional learning goals was met,

- The 4 5.1 Ecosystems & Matter Cycling Assessment System Overview document provides a table (Lesson-by-Lesson Assessment Opportunities) that lists assessment opportunities for the three-dimensional learning goals in each lesson. This table provides the color-coded learning goals for each lesson in one column and the color-coded "what to look for and listen for" in the adjacent column. The "look fors and listen fors" are matched to each learning goal.
- For example, in Lesson 3, the three-dimensional learning objective is Construct and refine an argument about the factors affecting plant growth, using weight as a way to track matter flows and cycles. The aligned look and listen for is Words, drawings, written or spoken descriptions, movement and/or gestures showing:
    - Initial ideas about the sources for plants' material for growth (such as water, soil, light, or possibly air)
    - Weight as a measurement of matter
    - Initial attempts to utilize evidence and reasoning to support two different claims about measuring matter and factors affecting plant growth
    - Evaluation that we don't have enough evidence to make a claim about factors affecting plant growth
- Lesson 1, the three-dimensional learning objective is Develop models to describe our initial ideas about how a very large fallen tree becomes a nurse log over time and provides matter and energy to other organisms.
- Lesson 2, the three-dimensional learning objective is Ask questions about moss and other components of the nurse log system.
- Lesson 7, the three-dimensional learning objective is Construct an argument with evidence, data, and/or a model about how plants acquire their material for growth chiefly from air and water, which is matter, and they transfer energy from the sun to grow.
- Lesson 10, the three-dimensional learning objective is Use a model as evidence to support a claim about how matter is conserved as it moves within a food chain system (between the ensatina salamander, its food sources, and its waste).
- Lesson 13, the three-dimensional learning objective is Develop and use a model to describe how decomposers are a key component of the nurse log system as they cycle matter between organisms and the environment.
- Lesson 15, the three-dimensional learning objective is Develop a model to describe the movement of matter and energy among the plants, animals and decomposers in a grassland ecosystem after wild hogs are introduced.

Pre-Assessment

- Lesson 1, Synthesize Section, Step 2: "Pre-assessment: Students' initial models provide an opportunity to gather evidence around Learning Goal 1 with the purpose of determining support that students may need in upcoming lessons around the practice of modeling, and around ideas of scale, matter, and energy. Students will continue to develop these ideas and practices throughout this unit. Accept all student ideas. Refer to the Lesson Assessment Guidance at the beginning of the lesson. (Lesson 1, Teacher Guide)
- Lesson 3, Synthesize Section, Step 6: "Pre-assessment: Students' written and verbal responses in this Synthesize component provide an opportunity to gather evidence about Learning Goal 3, with the purpose

of determining support students may need in upcoming lessons around the practice of argumentation, ideas around claims and evidence, and how to measure matter. Students will continue to develop these ideas and practices throughout this unit. Accept all student ideas for this pre-assessment. Students will likely identify their own experience and the time-lapse video as sources of evidence, but you can expect a range of ideas around what other types of evidence are still needed. Refer to the Assessment Guidance at the beginning of the lesson." (Lesson 3, Teacher Guide)

Formative Assessment

- The 4 5.1 Ecosystems & Matter Cycling Assessment System Overview document provides a table (Lesson-by-Lesson Assessment Opportunities) that lists assessment opportunities for the three-dimensional learning goals in each lesson. The table provides "where to check for understanding" and "what to look and listen for" that are aligned with each learning goal.
- Each lesson contains at least one Assessment Opportunity section denoted in a yellow box strategically placed where understanding could be checked, what to look and listen for, and some suggestions for the next instructional steps.
- Lesson 6, Synthesize Section, Step 6: "Key formative assessment: Students' Model to Explain Plants & Energy models and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 6.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to model and explain in their own words in combination with key terminology (e.g., energy, transfer, matter, particle), and use evidence from their discussion and gestures with peers to assess their thinking. Refer to the Instructional Guidance for Lesson 6 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 6, Teacher Guide)
- Lesson 13, Synthesize Section, Step 3: "Formative assessment: This group discussion and Fungi Evidence Collector provide an opportunity to gather evidence about Learning Goal 13.A, with the purpose of providing feedback and supporting students in using evidence to explain how fungi get matter and energy by breaking down once-living organisms or waste, and help other organisms by cycling the matter into the environment. Use the following suggestions to provide feedback (and possibly additional scaffolding during the modeling steps that follow)." (Lesson 13, Teacher Guide)
- Lesson 13, Synthesize Section, Step 5: "Key formative assessment: Students' models and explanations on Model a Mushroom, as well as the Consensus Discussion that follows, provide opportunities to gather evidence about Assessment Statement 13.B, with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to explain in their own words and use gestures as they demonstrate their ideas about decomposers' role as a key component for matter cycling in the nurse log system. Refer to the Instructional Guidance for Lesson 13 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 13, Teacher Guide)
- Lesson 14, Synthesize Section, Step 5: "Formative Assessment: Food Web Exit Slip provides an opportunity to gather evidence about learning goal 14 with the purpose of formatively assessing students' models and explanations of what makes a food web healthy and what makes them unhealthy. Look for student ideas about how the introduction of the American Bullfrog to the nurse log ecosystem creates an unequal flow of energy and matter which causes the food web to become unbalanced and unhealthy. Students should note that too much of the matter and energy in the food web is going to the American Bullfrogs." (Lesson 14, Teacher Guide)

