

EQUIP RUBRIC FOR SCIENCE EVALUATION

How can we read under covers when it is dark?

Developer: OpenSciEd

Grade 1 | July 2024

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 Extensive		
SCORE CAT I	3	SCORE CAT II	3	SCORE CAT III	3
		SUM CATEGORIES	9		
		RATING	E		

Summary Comments

This is a high-quality unit focused on equitable three-dimensional teaching and learning. This unit is strong in several areas, including opportunities for students to make sense of multiple phenomena through hands-on investigations that drive student learning and facilitate student questions that lead to new investigations and learning about science concepts related to light. Students are given frequent opportunities to use their own questions or experiences so they can feel as if they are driving the learning sequence, and the phenomena used in the unit are logically connected and coherently build upon one another. Students regularly return to the anchoring phenomenon: *What happens when we try to read under covers?*

Students have extensive opportunities for three-dimensional learning, with multiple elements of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts being used and/or intentionally developed throughout the unit. The unit focuses on the Disciplinary Core Idea of PS4.B: Electromagnetic Radiation and builds on two NGSS Performance Expectations: 1-PS4-2—Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated, and 1-PS4-3—Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. The unit intentionally develops three Science and Engineering Practices: Planning and Carrying Out Investigations, Developing and Using Models, and Constructing Explanations and Designing Solutions. The unit intentionally develops the Crosscutting Concept of Cause and Effect. The lessons and assessments integrate the three dimensions, providing students with a coherent learning sequence and experience. Throughout the unit, instructional guidance documents, assessment tools, and specific callouts in the lessons support instruction and student progress in each of the three dimensions.

There is strong evidence that students can demonstrate their learning of three-dimensional targets through extensive formative assessment opportunities that support the teacher in monitoring three-dimensional performance. The unit provides a coherent assessment system that includes all four types of assessment and provides scoring guidance to support both the teacher and the student with the interpretation of their progress throughout the unit. Students have extensive opportunities to share their thinking and ideas in multiple ways throughout the unit. Students are encouraged to use multiple modalities, languages, and cultural experiences to support their investigations and make sense of the phenomena. The unit provides resources that support multilingual students, incorporate trauma-informed approaches, broaden accessibility, support sensemaking discussions, integrate literacy and mathematics, and build an equitable classroom community for science.

The unit uses lesson components that are distinct purpose-driven segments of a lesson that teachers will recognize in each lesson. The components are arranged in a specific order within each lesson to help students make sense of science ideas and support teachers in understanding instructional elements and scheduling. Most lessons begin and end with the Navigate component that supports coherence from lesson to lesson. The Explore component occurs when students engage in the anchoring phenomenon, investigate ideas to support figuring out the phenomena, or work with data from previous investigations. The Connect component brings in ideas from beyond the classroom—typically through books, text, or other media—and aids students in seeing how their science ideas connect to the “real world.” The Synthesize component allows students to make sense of what they have figured out and consider how these ideas might help them explain the unit question. The unit consistently engages students in other routines such as the Notice and Wonder chart, their “Our Growing Ideas” chart, and “Gotta-Have-It Checklists.”

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

- *I.F Math and ELA.* The unit has multiple opportunities for literacy and math support. However, there is some mismatch between the claimed Standards for Mathematical Practice and Geometry standards in the

unit. Consider providing teachers with guidance to leverage language from the mathematical standards in science discussions and provide examples of how this language would be used in the discussions to prevent potential scientific misconceptions. For example, the connection of using the mathematical language “defining attributes vs. non-defining attributes” (Geometry standard 1.G.A.1) could lead students to develop a potential misconception about properties/attributes of matter that might affect their learning experiences in later grades.

- *III.C Scoring Guidance.* Consider adding proficiency levels (such as those found in other assessment guidance documents in the unit: not yet secure, secure with prompting, secure) to the annotated student examples in all the assessment guidance tools to support teachers with interpreting student performance, especially with the summative assessments.

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 improvements. 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 phenomena drives student learning. Materials are organized so that students are figuring out the central phenomenon: *“How can I read under covers when it’s dark?”* Student questions and prior experiences related to the phenomenon motivate sensemaking. There is a close match between the phenomena and student learning objectives throughout the materials, and they are in service of student sensemaking. The learning is consistently student-driven, giving students frequent opportunities to use their questions or prior experiences so they can feel as if they are driving the learning sequence. The phenomena used in the unit are logically connected and build on one another coherently. Engineering is not a learning focus, so it is not expected to be integrated with developing Disciplinary Core Ideas from physical sciences. Reviewers found a student-centered focus on phenomena throughout the unit, with students regularly returning to the phenomena to add layers of explanation based on new learning to explain the science ideas.

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

- Lessons 1 and 2, the three-dimensional learning goal is “Make firsthand observations about where light is coming from to construct an evidence-based account that objects that give off light (cause) make a space brighter (effect)”. Both lessons provide students with direct opportunities to ask questions and utilize their prior experiences through the phenomena used in each lesson. Phenomena from these lessons include students being able to see/read under different covers, reading Light in Our Communities, and a scavenger hunt. The phenomena and problems students encounter directly relate to the learning goals because they provide an experience and information about dark places, ways to brighten the dark spaces, and whether you can see in dark spaces. Additionally, students are provided opportunities to make observations with support that become evidence for their sensemaking and to construct initial explanations about their observations. (Lesson 1, Teacher Guide and Lesson 2, Teacher Guide)
- Lesson 2, Navigate Section, Step 1 “Revisit our notice and wonder chart. Co-construct the lesson question. Then, use these noticings and wonderings to connect to today’s activities and co-construct a lesson question with students. The question can be similar to, ‘Where is light coming from around us?’ Revise the question on slide B to match the words and language used by the class and then display it.” (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 1 “Recall where we left off. Co-construct the lesson question. Use student’s wonders and their ideas for finding out more to suggest a lesson question to guide the lesson’s work. The question can be similar to How can we test what happens when the same light shines on different materials? Revise slide C to the lesson question the class agreed upon and display the lesson question. (Lesson 3, Teacher Guide)
- Lesson 5, Navigate Section, Step 1 “Recall where we left off. Co-construct our lesson question. Using the language your class has been using, decide on a lesson question that allows the class to explain the

different amounts of light under each cover, such as Why is it brighter or dimmer under different cover materials? Revise the question as needed on slide B and then display it for students. Suggest looking back at our models from Lesson 1 to see what our first ideas about this question were.” (Lesson 5, Teacher Guide)

- Lesson 9, Synthesize Section, Step 2 “Build a Gotta-Have-It-Checklist. Seek clarification about ideas added. After adding ideas, be sure to check with students to confirm their thinking has been captured and that you give them the opportunity to ask questions, seek clarification, and/or add any words they may want to use in their writing.” (Lesson 9, Teacher Guide)

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

- Lesson 1, Synthesize Section, Step 5 “Develop an initial model. Transition to asking more questions. Summarize how students have shared many ideas about why there were differences reading under each cover, but there are still things we are unsure about. Suggest returning to the Notice and Wonder chart to make sure we add all the questions we have.” (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2 “Make observations. Prompt students to look around the room for where light might be coming from in the classroom. Give students about 15 minutes to complete their scavenger hunt. If you can, take students outside for some of this time to find where light is coming from outside.” (Lesson 2, Teacher Guide)
- Lesson 2, Synthesize Section, Step 6 “Create our growing ideas chart. Explain to students that we will use this chart to keep track of what we have figured out throughout the unit. As students share ideas, add them to the column titled, ‘What did we figure out?’” (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 4 “Carry out an investigation. Transition students to their small groups. Have them test each of the materials and draw what they observe happens when light is shined on the material with the flashlight beam directed toward the Light Lab Circle handout. (Lesson 3, Teacher Guide)
- When the phenomena from Lesson 3, Explore Section, Step 4 “Conduct an Investigation” (Lesson 3, Teacher Guide) combine with the phenomena from Lesson 4, Explore Section, Step 2 “Conduct an investigation” (Lesson 4, Teacher Guide) students are able to experience phenomena that support sensemaking around 1-PS4.B.2 directly: Some materials allow light to pass through them, others allow only some light through. Others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Students test different materials in Light Lab 1 in Lesson 3 and Light Lab 2 in Lesson 4 that are translucent, transparent, and opaque, which support students to make sense of light passing through materials because of the quality of the material and not thickness or other reasoning. (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 3 “Make sense of data. Emphasize that it is ok if we do not agree yet and still have questions. Suggest that we share our ideas about why we put materials into the different groups and provide students with the opportunity to retest or relocate their material to another location on the chart if they choose. Students will have yet another opportunity to retest/relocate materials during the Connect portion of this lesson, as well.” (Lesson 4, Teacher Guide)
- Lesson 4 lists the three-dimensional learning goal as “Make observations to collect data that can be used to make comparisons of how much light from a flashlight passes through or is blocked (effect) by placing different materials in its path (cause)”. The students are provided direct opportunities to investigate materials and collect data in Light Lab 2. Phenomena from Lesson 3 and Lesson 4 support sensemaking about materials that are translucent, transparent, and opaque by testing a variety of materials with examples for each category. Students collect data by representing the light they saw on their hand-outs and also have data related to their sorts. In Lesson 4, students also read an infographic that supports sensemaking around this three-dimensional goal. (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize Section, Step 2 “Reflect on my work. Lead a discussion to reflect on initial models and plan our new models. Using Our Growing Ideas chart, lead students through a discussion to brainstorm what new science ideas and relationships between light and materials they figured out in Lessons 2-4 that could help them explain why it is brighter or dimmer under the different covers using their model.” (Lesson 5, Teacher Guide)
- Lesson 6 lists the three-dimensional learning goal as “Make observations of an object in a pinhole box with and without a light source to use as evidence to explain how an object in a dark pinhole box can be seen only when illuminated with a light source”. The Explore Section of the lesson provides direct opportunities for students to investigate whether they can see with and without a light source and for students to conclude that a light source is necessary to see an object.” Additionally, students read a book, Light in the Dark, and watch a video that provides opportunities to make observations about needing light to see. These additional phenomena support sensemaking around *PS4.B-P1: Objects can be seen only when light is available to illuminate them*. (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 2 “Play and investigate. Add to our lesson question. Use student observations about the light appearing in other places to motivate investigating this effect further to help us answer the lesson question about making it light where it is dark.” (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2 “Use a model to explain. Recall how we have used models to explain. What have we used models to explain? Use models to explain ideas. Distribute the Reading Under Covers Model student assessment.” (Lesson 8, Teacher Guide)
- Lessons 9 and 10 list the three-dimensional learning goal as “Communicate an evidence-based account of how a book can be seen (effect) under a cover that allows all, some, or no light to pass through only if light is available to illuminate it (cause).” (Lesson 9, Teacher Guide) Both lessons provide direct opportunities for students to use artifacts and learning from previous lessons to author a class book to explain to readers that light is necessary to read/see a book.

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

NA

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 making sense of how one might be able to read in the dark. The targeted elements of all three dimensions are clearly 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 students have the opportunity to develop and use the SEPs in this unit. Students use the SEPs to make sense of the phenomena throughout the unit. The number of elements that students use and develop in the unit is appropriate for the grade band and the length of the unit. Teacher materials, such as the Unit Overview and the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix, provide explicit descriptions regarding the elements that are intentionally developed and those that are practiced or used.

The following SEPs were claimed to be intentionally developed in the unit. A narrative of how these are developed in the unit is provided in the 1 1.1 Waves Light Unit Front Matter - Unit Overview document in the section titled "Which Performance Expectations does this unit build toward?" Element-level descriptions of how each SEP identified in this unit progress lesson-by-lesson can be found in the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix. The evidence below represents the close match between the SEP elements that are claimed. The reviewers also found a close match with additional SEP identified as opportunities for practice. A brief description of how these are developed in the unit is provided in the 1 1.1 Waves Light Unit Front Matter - Unit Overview document in the section titled "Which Performance Expectations does this unit build toward?" Element-level descriptions of how each SEP identified in this unit progress lesson-by-lesson can be found in the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix.

Constructing Explanations and Designing Solutions

CEDS-P1 - Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomena.

Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Explore Section, Step 2 "Create a shared plan for making observations. Use some of the ideas students shared to provide guidance about what to do when trying to read under covers. Discuss with students that observations are details you notice by watching, listening, or feeling. Continuing to build off of their ideas, encourage students to make observations of the differences they see when they look at the book under each kind of cover, how dark it is, and the differences they feel when they touch the cover materials." (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2, the teacher uses prompts to support student sensemaking based on their observations, "Where have you noticed light coming from inside our classroom? Where have you noticed light coming from outside of our classroom? How did you know that light came from _____? What questions do you have about where light is coming from?" (Lesson 2, Teacher Guide)
- Lesson 6, Connect Section, Step 5, "In previous lessons, students made and used first-hand observations from their investigations as evidence to support their explanations on Our Growing Ideas chart. In this lesson, students also make observations while viewing the Can We See in Total Darkness? video. When

completing Our Growing Ideas chart later in the Synthesize, emphasize how scientists can also use observations from media, like this video, as evidence when constructing their explanations.” (Lesson 6, Teacher Guide)

- Lesson 8, Synthesize Section, Step 3, Students make claims supported with evidence to come to a consensus for how to explain, “How can we use a model to explain how to make it easier to read under covers that block light?” (Lesson 8, Teacher Guide) Students are reminded that “we always use evidence to support our claims in science. Evidence is the observations, data, or information that helps answer the scientific question. Point to each claim that students made, and ask students what evidence we have that supports that claim. As students share, continue to support them in responding to and building off of one another’s ideas. Then, add photos and artifacts to the column titled, “How did we figure it out? (Lesson 8, Teacher Guide).

INV: Planning and Carrying Out Investigations

INV-P2 - Plan and Conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 3, students collaboratively plan an investigation via discussion guided by teacher prompts that help them to “think through each aspect of the investigation plan and consider why following the plan will help them produce data that can serve as the basis for evidence to answer their question.” (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 4, “Carry out the investigation. Transition students to their small groups. Have them test each of the materials and draw what they observe happens when light is shined on the material with the flashlight beam directed toward the Light Lab Circle handout.” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, “Gather students in the Scientists Circle to briefly share ideas for how they could carry out an investigation to collect the necessary data they need to answer their question, What happens when we shine the same light on different materials? Prompt students, ‘If we want to figure out, What happens when we shine the same light on different materials, what would we need? Turn and talk with a partner.’” (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 2, Students plan to use a pinhole box to represent their classroom to determine if they need light to see. “Think, pair, share about using the materials. Ask students to think, pair, share about how they can make it dark in the box and how to make it light in the box. Then come back as a group and have a few students share ideas.” (Lesson 6, Teacher Guide)

INV-P4 - Make observations (firsthand or from media) to collect data that can be used to make comparisons.

Evidence was found in all claimed lessons. Examples include:

- Lesson 3, Explore Section, Step 4, students record observations during their light lab investigation by drawing and writing what they observe as they test each material. “Have them test each of the materials and draw what they observe happens when light is shined on the material with the flashlight beam directed toward the Light Lab Circle handout.” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, “While students complete the investigation, use the associated prompts to engage small groups in sensemaking discussions about their observations.” (Lesson 4, Teacher Guide) Prompts included, “Can you show or tell me why you placed (material) in (group)? What did you observe? You said you observed all/some/no light on the circle. What do you think that means about this material? Reference one of the categories: Why did you group these materials together?” (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 3: students make observations, writing and drawing what they could see when looking into the pinhole box with the pinhole covered, with the pinhole uncovered, and looking into

the pinhole box with a flashlight. In Step 4, they share their observations together and make sense of their observational data.

INV-P6 - Make predictions based on prior experiences.

Evidence was found in Lesson 3 as claimed. Examples include:

- Lesson 3, Explore Section, Step 4, “Turn and talk about what might happen to the light. Share with students that scientists often use their experiences to think about what they might observe before carrying out their investigations. Have students briefly turn and talk about the questions below to make predictions about what they may observe. How are the materials similar to our cover materials? What do you think you will see when you shine light on the square of parchment paper? The square of cardstock? The plastic lid?” (Lesson 3, Teacher Guide)

MOD: Developing and Using Models

MOD-P1 - Distinguish between a model and the actual object, process, and/or events the model represents.

Evidence was found in Lesson 6 as claimed. Examples include:

- Lesson 6, Explore Section, Step 2 “Introduce the pinhole box. Acknowledge how it would be really time-consuming to block all the light from all the light sources around our classroom to make it very dark. Share how sometimes scientists use a smaller version of an actual object or place to help figure things out when it would be hard to experience something in everyday life. Show students a pinhole box and display slide E. Explain that a pinhole box is a “tiny room” that has one tiny place for light to enter.” (Lesson 6, Teacher Guide)

MOD-P2 - Compare models to identify common features and differences.

Evidence was found in Lesson 5 as claimed. Examples include:

- Lesson 5, Navigate Section, Step 1 Teacher has students revisit their Reading Under Covers Initial Model from Lesson 1 and ask students to discuss with a partner “How are your initial models similar? How are they different?” (Lesson 5, Teacher Guide)

MOD-P3 - Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).

Evidence was found in all claimed lessons. Examples include:

- Lesson 1, Synthesize Section, Step 5, “Introduce planning our models. Summarize how we decided that we can use models to explain our ideas about the differences we noticed reading under the covers and why we think that happened. Lead a think, pair, share and record student ideas. Display slide G and explain to students that we will share our thinking about what we could include in our models using a Think, Pair, Share (see broadening access callout). One by one, ask each question aloud and direct students to think first, then talk with a partner, and then share with the group about their ideas. As students share their ideas with the whole group, record their thinking using words and drawings on a chart with the title “Initial Model Ideas.” This chart can be made in any public display space such as chart paper, whiteboard, or digital slide. When applicable, show or point to the object students want to represent.” Teacher prompts are provided to discuss students’ ideas about how to represent the materials, light sources, and what happened as they tried to read under the different covers. (Lesson 1, Teacher Guide)
- Lesson 5, Synthesize Section, Step 5, “Develop models using evidence from investigations. Transition students to independently develop their models or add to their Reading Under Covers Initial Model handout from Lesson 1. As students develop their models, remind them that they can look at the Our

Growing Ideas Chart and My Growing Ideas Checklist to help us remember our decisions about what to include to explain why it was brighter or dimmer under the three covers.” (Lesson 5, Teacher Guide)

- Lesson 5, Synthesize Section, Step 3, “As students develop their models, support them in considering how they can represent amounts of light in their model and the relationship between cover material and the amount of light that passes through. While these elements may have appeared in their initial models, students should be encouraged to make them explicit in their models in this lesson.” (Lesson 5, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2, “Recall how we have used models to explain. Gather in a Scientists Circle. Display slide B and use the example model to remind students that a model can be used to explain how or why something happens in the world...Give directions for the Reading Under Covers Model. Display slide D and show students the image of the model on the handout. Read the directions aloud for students. The model below can be used to explain how to read under covers that block light. Circle the parts of this model that help show how the person can read under the blanket. Write or tell why we need these parts in the model to explain how to read easily under the cover.” (Lesson 8, Teacher Guide)

**Rating for Criterion: DCI
Extensive**

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

The reviewers found extensive evidence that students have the opportunity to develop and use the DCIs in this unit. Students use the DCIs to make sense of the phenomena throughout the unit. The number of elements that students use and develop in the unit is appropriate for the grade band and the length of the unit. Teacher materials, such as the Unit Overview and the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix, provide explicit descriptions regarding the elements that are intentionally developed in the unit.

The following DCIs were claimed to be Intentionally Developed in the Unit in the Unit Overview and the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix. The evidence below represents a close match between the DCI elements that are claimed.

PS4.B Electromagnetic Radiation

PS4.B-P1: Objects can be seen only when light is available to illuminate them. Some objects give off their own light.

Evidence was found in all claimed lessons. Some examples include:

- Lesson 1, Explore Section, Step 2, “Make observations under each cover material. Turn off the overhead lights and let each group rotate from one cover to another for about 3-5 minutes per cover material. As students explore under each cover, use the following possible discussion prompts to talk to students in small groups and elicit their ideas about what they notice under each cover. How would you describe this cover? What does it look like? What does it feel like? What do you notice while under this cover? How dark is it? How well can you read under this cover? What do the words and pictures look like?” (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2 “Share observations. Facilitate a class discussion about observations. Use the prompts below to support pairs in sharing to the whole class about the place or object they have chosen. Can you tell us more about why you chose that object? What helps you know light comes from the

_____? What do you think we use that light for? What do you think would happen if we turned a light off?" (Lesson 2, Teacher Guide)

- Lesson 5, Synthesize Section, Step 3 "Develop a model. Engage in one-on-one discussions while students develop models. Prompts to use I see you included (light source). Why is it important to include a (light source) in your model?" (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Step 3 "Make observations. Make observations with the pinhole covered. Have students take turns looking in the pinhole box with the pinhole covered to observe the object inside. After they look in the box, they should record their observations about what they could see in the corresponding box on the Pinhole Box Observations handout and share their observations about the object with their group. As students try to view the object in the pinhole box, circulate between groups and ask the following questions. Encourage both scientific and everyday language to express their ideas. Can you tell me what you notice about the object in the pinhole box with the pinhole covered? Can you tell me about the color? Shape? Other details you notice? Why do you think you could/couldn't see anything? What caused that? Make observations with the pinhole uncovered. Have students take turns looking in the pinhole box with the pinhole uncovered. After they look in the box, they should share their observations about the object inside with their group about what they could see and record their observations in the corresponding box on the Pinhole Box Observations handout. As students try to view the object in the pinhole box, circulate between groups and ask the following questions. Encourage both scientific and everyday language to express their ideas. What did you notice about the object when the pinhole was uncovered? How could you now tell there was something in the box? Can you tell me about the color? Shape? Other details you notice? What do you think caused you to see the sticker this time?" (Lesson 6, Teacher Guide)
- Lesson 8, Connect Section, Step 4: "Read a book. Facilitate an interactive read-aloud using the associated prompts. Display slide F and introduce the Meet the People Who Work at Night book. Page 6: Why does Judd use a flashlight? How is this similar to how we have used flashlights? Page 12: What kind of materials do you think the door and window coverings are? Why do you think so? Page 16: What kind of light sources do you use when you need to see something at night?" (Lesson 8, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2 "Use a model to explain Gather in a Scientists Circle. Display slide B and use the example model to remind students that a model can be used to explain how or why something happens in the world. Under which cover was it the dimmest/darkest? What was that like? Why do you think so? What do you think should be included in a model that would explain how to make it easier to read under that kind of cover? Turn and talk about the lesson question. Have students turn and talk to share their first ideas about the lesson question: 'How can we use a model to explain how to make it easier to read under covers that block light?'" (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3 "Write to explain. Discuss directions and materials for writing time. Explain that we are ready to start writing our pages for the class book. We will each explain how to read under one of the covers and when we have all of our pages together in a book the book will explain how to read under all three covers." (Lesson 9, Teacher Guide)
- Lesson 10, Connect Section, Step 4, "Present the class book. Have students present the class book to their chosen audience. If students are sharing this work with a diverse audience beyond the classroom community, have one or two students explain what they have been focusing on in science and that they wrote the book to communicate information about reading under covers when it is dark to help their specific audience. Then, have students present their individual pages while encouraging them to either present in their home languages and/or provide any examples, community knowledge, and/or stories that are relevant to their audience for when they need to read in the dark. This can strengthen students' science identities as their histories and ways of knowing are valued and relevant in their individual pages." (Lesson 10, Teacher Guide)

PS4.B-P2: Some materials allow light to pass through them, others allow only some light through, and still others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.