Summative Assessment

- Lesson 7, Synthesize Section, Step 5: "Summative assessment: In this summative assessment moment for learning goal 7.B, use the Plants Growing in Different Places and guidance from Scoring Guide for L7 Transfer Task to collect evidence about how well students can write an argument that applies ideas

about matter and energy transfer as they relate to plant growth to a new context. The Scoring Guide for L7 Transfer Task can also be used to provide feedback to students about how well they are able to apply their ideas. While this is the final formal check for understanding about what plants need to live and grow, students will leverage these ideas and ways of representation throughout the rest of the unit." (Lesson 7, Teacher Guide)

- Lesson 10, Synthesize Section, Step 6: "Summative This transfer task is an opportunity to summatively assess students for Learning Goals 10.A and 10.B. Use the guidance in Scoring Guide for Lesson 10 Transfer Task to gauge where students are at in terms of their modeling and argumentation practices, and how they can apply ideas about conservation of matter and energy transfer to a new context. Use the range and breadth of students' responses to gauge if these key practices or ideas need to be revisited, either individually, in small groups, or as a class before building on them in Lesson Set 3." (Lesson 10, Teacher Guide)
- Lesson 15, Synthesize Section, Step 6: "This is an opportunity to individually summatively assess the learning goal 15. Use the transfer task assessment and guidance to gauge how well students can apply ideas about the flow of matter and energy through an ecosystem to a new context." (Lesson 15, Teacher Guide)

Self Assessment

- Lesson 5, Synthesize Section, Step 5: "Model our ideas about plants and matter. Display slide M. Walk through the parts of the Model to Explain Plants & Matter handout for students to model their ideas. Distribute the handout to students and circulate to support their individual modeling process. Press them to represent particles similarly to how we did in the class model. Note that the first question in Part B will require students to look back at the scientific argument they wrote in Lesson 4, at the end of the Interpret Plant Data handout. Finally, take note of questions that students ask in the final question of the handout, especially as related to how plants use light." (Lesson 5, Teacher Guide)
- Lesson 7, Synthesize Section, Step 5: "Self-reflection: In this self-assessment moment for learning goal 7.B, students use the Self Evaluation Rubric with the purpose of evaluating and improving the accuracy and completeness of their arguments about where plants get the matter and energy they need to grow. Remind students to use the class's Gotta-Have-It Checklist and evidence list to support their thinking. Refer to the Assessment Guidance at the beginning of the lesson for more details." (Lesson 7, Teacher Guide)

A coherent three-dimensional assessment system rationale is clearly described.

- Assessment System Overview: "Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons. These opportunities include: pre-assessment, formative assessment, summative assessment, peer assessment (called peer feedback with students), and/or self-assessment (called self-reflection with students)."
- Elementary Teacher Handbook, Assessment: "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 children to make their thinking visible and use this thinking to help make sense of science phenomena, children 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."

- 5.1 Ecosystems & Matter Cycling Assessment System Overview: "Please look for the yellow "Assessment Opportunity" support in each lesson plan to identify suggested assessments. In addition, there are two tables below that outline where each type of assessment can be found in the unit. The first table, Unit Assessment Plan by Assessment Type, lists the purpose, placement, and tools for each assessment type. The second table, Lesson-by-Lesson Assessment Opportunities, chronologically lists the assessment guidance for each lesson. For more information about the OpenSciEd approach to assessment, visit the OpenSciEd Elementary Teacher Handbook."

Suggestions for Improvement: NA

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 targeted learning objectives are included in more than one activity and assessment so that students have opportunities to develop and improve their performance over time. Teacher feedback prompts focus on student performance related to the learning objectives and sensemaking. Teacher and peer feedback focus on student performance related to the learning objectives and sensemaking. There are opportunities for peer feedback or for students to improve their performance using feedback loops on Arguing From Evidence with their understanding of Disciplinary Core Ideas and Crosscutting Concepts.