Evidence was found in all claimed lessons. Some examples include:

- Lesson 1, Explore Section, Step 3 “Share observations Facilitate an Initial Ideas Discussion. Use the prompts below to facilitate a whole group Initial Ideas Discussion about their experiences reading under each cover material. Try to use your words, body, or hands to share what you noticed about the differences in covers? What did you observe under the ____ cover? Why do you think it was easier/harder to read under ___ cover? What do you think caused that to happen?” (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 4 “Carry out an investigation. Have them test each of the materials and draw what they observe happens when light is shined on the material with the flashlight beam directed toward the Light Lab Circle handout. Facilitate small group discussions. While students complete the investigation, use the associated prompts to engage small groups in sensemaking discussions about their observations. What happened when you shined the flashlight on the plastic lid? What happened when you shined the flashlight on the parchment paper? What happened when you shined the flashlight on the cardstock?” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 4 “Carry out an investigation. Discuss the new materials. Ask students what they notice and how they would describe the different materials. Support students in making connections between the materials that they investigated in Lesson 3 and these new materials. For example, students may notice the acrylic disc from today and the plastic lid from lesson 3 are both clear. What do you notice about these materials? (ideas about how see through, what they are made of, color, thickness, shape, size) How are they similar to the Light Lab 1 materials or the cover materials? How are they different? Display slide D and show the pre-cut Category Cards labels to students reading each aloud, “We see all the light on the circle,” “We see some light on the circle,” and “We see no light on the circle.” connecting how they match the observations we made last time when we recorded observations on the Light Lab Observations handout from Lesson 3. Carry out the investigation.” (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3 “Develop a model. Engage in one-on-one discussions while students develop models. Prompts to use Why do you think it was brighter or dimmer under the different cover materials? How did you show/tell about that? Feel free to use your body, hands, and model to explain why it was brighter or dimmer. I see you are working on showing how much light passes through each material. How much light could you show passing through the shower curtain? I see you included (cover materials) and used yellow and black crayon. Can you tell me more about what those colors mean? I see you included (way to show how light passes/does not pass through a material). How does that help you explain why it was brighter/dimmer under the cover?” (Lesson 5, Teacher Guide)
- Lesson 7, Explore Section, Step 3 “Plan and carry out an investigation. Carry out an investigation in pairs. Have one partner use tape to secure the paper circles to the wall. Distribute the remaining materials (flashlights, mirror, foil), and provide about 5-10 minutes for students to investigate. Remind students that during the investigation, they should make observations of the light on the mirror/foil and on the paper circle on the wall. While they are investigating, circulate and use the following prompts to check in with students.” (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2 “Use a model to explain Gather in a Scientists Circle. Display slide B and use the example model to remind students that a model can be used to explain how or why something happens in the world. Under which cover was it the dimmest/darkest? What was that like? Why do you think so? What do you think should be included in a model that would explain how to make it easier to read under that kind of cover? Turn and talk about the lesson question. Have students turn and talk to share their first ideas about the lesson question: How can we use a model to explain how to make it easier to read under covers that block light?” (Lesson 8, Teacher Guide)

- Lesson 9, Synthesize Section, Step 2 “Our goal for today is to explain how to read under each cover when it is dark to members in our community who also need to do things when it is dark, so it will be our job to plan what information we need to write about to explain that...Transition to writing our book pages. Once students have come to agreement about the important ideas needed to explain how to read under each cover, explain that they will now be able to start using those ideas to write their page of the class book!” (Lesson 9, Teacher Guide)
- Lesson 10, Connect Section, Step 4, “Present the class book. Have students present the class book to their chosen audience. If students are sharing this work with a diverse audience beyond the classroom community, have one or two students explain what they have been focusing on in science and that they wrote the book to communicate information about reading under covers when it is dark to help their specific audience. Then, have students present their individual pages while encouraging them to either present in their home languages and/or provide any examples, community knowledge, and/or stories that are relevant to their audience for when they need to read in the dark. This can strengthen students’ science identities as their histories and ways of knowing are valued and relevant in their individual pages.” (Lesson 10, Teacher Guide)

Criterion-Based Suggestions for Improvement: NA

Rating for Criterion: CCC
Extensive

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

The reviewers found extensive evidence that students have the opportunity to develop and use the CCCs in this unit. Students use the CCCs to make sense of the phenomena throughout the unit. The number of elements that students use and develop in the unit is appropriate for the grade band and the length of the unit. Teacher materials, such as the Unit Overview and the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix, provide explicit descriptions regarding the elements that are intentionally developed and those that are practiced or used.

The following CCCs were claimed to have been Intentionally Developed in the Unit in the Unit Overview and the 5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix. The evidence below represents a close match between the CCC elements that are claimed.

CE: Cause & Effect

CE-P1 Events have causes that generate observable patterns.

Evidence was found in all claimed lessons. Some examples include:

- “All of these experiences help students notice patterns in how bright or dim it appears to be beyond a different material in the path of a beam of light. They use these patterns to figure out that the material causes some, none, or all light to pass through making it appear to be bright or dim. Through multiple experiences, students also recognize illuminating an object causes us to be able to see that object.” (Unit Overview)
- Lesson 3, Synthesize Section, Step 5, students begin to notice patterns in how much light passes through different materials they are investigating. “Continue the discussion about students’ ideas that connect to the unit question. Remind students of the unit question, How can we read under covers when it is dark? Ask students to turn and talk about how their investigation - placing different materials in the path of

light to observe for light on the circle (or how bright/dim it is underneath the material) - relates to the unit question. Then, ask students to share their ideas aloud. "What similarities did you notice about the materials that you tested today and the covers you tried to read under?" After they have completed this discussion with evidence-based claims, they revisit the Notice and Wonder chart to consider answered questions or new wonderings. The Teaching Tip Callout shares, "It may be helpful to return to the Notice and Wonder chart during this discussion to motivate further investigation in Lesson 4, especially if new questions or areas of disagreement did not immediately surface in this lesson. Ideas and questions about the amount of light coming through and other cause-and-effect relationships your students may have identified will be addressed in Lesson 4." (Lesson 3, Teacher Guide)

- Lesson 4, Explore Section, Step 2, "Facilitate small group discussions. While students complete the investigation, use the associated prompts to engage small groups in sensemaking discussions about their observations. Encourage students to use the investigation materials, their hands, words in any language, and drawings as needed to demonstrate their sensemaking." Associated prompts include: "You said you observed all/some/no light on the circle. What do you think causes that to happen?" (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 3, "Problematize students' understanding. Summarize students' observations that supported placing their materials in given categories: we have figured out that we can see all, some, or no light on the other side of the different materials. Ask students to think first and then talk to a partner about what they think that means about the light and different materials: What do our observations mean about the light and these different materials? How do you think we can see all the light on the other side of the plastic, but none of the light under the foil? What do you think is happening?" (Lesson 4, Teacher Guide)
- Lesson 7, Explore Section, Step 3, "Share our observations. Have students return their investigation materials, scissors, glue, and writing utensils to the classroom's storage space/spaces for those items. Then, invite students to come together in a Scientists Circle with their completed Light to Dark Investigation handout. Have one set of investigation materials (mirror, foil, flashlight, Investigation Circle) available in the middle of the Scientists Circle. Use the associated prompts to discuss what the class observed: A cause explains why something happens. What causes the light to reach the paper circle? How does the flashlight beam get to the paper circle on the wall? What evidence do you have for your idea? An effect explains what happened. So, if we have a beam of light and we put foil or a mirror in its path, what will the effect be?" (Lesson 4, Teacher Guide)

CE-P2 Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Evidence was found in all claimed lessons. Some examples include:

- "Students are formally introduced to cause and effect when they read an informational text about light in their communities in Lesson 2. Students discuss how turning on a flashlight caused a space to become brighter. The class then performs the simple test of turning classroom lights on and off to determine the effects together. Then, throughout the unit, students have opportunities to design and use simple tests (shining light on different materials in Lessons 3, 4, and 7 and observing objects in different lighting conditions in Lesson 6) in small groups and eventually partnerships to gather evidence to support and refute their ideas about what causes a space to be bright or dim and what causes it to be easier or harder to see. Through these tests, students use evidence to support ideas about light sources illuminating spaces, materials causing certain amounts of light to come through, and that light is what causes us to see objects. Tests shining light on different materials allow students to gather evidence to refute ideas that characteristics of a material like its thickness or color alone caused a certain amount of light to pass through." (Unit Overview)

- Lesson 3, Explore Section, Step 4, Cause and Effect Callout: “In Lesson 2 students performed simple tests as a class to gather evidence to support or refute ideas about light sources making a space brighter. Support students in building on that use by encouraging them to retest their Light Lab 1 materials as needed in their small group to notice the effect each material has on the beam of light. Students will continue to develop their use of this Crosscutting Concept in Lesson 4 as they test and sort materials by the effect of placing them in the path of a flashlight beam in order to gather more evidence. Facilitate small group discussions. While students complete the investigation, use the associated prompts to engage small groups in sensemaking discussions about their observations. What happened when you shined the flashlight on the plastic lid? Can you show me with your hands or body what happened? What happened when you shined the flashlight on the parchment paper? What happened when you shined the flashlight on the cardstock? What do you think caused ____ to happen?” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, Cause and Effect Callout, “Students use this crosscutting concept as they perform the simple test of placing materials with similar attributes (transparency, opacity, color, size, thickness) to gather information about what makes the Light Lab Circle lighter or darker. Students should be using this evidence to begin refuting ideas that attributes such as color or thickness alone cause light to go through to the circle. Students will continue to gather evidence that further supports how the type of material (transparent, translucent, opaque) is what causes different amounts of light to pass through to the circle.” (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 3, “Problematize students’ understanding. Summarize students’ observations that supported placing their materials in given categories: we have figured out that we can see all, some, or no light on the other side of the different materials. Ask students to think first and then talk to a partner about what they think that means about the light and different materials: What do our observations mean about the light and these different materials? How do you think we can see all the light on the other side of the plastic, but none of the light under the foil? What do you think is happening?” (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section Step 4, Cause and Effect Callout: “In these discussions, students share ideas for what causes it to be easier or harder to see the object (why they can see an object). Encourage students to use evidence from their investigation to support or refute ideas about causes.” (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Cause and Effect Callout: “Students previously performed simple tests to gather evidence about what caused different amounts of light to appear beyond different materials. They build on that here in developing their investigation plan by using simple tests to gather evidence about what causes light to redirect into a certain place when shined on mirrors and foil. They will also progress in their use of this crosscutting concept while testing ideas about causes in the context of engineering in *OpenSciEd Unit 1.2: How do objects make and use sound to communicate? (Sound Signals Unit)*. (Lesson 7, Teacher Guide)

Criterion-Based Suggestions for Improvement: NA

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 phenomena requires student performances that integrate elements of the SEPs, CCCs, and DCIs. In the unit, students are expected to collaboratively plan and conduct investigations to gather evidence that can be used to answer questions about the effect of placing different materials in the path of a beam of light, and use observations to make an evidence-based account that the objects in the dark can only be seen when illuminated by a light source, which requires them to use grade-appropriate elements of the three dimensions simultaneously. The three dimensions are not used in isolation, but are integrated to support student sensemaking over time. Students are expected to figure out something that requires the use of three dimensions working together at grade level.