Students have multiple opportunities to develop their performance in developing and using models to connect with their understanding of disciplinary core ideas and crosscutting concepts.

- Lesson 5, Learning Goal 5A: Develop a model to describe that air (a gas) inside of a beach ball and syringe is made of particles of matter too small to be seen.
  - Explore Section, Step 2: "Create an initial model about air. As groups finish with the first two parts of the handout, ask if any of their findings were surprising. Air having matter may be a surprising/challenging concept. Prompt them to use the last part of the *Investigating Matter* handout to draw a model of how air could be made of matter, explaining that the class will work together to share ideas in the next step." (Lesson 5, Teacher Guide)
- Lesson 5, Learning Goal 5A: Develop a model to describe that air (a gas) inside of a beach ball and syringe is made of particles of matter too small to be seen.
  - Synthesize Section, Step 4: "Create a class model. Tell the class that we'll use their ideas and initial models on the *Investigating Matter* handout to create a class model that shows how air can be made of matter. Start by drawing (or displaying a deflated beach ball and an inflated beach ball next to it. Ask one group to share their before and after weights for the beach ball, write their before weight under the deflated beach ball and their after weight underneath the inflated beach ball." (Lesson 5, Teacher Guide)

- Lesson 5, Learning Goal 5B: Develop a model to explain the source(s) from which plants acquire their matter for growth.
    - Synthesize Section, Step 5: "Review our evidence. Display slide L. Direct students' attention to the chart and class model that they just created, noting that they now have evidence to support the claims that air and water are made of matter, and a good way to represent air as we model. Consider other aspects that we need to model. As on the slide, remind students that we were doing this investigation to help us answer our lesson question: *Where do plants get the matter they need to grow?*" (Lesson 5, Teacher Guide)
- Lesson 6, Learning Goal 6B: Develop a system model to explain how a chosen plant transfers energy from the Sun for growth.
    - Synthesize Section, Step 6: "Compare to our initial models. Have students take out the initial model of the pumpkin they drew in Lesson 3. Ask them to compare to their new models and answer the prompts on the second part of the Revised Model: Plant Matter and Energy handout. Share our comparisons: Ask student volunteers to share their models and tell us about how their model is different from their initial model. As students share their models, guide them to consider the components of their models and how they interact as part of a system using the discussion prompts below." (Lesson 6, Teacher Guide)

Students have opportunities to apply multi-modal feedback to develop their performance in developing and using models to connect with their understanding of disciplinary core ideas and crosscutting concepts throughout the unit.

- Lesson 5 Synthesize Section, Step 5: "Model our ideas about plants and matter. Display slide M. Walk through the parts of the Model to Explain Plants & Matter handout for students to model their ideas. Distribute the handout to students and circulate to support their individual modeling process. Press them to represent particles similarly to how we did in the class model. Note that the first question in Part B will require students to look back at the scientific argument they wrote in Lesson 4, at the end of the Interpret Plant Data handout. Finally, take note of questions that students ask in the final question of the handout, especially as related to how plants use light." (Lesson 5, Teacher guide)
- Lesson 7, Synthesize Section, Step 5: "Self reflection: In this self-assessment moment for learning goal 7.B, students use the Self Evaluation Rubric with the purpose of evaluating and improving the accuracy and completeness of their arguments about where plants get the matter and energy they need to grow. Remind students to use the class's Gotta-Have-It Checklist and evidence list to support their thinking. Refer to the Assessment Guidance at the beginning of the lesson for more details." (Lesson 7, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3: "Formative and peer feedback: Use students Revised Nurse Log Model with the purpose of providing feedback and supporting students in Learning Goal 10.A. If students are not yet explaining or representing how matter and energy move through the system as animals eat food, encourage them to review the Gotta-Have-It checklist and key artifacts from Lessons 8 and 9. Additionally, explaining their model ideas to a peer verbally and using gestures provides an opportunity for students to figure out what they are representing and how to explain their ideas to others. This can be another moment to circulate and formatively assess. Finally, providing feedback to their partner supports them in improving their modeling practice and with better understanding of ideas about matter and energy. Students will have an opportunity to use the feedback from their partners when they revise their models before moving to a Consensus Discussion in the next part of the lesson." (Lesson 10, Teacher Guide)

Suggestions for Improvement: NA

CATEGORY RATINGS			Total Score
CATEGORY I: NGSS 3D Design	CATEGORY II: NGSS Instructional Supports	CATEGORY III: Monitoring NGSS Student Progress	
0 1 2 (3)	0 1 2 (3)	0 1 2 (3)	9

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**