- Lesson 1, students are introduced to the anchoring phenomenon as they read under covers made of different materials to generate ideas and questions about the differences in the amount of light and how easily they were able to see under each cover. They develop an initial model to explain their thinking about reading under different covers. Integration of elements of the three dimensions: **CE-P1: Events have causes that generate observable patterns.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach,** and **MOD-P3: Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).**
- Lesson 2, students use evidence from a scavenger hunt about light sources to support claims they build later in the lesson to answer the lesson question about where light comes from. They work to connect these ideas with cause and effect relationships discussed in Lesson 1 when trying to figure out how to read under the covers. Integration of elements of the three dimensions: **CE-P2 Simple tests can be designed to gather evidence to support or refute student ideas about causes.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach,** and **INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.**
- Lesson 3, students describe what they have figured out related to how light interacts differently with different materials and how it connects with the unit question about reading under covers in the dark. Integration of elements of the three dimensions: **CE-P2 Simple tests can be designed to gather evidence to support or refute student ideas about causes.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach,** and **INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.**
- Lesson 5, students develop a model to explain why it is dimmer or brighter under cover materials. Integration of elements of the three dimensions: **CE-P1: Events have causes that generate observable patterns.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach,** and **MOD-P3: Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).**
- Lesson 6, students analyze data to explain why they can see when there is light in a box and why they cannot see when there is no light in a box. Integration of elements of the three dimensions: **CE-P2 Simple tests can be designed to gather evidence to support or refute student ideas about causes.** **PS4.B Electromagnetic Radiation: Objects can be seen if light is available to illuminate them or if they give off their own light,** and **INV-P4: Make observations (firsthand or from media) to collect data that can be used to make comparisons.**

- Lesson 7, students collaboratively plan and conduct an investigation to gather evidence that mirrors can be used to redirect a beam of light to places that are dark. Integration of elements of the three dimensions: **CE-P2 Simple tests can be designed to gather evidence to support or refute student ideas about causes.** **PS4.B Electromagnetic Radiation: Mirrors can be used to redirect a light beam,** and **INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.**
- Lesson 8, students revise or create a new model to represent the relationship between light and seeing to explain how illuminating a book in a dark space makes the book easier to see. Integration of elements of the three dimensions: **CE-P1: Events have causes that generate observable patterns.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam,** and **MOD-P3: Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).**
- Lessons 9 and 10, students plan and write an informational text that explains how to read under the cover when it is dark. They construct an evidence-based account of how a book can be seen under a cover that allows all, some, or no light to pass through only if light is available to illuminate it. Integration of elements of the three dimensions: **CE-P1: Events have causes that generate observable patterns.** **PS4.B Electromagnetic Radiation: Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.,** and **CEDS-P1: Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.**

Suggestions for Improvement: NA

I.D. Unit Coherence

Extensive

Lessons fit together to target a set of performance expectations.

- 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.
- 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 the lessons work together to provide sufficient opportunities for students to build proficiency in all of the targeted learning for all three dimensions, and each lesson builds directly on prior lessons and makes the links between lessons explicit to the students. Students answer their questions that arise during sensemaking opportunities by connecting evidence from their investigations and information collected about how objects in the dark can only be seen when illuminated and the effect of placing different materials in the path of a beam of light.

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.

- The first page of each lesson's Teacher Guide provides a quick glimpse of what has been done in the previous lesson (left side, gray bar) and where you will be going in the next lesson (right side, gray bar). This helps the teacher know some of the boundaries of the daily lesson and determine if/when additional ideas will be presented.
- Each lesson begins with a Navigate Section that supports students in recalling where the prior lessons ended. Each lesson ends with a Navigate Section that helps students decide where to go next. This requires some facilitation by the teacher, such as recording each lesson's new understandings on the Our Growing Ideas Chart. It also requires the teacher to prompt students to ask questions and record those ideas in order to include them in where to go next. During class discussions, students' responses to questions and other students' comments, including misconceptions, surface and can lead to the next investigation. Students are prompted with, "What questions do we still have?" "What did we figure out?" "How did we figure that out?" and by using tools such as a Notice/Wonder chart. These are all ways that students' ideas can connect this lesson to the next investigation.
- Students develop, add to, and use evidence from a Notice & Wonder Chart and/or their Our Growing Ideas Chart in each lesson of the unit. The use of these charts throughout the unit provides coherence and connection for the student's ideas and learnings and supports students in explicitly making connections to previous investigations or learnings.
- Lesson 3, Explore Section, Step 3 "Plan an investigation." Students make explicit connections of the investigation materials to the covers used in Lesson 1: "Can we share with words or our bodies what reasons might we have for not using our blanket, our sheet, and our shower curtain in our investigation? (Show students the cover materials from Lesson 1." There are multiple opportunities for students to connect this lesson to lessons 1 and 2, where students learn that they cannot read under one cover and what a light source is. This investigation builds the understanding by focusing on the same light source with different materials. (Lesson 3, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3 "Write an explanation. Students write and illustrate a page in a class book that is designed to elicit all the three-dimensional learning from the unit. The learning includes the continued use of models, the cause and effect patterns when light is or is not present and students discovered through investigations, and the understanding that light is necessary to see and some materials allow light to pass through while others do not." (Lesson 9, Teacher Guide)

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

- 1 1.1 Waves Light Unit Front Matter document, "Which Performance Expectations does this unit build toward?" section, provides a narrative description of how the unit develops student ideas and practices and works toward proficiency with two NGSS Performance Expectations: 1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated; 1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.
- Two "Following Student Sensemaking Tools" are provided in the unit to support teachers in gathering evidence of students' ongoing sensemaking proficiency aligned with the unit's performance expectations. These are designed to help teachers look for evidence of three-dimensional sensemaking across a variety of modalities. Each provides a checklist of "listen/look for" and a place for teachers to track notes of what students say, write, draw, gesture, or do for the three-dimensional learning goals in the selected lessons. A chart is provided giving possible evidence of student sensemaking based on what students might say and/or what students might gesture/manipulate.

- Lesson 2 Assessment Tool - Following Student Sensemaking 1 document allows teachers to document evidence of students' progress through Lessons 2, 6, 8, and 9 with Assessment Statement 1 "Students can use observations to make an evidence-based account that objects in the dark can only be seen when illuminated by a light source. (aligned to PE 1-PS4-2)."
- Lesson 3 Assessment Tool - Following Student Sensemaking 2 document allows teachers to document evidence of students' progress through Lessons 3, 4, 5, and 7 with Assessment Statement 2 "Students can collaboratively plan and conduct an investigation to gather evidence that can be used to answer questions about the effect of placing different materials in the path of a beam of light. (aligned to PE 1-PS4-3)."

Suggestions for Improvement: NA

I.E. Multiple Science Domains	Extensive
<p>When appropriate, links are made across the science domains of life science, physical science, and Earth and space science.</p> <ol style="list-style-type: none"> Disciplinary core ideas from different disciplines are used together to explain phenomena. 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 phenomena driving the learning can be fully addressed within one science domain. As mentioned in I.B., a close match between all claimed DCI elements was found in the unit.

PS4.B-P1 Objects can be seen only when light is available to illuminate them. Some objects give off their own light.

- The Unit Overview document provides a summary of the progression of this DCI in the section titled *Which Performance Expectations does this unit build toward?*: "Students first investigate where light comes from in their classroom, school, and communities to identify different objects that give off their own light. In Lesson 6, students further build on their understanding of light sources by investigating environments with and without light using pinhole boxes. When the pinhole is covered, the pinhole box represents what it is like to be in total darkness without any light sources present. Students observe that an object is visible when light illuminates it inside the pinhole. When there is no light to illuminate an object in the pinhole box, the object is not visible. Students also watch a video and read an informational text to reinforce their observations that objects can only be seen when there is a light source to illuminate them. These experiences help them to develop a model that explains how it is easier to see/read a book under covers when the book is illuminated." (1 1.1 Waves Light Unit Front Matter document)

PS4.B-P2 Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is

developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)

- The Unit Overview document provides a summary of the progression of this DCI in the section titled *Which Performance Expectations does this unit build toward?*: “Students also investigate the effect of placing materials in the path of a beam of light in Lessons 3 and 4 to figure out why light from the same light source can appear brighter or dimmer under different cover materials. They place transparent, translucent, opaque materials in the path of a flashlight’s beam of light and observe the surface below the material. In Lesson 4, they analyze these effects and figure out that different materials allow all, some, or no light to pass through them and a dark shadow forms where light does not pass through. Finally, in Lesson 7, students investigate how mirrors can be used to redirect a beam of light to illuminate an object we want to see.” (1 1.1 Waves Light Unit Front Matter document)

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 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. All students use reading skills at a grade-appropriate level to develop understanding of scientific concepts and support their sensemaking. Students use writing skills to explain and communicate their understanding of the scientific concepts and phenomena. Students have multiple opportunities to speak and listen to peers in a variety of formats and scenarios. Mathematics concepts related to Measurement and Data are explicitly incorporated into lessons when a reasonable match exists with the science concepts. Students use them to explain or understand scientific concepts, phenomena, or results. **However, there is some mismatch among the Mathematics standards claimed in the unit.**

ELA

1 1.1 Waves Light Unit Front Matter document provides a section titled “How are connections to CCSS ELA used to support sensemaking in this unit?” that explains how the unit integrates “opportunities for practicing reading, writing, speaking and listening to support science learning.” This section provides a table that explains the different types of books and texts used within the unit and shares how ELA standards are integrated throughout the unit, offering explicit support for teachers around specific standards in lesson materials and how there are many regularly occurring ELA standards “intertwined with students’ science learning and their communication of their sensemaking.” A table is included to describe how those standards are regularly built into lessons. They are listed and explained in this section and also found in the Unit Connections to the Common Core Standards matrix.

5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix document, Unit Connections to the Common Core Standards, “Building Toward English Language Arts Standards” provides explicit guidance to teachers related to the ELA standards within the unit, indicating the standards explicitly claimed within a lesson with specific support for teachers with an asterisk and the standards embedded in the work (regularly occurring) with a check mark. This document also provides information regarding the grade levels of the texts used within the unit in the “Building Towards English Language Arts Standards” section: “Texts intended for use in interactive read alouds are approximately two grade levels above the CCSS range for text complexity, and texts intended for scaffolded independent reading are within the CCSS text complexity range for that grade level.”

Related reading materials go beyond textbooks and include a variety of formats:

- Nonfiction/Informational Books (read-alouds):
 - Lesson 1, *Scientists Explain Using Models*, Lesson 2 and 10, *Light in Our Communities*, Lesson 3, *Scientists Plan and Carry Out Investigations*, Lesson 6, *Light in the Dark*, and Lesson 8, *Meet the People who Work at Night*. (Unit Front Matter)
- News article:
 - Lesson 7, *Middlebury Elementary Moon Race Riders*, “This newspaper article supports students in connecting the information in the article about how people use reflective materials to redirect light to their observations, and lived experiences investigating reflective materials.” (Unit Front Matter)
- Infographic:
 - Lesson 4, *Types of Materials*, “This infographic helps students gather information from a new kind of text. Students connect their observations to the descriptions and images to define transparent, translucent, and opaque materials and shadows.” (Unit Front Matter)

ELA standards are integrated throughout the unit to highlight the link between literacy and science for teachers and students. Explicit support for teachers and/or students in connecting standards to specific science learning objectives is indicated by a “Literacy Supports” callout in the gray sidebar of each lesson Teacher Guide.

Language, Reading: Informational Text, Speaking and Listening, and Writing are supported. Examples include:

Language

- L.1.1G (conjunctions) - Lesson 8
 - Lesson 8, Synthesize Section, Step 2, Literacy Supports Callout: “As students work on their model, they are writing an explanation for how to read easily under the cover. This is a good moment to encourage students to use frequently occurring conjunctions, like “because” to connect their ideas about reading under the cover. Using these words will enable students to write more complex sentences and connect more of their ideas within their explanation. This work supports L.1.1G when students use frequently occurring conjunctions.”

Reading: Informational Text

- RI.1.5 (text features) - Lesson 10
 - Lesson 10, Connect Section, Step 2, Literacy Supports Callout: “As students identify text features, they are gaining print knowledge relevant to science texts. They are also learning how to use text features to quickly locate information in the text and support their understanding of what was read. This work supports RI.1.5.”
- RI.1.7 (illustrations and details to describe key ideas) - Lessons 1, 6, 7
 - Lesson 1, Connect Section, Step 4, Literacy Supports Callout: “Students answering questions about the illustrated models in the text to describe key ideas about how scientists develop and use models supports RI.1.7. As students identify the rationale for images in a text, they learn that illustrations

have meaning and that it is important to understand how that meaning supports key details in a text.”

- Lesson 6, Connect Section, Step 6, Literacy Supports Callout: “The illustrations in *Light in the Dark* book are essential for students to understand the key idea that there is a difference between dark and total darkness. Students identify light sources in the images to determine whether the children in the book are in total darkness. Through this work, students learn that images have meaning in a text and that it is important to understand how that meaning supports the author’s point of view which offers an opportunity for practicing RI.1.7.”
- Lesson 7, Connect Section, Step 4, Literacy Supports Callout: “Discussion of the illustration of light reflecting off a mirror helps to visualize the key ideas about how reflective materials work that are described in the written text. As students identify the rationale for images in a text, they are learning that images have meaning in a text and that it is important to understand how that meaning supports the author’s point of view (R.1.7).”

Speaking and Listening

- SL.1.1A (follow agreed-upon rules for discussions) - Lessons 1, 5
 - Lesson 1, Explore Section, Step 2, Literacy Supports Callout: “Establishing classroom agreements provides an opportunity for students to develop and follow agreed-upon rules for discussion, supporting SL.1.1A...”
 - Lesson 5, Synthesize Section, Step 4, Literacy Supports Callout: “As we share our explanations, it is helpful to check in on class agreements and encourage our community to follow the agreed-upon rules for discussions (e.g., listening to others with care, and speaking one at a time about the topics and texts under discussion). This will support students in practicing SL.1.1A as they follow agreed-upon rules for discussions and further cultivate a safe community for learning science together.”
- SL.1.5 (add drawings/visual displays to clarify ideas) - Lessons 1, 2, 5
 - Lesson 1, Synthesize Section, Step 5, Literacy Supports Callout: “During the modeling tasks, students adding more detailed drawings and labels to their models and descriptions of reading under the different covers to clarify their ideas supports CCSS-ELA-LITERACY.SL.1.5. Incorporating these visual displays with their oral and written language enhances its meaning for a reader or listener.”
 - Lesson 2, Explore Section, Step 2, Literacy Supports Callout: “Adding visual displays of understanding, like drawings, along with their oral and written language on the *Light Scavenger Hunt* supports students in enhancing meaning for others who will be using or looking at their observations later in the lesson (SL.1.5).”
 - Lesson 5, Synthesize Section, Step 2, Literacy Supports Callout: “Even if students have already represented a given component, encourage them to add drawings or other visual displays to their existing drawings and descriptions of the cover materials to clarify their ideas about why it was brighter or dimmer under the covers. Adding these visual displays enhances the meaning of the model to others and supports SL.1.5.”

Writing

- W.1.2 (write informative/explanatory texts) - Lessons 9, 10
 - Lesson 9, Navigate Section, Step 1, Literacy Supports Callout: “The class book is an opportunity for students to collaboratively write an informative text about how to read under covers, which supports

W.1.2. Each student will provide facts to explain about reading under a cover material in this lesson and then the class will collaboratively write a closing page in Lesson 10. As students practice this standard they start to understand the uses and forms of informational text. This practice helps them when they have future experiences reading and writing other informational texts.”

- Lesson 10, Synthesize Section, Step 5, Literacy Supports Callout: “Students write their individual book pages and other collaborative pages in their book that incorporate a topic, some facts about the topic, as well as a closing. As students practice this standard, they start to understand the uses and forms of informational text. This practice helps them when they have future experiences reading and writing other informational texts and supports W.1.2.”

Mathematics

1 1.1 Waves Light Unit Front Matter document provides a section titled “How are connections to CCSS Math used to support sensemaking in this unit?” that explains the goal of integrating mathematics is to “build a strong base of knowledge to reinforce and strengthen science learning.” It describes the mathematics standards that are claimed to be intentionally integrated into specific lessons and how the mathematical practices are employed alongside crosscutting concepts to deepen learning.

5 1.1 Waves Light’s SEP-DCI-CCC-ELA-Math-Matrix document, Unit Connections to the Common Core Standards, “Building Toward Mathematics Standards,” provides explicit guidance to teachers related to the Math standards connections claimed to be supported within the unit. It indicates those that are explicitly used and named within a lesson with specific support for teachers with an asterisk.

Math Supports Callouts in Gray Sidebar of Lesson Teacher Guides:

MP4 Model with mathematics - Lessons 4, 5, 6, 8. **However, Lessons 5 and 8 are not mathematical connections, even though they use the language from the standard to show the amount of light present. The focus of this activity is scientific modeling, not mathematical modeling. They are not using numbers, equations, or anything quantitative to describe these models or to indicate the amount of light in quantitative measures.**

- Lesson 4, Explore Section, Step 3, Math Supports Callout: “Students will organize, represent, and interpret data during the analysis as they sort materials into three categories: those that (1) let all the light through, (2) let some of the light through, and (3) let no light through (MP4 and part of 1.MD.C.4). Refer to the prompt response table for specific questions about the data.”
- Lesson 5, Synthesize Section, Step 3, Math Supports Callout: “Students will draw a pictorial representation that displays the amount of light that passes through different materials. Have students show the amount of light present under each of the three covers as they develop their models, representing the amount of light using labels, numbers, or colors. (MP4)”
- Lesson 6, Lesson 6, Navigate Section, Step 1, Math Supports Callout: “Throughout this lesson, students will use a chart as a tool to display their developing understandings of whether or not we need light to see. Students will be organizing, representing, and interpreting data using this chart that will help them answer the lesson question. (MP4 and part of 1.MD.C.4)”
- Lesson 8, Synthesize Section, Step 2, Math Supports Callout: “Using a model that shows how to read under covers that block light will support students in making sense of the science. Additionally, the model will support students with precisely explaining how the different objects labeled in the model (blanket, mirror, light, etc.) interact with one another to allow someone to read under the covers (MP4 and MP6). Use questions from the prompt-response table to encourage students to explain their thinking about the relationship between the objects in the model.”

MP6 Attend to precision - Lessons 3, 4, 8. **Though using the language from the standard to discuss/describe properties/attributes of matter, there is no mathematical connection.**

- Lesson 3, Explore Section, Step 3, Math Supports Callout: "Students will practice distinguishing between, identifying, and precisely describing attributes of various materials as they explore the materials and test how much light shines through. (MP6)"
- Lesson 4, Explore Section, Step 4, Math Supports Callout: "As students test the amount of light shining through each material, ask them what they are noticing about each object's attributes. Prompt students to pay attention to details such as size, shape, and color of the materials to identify defining and non-defining attributes and to be precise in their explanations (part of 1.G.A.1 and MP6). For example, students may use the shape of the object to help notice there is a shadow surrounded by light which can help the students make sense of the light being blocked."
- Lesson 8, Synthesize Section, Step 2, Math Supports Callout: "Using a model that shows how to read under covers that block light will support students in making sense of the science. Additionally, the model will support students with precisely explaining how the different objects labeled in the model (blanket, mirror, light, etc.) interact with one another to allow someone to read under the covers (MP4 and MP6). Use questions from the prompt-response table to encourage students to explain their thinking about the relationship between the objects in the model." **Students have not quantified any of the interactions with light (measured the light/shadows, distances, etc.).**

MP8 Look for and express regularity in repeated reasoning - Lesson 9

- Lesson 9, Synthesize Section, Step 2, Math Supports Callout: "Students will revisit data collected throughout the unit about the defining and non-defining attributes of materials and the amount of light shining through different materials to help construct the Gotta-Have-It Checklist. (part of 1.MD.C.4, part of 1.G.A.1, and MP8)" **While using language from the standard, they are not using mathematical/quantitative data to see a mathematical "repeated reasoning". They are looking for patterns within their qualitative data about the properties/attributes of the materials.**

1.G.A.1 Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes. - Lessons 3, 4, 9. **While this uses the language from the standard, there is no mathematical connection. In Lessons 3 and 4, students discuss the properties of materials, and the discussion of a defining versus non-defining attribute here could lead to scientific misconceptions about the properties/attributes of matter. In Lesson 9, they are not using mathematical/quantitative data to see a mathematical "repeated reasoning". They are looking for patterns within their qualitative data about the properties/attributes of the materials.**

- Lesson 3, Explore Section, Step 3, Math Supports Callout: "As students describe attributes of the materials, including color, shape, and thickness, support them in attending to precision in their communication by asking them if these are defining or non-defining attributes and why (part of 1.G.A.1)."
- Lesson 4, Explore Section, Step 4, Math Supports Callout: "Students will make connections between the materials they will explore today and the materials they explored in lesson 3. Encourage them to talk about defining and non-defining attributes such as color, texture, shape, size, and thickness as they predict how much light will shine through each material (part of 1.G.A.1). It may be helpful to have the materials from lesson 3 available for students to compare."
- Lesson 4, Explore Section, Step 4, Math Supports Callout: "As students test the amount of light shining through each material, ask them what they are noticing about each object's attributes. Prompt students to pay attention to details such as size, shape, and color of the materials to identify defining and non-defining attributes and to be precise in their explanations (part of 1.G.A.1 and MP6). For example, students may use

the shape of the object to help notice there is a shadow surrounded by light which can help the students make sense of the light being blocked.”

- Lesson 9, Synthesize Section, Step 2, Math Supports Callout: “Students will revisit data collected throughout the unit about the defining and non-defining attributes of materials and the amount of light shining through different materials to help construct the Gotta-Have-It Checklist. (part of 1.MD.C.4, part of 1.G.A.1, and MP8)”

1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another. - Lessons 4, 6, 7, 9

- Lesson 4, Explore Section, Step 3, Math Supports Callout: “Students will organize, represent, and interpret data during the analysis as they sort materials into three categories: those that (1) let all the light through, (2) let some of the light through, and (3) let no light through (MP4 and part of 1.MD.C.4). Refer to the prompt response table for specific questions about the data.”
- Lesson 6, Navigate Section, Step 1, Math Supports Callout: “Throughout this lesson, students will use a chart as a tool to display their developing understandings of whether or not we need light to see. Students will be organizing, representing, and interpreting data using this chart that will help them answer the lesson question. (MP4 and part of 1.MD.C.4)”
- Lesson 7, Explore Section, Step 3, Math Supports Callout: “As students are carrying out the investigation, they will be collecting and interpreting data about whether or not the light shines on the circle on the wall based on where they decide to place the materials (part of 1.MD.C.4). Ask students to demonstrate how the materials interact with one another as they make claims about the data they have collected.”
- Lesson 9, Synthesize Section, Step 2, Math Supports Callout: “Students will revisit data collected throughout the unit about the defining and non-defining attributes of materials and the amount of light shining through different materials to help construct the Gotta-Have-It Checklist. (part of 1.MD.C.4, part of 1.G.A.1, and MP8)” The mathematical connection is to the organization and interpretation of data in 1.MD.C.4 and a slight match to MP8; **however, there is not a connection to 1.G.A.1.**

Suggestions for Improvement

- Consider providing teachers with guidance for leveraging the use of similar language from the Mathematical standards in science discussions and providing examples of how this language would be used to prevent potential scientific misconceptions. For example, the connection of using the mathematical language “defining attributes vs. non-defining attributes” (Geometry standard 1.G.A.1) could lead students to develop a potential misconception about properties/attributes of matter that might affect their learning experiences in later grades.

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 the phenomena and classroom activities are set up in a way that authentically connects with most students' lives. Throughout the unit, students experience the phenomena or design problems as directly as possible, with multiple investigations so that students can connect the phenomenon to their lives. The materials include suggestions for how to connect instruction to the students' home, neighborhood, community, and/or culture as appropriate. The materials provide opportunities for students to connect their explanation of a phenomenon to questions from their own experiences related to reading or playing in the dark, needing a flashlight to see in the dark, or using reflective materials in the dark, and when investigating materials that may/may not allow light to pass through.

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

Students directly experience the Unit phenomena of how different amounts of light affect their ability to read under different covers in Lesson 1 and again in Lesson 8. They experience lesson-level phenomena directly as well in Lesson 2 with a light sources scavenger hunt, Lessons 3 and 4 with investigations to observe how different materials cause different amounts of light to pass through, Lesson 6 with pinhole box observations, and Lesson 7 with reflective materials. This unit immerses students in experiencing light in different ways, using flashlights, covers, sunlight, classroom overhead lights, etc., and investigating how different materials interact with light.

- Lesson 1, Explore Section, Step 2, "Make observations under each cover material. Turn off the overhead lights and let each group rotate from one cover to another for about 3-5 minutes per cover material. As students explore under each cover, use the following possible discussion prompts to talk to students in small groups and elicit their ideas about what they notice under each cover. How would you describe this cover? What does it look like? What does it feel like? What do you notice while under this cover? How dark is it? How well can you read under this cover? What do the words and pictures look like?"
- Lesson 6, Navigate Section, Step 1, Teaching Tip Callout: "This discussion is an opportunity to leverage differences in what students noticed in the anchoring phenomenon experience. If some students noticed they could read under the blankets in the dark and others noticed they could not, you can connect these experiences to the lesson activities, when students investigate whether or not they need light to see."
- Lesson 7, Explore Section, Step 2, "Add to our lesson question. Use student observations about the light appearing in other places to motivate investigating this effect further to help us answer the lesson question about making it light where it is dark. Use this opportunity to collaboratively revise the lesson question as a class using students' words." Step 3, "Collaboratively plan an investigation with reflective materials. Have students remain in a Scientists Circle and have one set of investigation materials available for them to reference for this discussion. Display slide F and tell students that, as scientists, we will plan an investigation

to gather data to answer our questions about how we can make it light where it is dark using our materials. Students will use a flashlight, foil, a mirror, and a paper circle like the one they used in their Light Lab investigations.”

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

- 1 1.1 Waves Light Unit Front Matter document includes a subsection in the unit-specific strategies for supporting equitable science learning titled “Darkness and Enclosed Spaces Trauma” that offers guidance related to “concerns students may have about engaging learning activities exploring the dark and enclosed spaces.” This section provides information on the three-step ‘recipe’ of “Be Curious, Validate, and Thank the Student” that can be used during group discussions to give structure and boundaries to sharing personal experiences in discussions. This section includes prompts and language to help students as they are sharing and additional strategies to support emotional regulation and healthy relationships. “When teaching about reading in the dark and/or in an enclosed space, this may include students sharing stories about events they’ve experienced or heard about second-hand that may be experienced as traumatic. When this occurs, teachers can respond in a way that continues to encourage students to connect the lesson to their own lives and discuss that with their class, support the student in the event they may share a distressing event or thought, and still stay within the structure and routine of the lesson to accomplish instructional goals.”
- Lesson 2, Connect Section, Step 4, Community Connections Callout: “The Spanish word luminaria (loo-mee-nah-ryah) meaning “illumination” is used across communities in New Mexico, most often, south of Santa Fe. The Spanish word farolito (fa-ro-li-to) which means “little lantern,” is often used in communities north of Sante Fe. While Luminarias can be found in New Mexico in the winter months, they are also used by other groups within the United States, such as the American Cancer Society. Many peoples and cultures have influenced what this tradition is today. This tradition takes place in the coldest and darkest part of the year (winter solstice), therefore, relating to our unit and the need for light to read in the dark.”
- Lesson 2, Connect Section, Step 4, “Transition to the community connection. Use the prompt on page 19 What light sources have you seen in the world around you? to have students turn and talk about where they have noticed light in their communities. Share with students that just like there are many places we notice light at school, light can also be found in our communities. Introduce the Out-of-School Light Source Scavenger Hunt handout. Display slide F and the Out-of-School Light Source Scavenger Hunt community connection. Read the directions aloud for students. Encourage students to bring back examples of places and objects throughout the unit.”
- Lesson 4, Connect Section, Step 4, Community Connections Callout: “Invite students to share ideas about objects and materials from their everyday lives that are transparent, translucent, or opaque (e.g., sunglasses with translucent lenses). This helps optimize the relevance, value, and authenticity of the focal science idea for students.”
- Lesson 5, Navigate Section, Step 5, Teaching Tip Callout: “While students have everyday experiences with comparing what they can see when it is light and dark, they may not have made the explicit connection that light is what causes them to see something. Students may also have limited to no experiences with the difference between our everyday understanding of darkness and total darkness. Leverage these everyday experiences to help navigate into an explicit exploration of the relationship between light and seeing in Lesson 6.”
- Lesson 8, Connect Section, Step 5, “Share our out-of-school community connections. Display slide G and remind students of their Out-of-School Light Source Scavenger Hunt handout. Explain to students we have read about light in different communities and workplaces and now we can share about light from our homes and neighborhoods. Have students pair up with a partner (or group of three) around the classroom

and have them share 1 inside light source and 1 outside light source with or without using their Out-of-School Light Source Scavenger Hunt handout. Have students find a new partner/small group and repeat 2-3 times so students get a chance to move around the classroom and share with different classmates.”

“Discuss our community light sources. Return to a Scientists Circle and ask for a few students to share the light sources they found. As students share, use the following prompts to include students who have not shared and/or did not bring their Out-of-School Light Source Scavenger Hunt handout.”

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

- Lesson 1, Connect Section, Step 1, students are introduced to the phenomenon of trying to read under covers and have an opportunity to share and connect to their experiences related to reading or playing under different types of covers. Their experiences are connected to “the idea that we had differences (in how light/dark or easy/hard to see) in what it was like trying to do different things in the dark.” This begins their exploration of the phenomenon.
- Lesson 3, Explore Section, Step 3, Teaching Tip Callout: “The previous discussion helps students connect their questions about cover materials to investigating different types of materials more broadly. Use the prompts provided in the Synthesize component later in this lesson to help students connect their observations in this investigation back to the cover materials from the anchoring phenomenon experience.”
- Lesson 5, Synthesize Section, Step 2, “Lead a discussion to reflect on initial models and plan our new models. Using Our Growing Ideas chart. Lead students through a discussion to brainstorm what new science ideas and relationships between light and materials they figured out in Lessons 2-4 that could help them explain why it is brighter or dimmer under the different covers using their model.” The teacher is provided with prompts to help the students use what they have learned from their previous investigations to update their models.
- Lesson 6, Connect Section, Step 6, Teaching Tip Callout: “It is rare that young children have experienced total darkness. Therefore, they may have shared experiences of their eyes adjusting to available light sources when it is “dark.” This is an important place in the lesson to elevate student ideas and wonders about why we could still kind of see when it was dim/it looked dark. Plan to address your students’ questions during the read aloud of Light in the Dark.”
- Lesson 8, Synthesize Section, Step 2, “Transition to connect. Celebrate with students in their work applying ideas from our investigations with pinhole boxes, flashlights, and reflective materials to explain how to make it easier to read under covers that block light using the model. Transition to the connect by asking students if they think light can be helpful to do other things when it is dark? Use the prompts, When else might we need light when it is dark? Who else might need to use light sources to see in the dark?”
- Lesson 10, Synthesize Section, Step 5, Community Connections Callout: “This final Consensus Discussion can be a good time to return to and reflect on your classroom agreements. You may choose to emphasize an agreement such as, “We let our ideas change and grow,” to celebrate all the class has figured out over the unit and give students a chance to think about how they have used this agreement. To develop self-assessment and reflection routines, it is important to allow space for students to share their own experiences of how they overcame difficulties or adjusted their thinking through the unit. The sentence stem “I used to think _____, but now I think _____” can support this work.” (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 clarify, justify, and build upon the ideas they encountered in the unit's learning experiences. The materials provide appropriate, accessible, and culturally-affirming ways for students to communicate their thinking. Artifacts show evidence of students' reasoning and changes in their thinking over time. There are teacher-to-student and peer-to-peer feedback loops to help students clarify and revise their thinking and reasoning, and they are provided opportunities to use multiple modalities of expression.

Student ideas are clarified, justified, and built upon.

- Several lessons in the Navigate Section, Step 1, have a section where students and teachers co-craft lesson questions they want to investigate as they relate to the unit question. Examples include:
 - Lesson 2, Navigate Section, Step 1 "Co-construct the lesson question. Use the Notice and Wonder chart to point out students' noticings and wonderings related to light (and dark) from Lesson 1. Ask students to use a signal such as a raised hand or thumbs up if this is a question they are still wondering about or have ideas about. Then, use these noticings and wonderings to connect to today's activities and co-construct a lesson question with students. The question can be similar to, Where is light coming from around us? Revise the question on slide B to match the words and language used by the class and then display it. (Lesson 2, Teacher Guide)
 - Lesson 3, Navigate Section, Step 1 "Co-construct the lesson question. Use student's wonders and their ideas for finding out more to suggest a lesson question to guide the lesson's work. The question can be similar to How can we test what happens when the same light shines on different materials? Revise slide C to the lesson question the class agreed upon and display the lesson question." (Lesson 3, Teacher Guide)
 - Lesson 4, Navigate Section, Step 1 "Co-construct the lesson question. Use students' ideas and language about further investigation or data collection to propose a lesson question, which can be similar to, What happens when we shine the same light on different materials? Revise the question on slide B as needed to match the question decided by the class and then display slide B. Suggest that today we will be able to do some additional investigating to gather more evidence to answer the lesson question." (Lesson 4, Teacher Guide)
- Lesson 1, Explore Section, Step 3, Broadening Access Callouts: "When recording students' ideas in the Notice and Wonder chart, it is important that students have their ideas recorded in alignment with the ways they shared them (e.g., using their own words, capturing gestures they might have used, etc.). Doing so not only helps students understand what is recorded in the chart, but also sends the message that their language resources and practices are valuable for the classroom community's sensemaking work. This is an important message for all students to receive, and especially for those whose language resources are not always valued in school spaces, such as multilingual students." and "Offering students an opportunity to work with peers by engaging in a turn and talk before and during the whole class discussion is important for giving students a chance to express their ideas and learn from other students before sharing their ideas in a larger discussion." (Lesson 1, Teacher Guide)
- Lesson 3, Navigate Section, Step 1 "Recall where we left off. Discuss how we can explore our wonders. Summarize how many of our wonders had to do with why the covers were brighter or dimmer when we

had the same light and we were now wondering if the covers had something to do with what we observed. Prompt students for their ideas about how we can find out more. Co-construct the lesson question. Use student's wonders and their ideas for finding out more to suggest a lesson question to guide the lesson's work. The question can be similar to "How can we test what happens when the same light shines on different materials?" (Lesson 3, Teacher Guide)

- Lesson 4, Connect Section, Step 4 "Gather information from an infographic. Test materials to clarify ideas. Ask students if there are any materials from any of the groups on the Light Lab Floor Data chart that they'd like to test again or want to move (such as the parchment paper). Invite a few students to test these materials for the class." (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 4 "Make sense of data Share observations about the object. Display slide H and use the following questions to lead a brief discussion to share observations. As groups share, use words and pictures to record a synthesis of ideas onto the class copy of the Pinhole Box Observations handout to later use as evidence on Our Growing Ideas chart. Start with having 1-2 groups share per question, and allow more groups to share as needed if their ideas have not been captured yet. If there are points of disagreement, add those ideas as wonders to the Notice and Wonder chart instead. Follow-up responses Did any groups make a similar observation?, It sounds like your group disagrees with the group that just shared. Can you explain your thinking? Did any groups notice something similar (or different)?" (Lesson 6, Teacher Guide)

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

- Students use class recording charts such as the Notice & Wonder Chart and "Our Growing Ideas" chart throughout the unit to capture their ideas about what they are noticing, questions they have, what they figure out with each lesson, and how to connect it to their unit question. They often begin and end each lesson by reviewing these charts, adding ideas to them, answering questions on them, and adding new questions to them.
- Lesson 2, Synthesize Section, Step 5, Teaching Tip Callout: "Our Growing Ideas chart should be co-constructed together as a class with student ideas, not pre-filled before the lesson. This allows students to see themselves as members of a scientific community that uses data collected during an investigation to figure out the answers to questions they have been wondering about. For support with completing Our Growing Ideas chart, refer to the Unit Class Charts." 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. 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. See the Teacher Handbook for more information about types of science discussions." Broadening Access Callout: "To enhance students' language learning and language use opportunities, consider using the Reading Under Covers Initial Model handout. This handout provides discussion phrases that students can use to support their sensemaking work. These phrases will help students fully explain their ideas, attune to and make sense of their peers' ideas, and build off ideas shared by classmates." (Lesson 2, Teacher Guide)
- Lesson 4, Explore Section, Step 2 "Carry out an investigation Review the investigation setup. Before distributing materials to groups to investigate and sort into piles, review the investigation setup that students used during Lesson 3 by inviting 1-2 students to demonstrate using the flashlight, Light Lab Circle, and either the plastic lid, square of cardstock, or square of parchment paper. This provides an opportunity to revise the investigation setup as needed as students gather more data. Use the prompts below to support this brief discussion. Is there anything you would change about how we hold or use the materials? How might that change better help us figure out what happens to the light?" (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 2 "Reflect on my work. Lead a discussion to reflect on initial models and plan our new models. Using Our Growing Ideas chart, lead students through a discussion to brainstorm

what new science ideas and relationships between light and materials they figured out in Lessons 2-4 that could help them explain why it is brighter or dimmer under the different covers using their model. As students share ideas and relationships they figured out, have them point out relevant artifacts and evidence added to Our Growing Ideas chart that support their claims. If not already on Our Growing Ideas chart through drawings or artifacts, add visuals such as a quick drawing or examples of how students said they could represent their ideas so students can refer back to them when creating models individually. Complete the Lesson 2 row of the My Growing Ideas handout. Turn and talk about next steps for my model. Make final decisions about planning for our models. (Lesson 5, Teacher Guide)

- Lesson 5, Synthesize Section, Step 3 “Develop a model. Introduce choice in developing the model. Explain that students can choose how they will make their drawn model. They can add to their Reading Under Covers Initial Model from Lesson 1 or draw a new model on the first page of the Brighter and Dimmer Model handout. Encourage students to use their My Growing Ideas Checklist to recall what their models still need to include. As needed, help students decide if there is space for adding ideas to their Reading Under Covers Initial Model handout. Students may want to start over if their ideas changed a lot or if there is no room for new writing or drawing. Develop models using evidence from investigations. Transition students to independently develop their models or add to their Reading Under Covers Initial Model handout from Lesson 1. As students develop their models, remind them that they can look at the Our Growing Ideas Chart and My Growing Ideas Checklist to help us remember our decisions about what to include to explain why it was brighter or dimmer under the three covers.” (Lesson 5, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2 “Use a model to explain. Turn and talk about the lesson question. Have students turn and talk to share their first ideas about the lesson question: How can we use a model to explain how to make it easier to read under covers that block light? Give directions for the Reading Under Covers Model. Display slide D and show students the image of the model on the handout. Read the directions aloud for students. The model below can be used to explain how to read under covers that block light. Circle the parts of this model that help show how the person can read under the blanket. Write or tell why we need these parts in the model to explain how to read easily under the cover. Encourage students to use Our Growing Ideas chart, especially the rows for Lessons 6 and 7, to help them decide which parts of the model best help explain how to read under covers that block light. Help students notice the words “why” and “explain” in step 2 of the prompt. These words tell us that we should include connecting words like “because” in our writing to explain all of our ideas. (Lesson 8, Teacher Guide)

Students receive feedback and revise their thinking accordingly.

- Lesson 4, Explore Section, Step 3 “Make sense of data. Have one student from each small group gather one of their category cards and the material(s) that they sorted into that category. Guide each group of students to place the materials from their Light Lab onto the class Light Lab Floor Data chart in the column corresponding to their group’s observations and decisions. Make observations about our class data. Facilitate a class discussion to begin to make sense of their data, using the associated prompts. Are there any materials in more than one spot on our table? What questions do we have about our floor chart? Acknowledge points of agreement and uncertainty. While consensus is not necessary at this stage of the lesson, acknowledge any materials the class grouped into the same category by saying something like, We all agree that (material) is in (group). Emphasize that it is ok if we do not agree yet and still have questions. Suggest that we share our ideas about why we put materials into the different groups and provide students with the opportunity to retest or relocate their material to another location on the chart if they choose. Problematize students’ understanding. Summarize students’ observations that supported placing their materials in given categories: we have figured out that we can see all, some, or no light on the other side of the different materials. Ask students to think first and then talk to a partner about what they think that means about the light and different materials: What do our observations mean about the light and these

different materials? How do you think we can see all the light on the other side of the plastic, but none of the light under the foil? What do you think is happening?" (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize Section, Step 3 "Develop a model Engage in one-on-one discussions while students develop models. Prompts to use Can you show and tell me about your model?, I see you included (light source). Why is it important to include a (light source) in your model? I see you are working on showing how much light passes through each material. How much light could you show passing through the shower curtain? I see you included (cover materials) and used yellow and black crayon. Can you tell me more about what those colors mean? I see you included (way to show how light passes/does not pass through a material). How does that help you explain why it was brighter/dimmer under the cover?" (Lesson 5, Teacher Guide)
- Lesson 6, Connect Section, Step 6 "Read a book. The interactive read-aloud of the Light in the Dark book provides opportunities to gather evidence about learning goal 6 (aligned to Assessment Statement 1), to provide feedback and support students in overcoming ideas that it is possible to see an object in total darkness." (Lesson 6, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3, "Gather in a Scientists Circle. Gather students in a Scientists Circle with their Reading Under Covers Model student assessment for a Consensus Discussion about how to read under covers that block light. Explain to students that our goal in this discussion is to agree on what we have figured out so far. Revisit your class's [class agreements] and suggest the agreement, "We look, listen and respond to each other's ideas," for the class to work on during this discussion. Have students briefly turn and talk to share how they think this agreement will help the class work together to decide how to use the model to explain how to read under the cover that blocks light." (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, "Think, pair, share to plan writing. Give partners 1-2 minutes to quietly think about what details from the Gotta-Have-It Checklist they want to include in their writing. Then give partners about 5 minutes to tell their partner what they plan to write to help them organize their ideas before putting them onto paper..." "Self-reflect about our explanations. Once students have had about 10 minutes to write, display slide E and the Gotta-Have-It Checklist. Explain to students that we will be pausing to use the Gotta-Have-It Checklist to reflect on the progress we made today. For each item on the checklist, ask students to give a thumbs up if they have done that item and a hand-up if they are still working on it or have things they would like to add or change. Explain that this is a way to help us figure out what we still need to work on for the rest of our writing time today." (Lesson 9, 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:

- Explicitly identifying prior student learning expected for all three dimensions
- 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. The materials provide a broad overview of prior learning expected for all three dimensions,

but do not identify the prior learning expected at the element level. The support provided to teachers broadly explains how prior learning will be built upon. The materials provide a clearly described progression of learning toward the targeted elements of the three dimensions, and the learning progresses logically throughout the materials. The materials also provide explicit support to teachers to clarify adult understanding of the potential alternate conceptions that they, or their students, may have during the unit.

Materials explicitly state the expected level of prior proficiency students should have with individual elements of all three dimensions for the core learning in the materials. A progression of learning toward the targeted elements of all three dimensions is clearly described for teachers in each section of the materials.

Disciplinary Core Ideas: the Unit Overview provides a clearly described progression of learning, noting specific roles in the progressions for both elements of the DCI that begin after the experiences with the anchoring phenomenon in Lesson 1. The Unit Overview section titled “Which Performance Expectations does this unit build toward?” provides the narrative description of this progression and notes specific lesson’s roles in the progression. Prior learning expectations for the science ideas are found in the section titled “What ideas and experiences will students bring that can help them in this unit?” The “About the Science” document also describes the science ideas the students will figure out in the unit and offers information about alternate conceptions, grade band boundaries of the science ideas, and recommended adult-level learning resources for these science ideas. The section about prior learning covers the science ideas of the DCI, however, the language used to describe the elements “everyday ideas about light and dark” and “light and materials” does not signal to the reader that these are the elements of the DCI, as no element-level coding or direct language was used.

- The Alignment with the Three Dimensions of NGSS document provides lesson-level information about the development of each DCI element throughout the unit.
- 3 1.1 Waves Light About the Science, “What science ideas will students figure out in this unit?” section, “This unit focuses on developing foundational science ideas about how light is needed to see objects in the world around us and the effects of placing materials in the path of a beam of light. From life experiences, your students will enter 1st grade with ideas about light. For example, students may have ideas about where light comes from. They may also have ideas about differences in what they can see when it is light versus when it is dark. Finally, students may enter 1st grade having noticed differences in how light interacts with different materials (e.g., sunshine comes through the window into the classroom, but not through the wall).” (About the Science, 3 1.1 Waves Light About the Science)

Science and Engineering Practices: the Unit Overview provides a narrative description of the progression of learning, noting specific lesson’s roles in the progression for each of the three *intentionally developed* SEPs: Developing and Using Models, Planning and Carrying Out Investigations, and Constructing Explanations and Designing Solutions. Progression descriptions are also given for the SEPs, which *opportunities to practice* in this unit. The Alignment with the Three Dimensions of NGSS document provides lesson-level information regarding the intentional development and/or use of the specific elements of the practices. Prior learning expectations for each of the *intentionally developed* SEPs are found in the section titled “What ideas and experiences will students bring that can help them in this unit?” However, prior learning is discussed in broad terms and is not always addressed at the element level. No element-level coding or direct language was used, so the element-level expectations may be unclear to the reader.

- 1 1.1 Waves Light Unit Front Matter provides explicit examples of prior experiences in planning and carrying out investigations. Examples include, “If students have had experiences with OpenSciEd units in Kindergarten, students will enter this unit with additional experiences with the practice of planning and carrying out investigations from the Schoolyard Engineering Unit and OpenSciEd Unit K.3: How can we move things to where we want them to go? (Mighty Movers Unit) units. For example, they will have made observations of surfaces to compare what causes a surface to be hot or less hot.” (Unit Front Matter)

Crosscutting Concepts: the Unit Overview provides a narrative description of the progression of learning, noting specific lesson's roles in the progression, for the *intentionally developed* CCC of Cause and Effect. The Alignment with the Three Dimensions of NGSS document provides lesson-level information regarding the intentional development and/or use of the specific elements of this CCC. Prior learning expectations for Cause and Effect are found in the section titled "What ideas and experiences will students bring that can help them in this unit?" However, no element-level coding or direct language was used, so that the element-level expectations may be unclear to the reader.

- 1 1.1 Waves Light Unit Front Matter provides explicit examples of prior experiences in cause and effect. For example, "students may understand that if they do something (e.g., flip a light switch up), something else happens (e.g., the light turns on). OpenSciEd kindergarten units build on these experiences to allow students to deepen their use of it to explain patterns they observe." (Unit Front Matter)
- The Unit Overview section titled "Where does this unit fall within the OpenSciEd Scope and Sequence?" provides tables that indicate the units (within OpenSciEd) that will intentionally develop each SEP and CCC, offering clear guidance to teachers regarding where students have worked with these practices and concepts before and when they will work with them again, provided they are following this sequence.

Learning progresses logically throughout the materials.

- The Alignment with the Three Dimensions of NGSS document provides lesson-level information regarding the progression of learning and the use of the specific elements of each of the three dimensions.
- The first page of each lesson's TE gives notes about what they've done in the previous lesson and where they are going in the next lesson (gray sidebars with arrows pointing on the left and right side).
- For Lessons 2 through 10, teachers are given a snapshot of what students did and what they figured out in the previous lesson. For example, in Lesson 2, "In the previous lesson, we tried reading under different cover materials and created a class Notice and Wonder chart. We then used our observations to create models to explain our initial ideas about the differences in reading under each type of cover." (Lesson 2, Teacher Guide)
- For all lessons, teachers are given a snapshot of what students will do during the lesson and what they will figure out during that particular lesson. For example in Lesson 2, "What we do: In this Investigation lesson, we revisit our Notice and Wonder chart to remember we want to know more about light. We decide to go on a scavenger hunt and make observations about where light comes from. We read a book about light and light sources in different communities and make connections to our observations. We create Our Growing Ideas chart to keep track of what we figure out about how light sources make spaces brighter and help us read under covers." "What we figure out: Light sources are objects that make light. Light sources can make a space brighter. Light comes from many places, inside and outside of our classroom." (Lesson 2, Teacher Guide)
- For all lessons, teachers are given a statement of how the lesson builds towards specific standards. For example in Lesson 2, This unit builds toward these NGSS PEs: 1-PS4-2, 1-PS4-3. See this matrix for the NGSS elements and CCSS ELA and Math connections." (Lesson 2, Teacher Guide)
- Lessons in the unit include callouts to highlight for teachers how students are using and developing SEPs and CCCs across the unit and offer guidance to teachers in supporting students as they progress. Some examples:
 - Lesson 1, Explore Section, Step 2 "Make observations. Constructing Explanations and Designing Solutions This is the first time in this unit that students are making first-hand observations to create an evidence-based account. Support students in planning what types of observations they will make to help explain what happens (how well they can see the letters and pictures, differences in how easy or hard it is to see the book under different covers). Students will continue to make

- observations to use as evidence to explain how to read under covers in this unit; they will have additional opportunities to develop their use of this element in unit 1.4.” (Lesson 1, Teacher Guide)
- Lesson 1, Synthesize, Step 5, “Students previously developed models to represent relationships in unit kindergarten and here they build on that knowledge through representing initial ideas surrounding the relationship between cover material and light under the cover. Students can also represent amounts (more or less light) as part of showing this relationship. As these are initial models, students will continue to build on these representations in Lesson 5 of this unit.” (Lesson 1, Teacher Guide)
 - Lesson 2, Synthesize Section, Step 5, introduces students to the science practice of building claims and supporting them with evidence and using the crosscutting concept of cause and effect to think about the relationship with the evidence and connection to the lesson/unit question. This practice is used in subsequent lessons 3-8 as they revisit their Growing Ideas Chart, add what they have figured out and develop or revise claims to answer both lesson and unit questions.
 - Lesson 3, Explore, Step 3, “This is the first time students collaboratively plan and carry out investigations in this unit. Use the discussion prompts to encourage the class to think through each aspect of the investigation plan and consider why following the plan will help them produce data that can serve as the basis for evidence to answer their question. This whole group collaborative discussion will support students in planning investigations in small groups and partnerships later in the unit.” (Lesson 3, Teacher Guide)
 - Lesson 4, Explore Section, Step 2, Cause and Effect Callout: Students use this crosscutting concept as they perform the simple test of placing materials with similar attributes (transparency, opacity, color, size, thickness) to gather information about what makes the Light Lab Circle lighter or darker. Students should be using this evidence to begin refuting ideas that attributes such as color or thickness alone cause light to go through to the circle. Students will continue to gather evidence that further supports how the type of material (transparent, translucent, opaque) is what causes different amounts of light to pass through to the circle. (Lesson 4, Teacher Guide)
 - Lesson 5, Explore, Step 3, “Students build on their use of this cross-cutting concept when they represent ideas about how different cover materials allow different amounts of light to pass through in their models. They apply evidence gathered from simple tests in Lessons 2-4 as they explain these relationships. They will continue to build on this crosscutting concept by using simple tests to gather evidence to support or refute ideas about new aspects of the phenomenon later in the unit (what caused it to be easier/harder to read).” (Lesson 5, Teacher Guide)

Explicit support is provided to teachers to clarify adult understanding of the potential alternate conceptions along with guidance for how to help students negotiate their understandings.

- The “About the Science” document describes the science ideas the students will figure out in the unit and offers information about alternate conceptions and boundaries of the science ideas. The document also offers recommended adult-level learning resources for the science concepts in the unit.
- Lesson-level Teacher Guides offer guidance and support to teachers for how to help students negotiate their understandings, allowing students to consider and reconsider their ideas throughout the learning cycle.

Suggestions for Improvement

- Consider elaborating on the prior learning expectations for each of the three dimensions at the element level.

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 their three-dimensional learning. The scientific ideas and representations included in the materials are accurate. Unit materials support teachers regarding possible misconceptions that may arise and offer guidance to help students work through these misconceptions. Students are encouraged to express their scientific ideas and continually examine and re-examine them in light of new evidence.

- Lesson 1, Explore Section, Step 3, Cause and Effect Callout: "Use this discussion to begin to help students connect to this crosscutting concept when eliciting students' initial ideas about what caused some covers to be easier or harder to read under, as well as what caused there to be different amounts of light under the covers (e.g., opacity, thickness, color of cover). The use of simple tests throughout the unit will allow for students to gather evidence to further support or refute these first ideas."
- Lesson 1, Connect Section, Step 4, "Connect to how scientists develop models. Gather students in a Scientists Circle and summarize that although we made helpful observations about the differences reading under each cover, we still have some questions we need to answer. Share that sometimes scientists draw their observations and ideas to use as a tool to explain how or why something happens—his tool is called a model. Use the prompt below to invite students to consider how engaging in developing and using models could help us explain our ideas. Transition to reading the Scientists Can Explain Using Models book. Let's see how scientists use models so that we can use them to help us explain what we observed. Introduce the "Scientists Can Explain Using Models" book...Facilitate an interactive read aloud using the associated prompts."
- Lesson 2, Connect Section, Step 4, Teaching Tip Callout: "Students may enter this unit with ideas and experiences about how light helps us see, and will be figuring out new ideas about light throughout this unit. For that reason, we do not provide a singular definition of "light" for the Word Wall. Instead Our Growing Ideas chart will provide a common space to update and revise our growing understanding of light."
- Lesson 3, Synthesize Section, Step 5, Teaching Tip Callout: "If you notice students bringing up observations or ideas about dark spaces or shadows- especially after they have investigated the cardstock and possibly the parchment paper - acknowledge these ideas and any related experiences students may share. Add questions about dark and shadows to the Notice and Wonder chart. Students will have opportunities to explore shadows as part of the effects of materials blocking light in Lesson 4. They can also use ideas about shadows to support their understanding of darkness in Lesson 6."
- Lesson 4, Explore Section, Step 2 "Cause and Effect Callout: Students use this crosscutting concept as they perform the simple test of placing materials with similar attributes (transparency, opacity, color, size, thickness) to gather information about what makes the Light Lab Circle lighter or darker. Students should be using this evidence to begin refuting ideas that attributes such as color or thickness alone cause light to go through to the circle. Students will continue to gather evidence that further supports how the type of material (transparent, translucent, opaque) is what causes different amounts of light to pass through to the circle." (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize Section, Step 4 “Construct an explanation. Engaging in Argument from Evidence The Consensus Discussion opens the opportunity for students to bring different claims supported by evidence to the class (Some light passed through the sheet because it was thin and some light passed through the sheet because it is translucent are both supported by evidence that some light passed through the thin parchment paper). When students ask questions like, but what about the thin foil and cardstock? And students respond to prompts like “Does all of our evidence support this explanation? They gain practice in distinguishing between explanations that account for all gathered evidence and those that do not. (Lesson 5, Teacher Guide)
- Lesson 6, Connect Section, Step 6, Teaching Tip Callout: “It is rare that young children have experienced total darkness. Therefore, they may have shared experiences of their eyes adjusting to available light sources when it is “dark.” This is an important place in the lesson to elevate student ideas and wonders about why we could still kind of see when it was dim/it looked dark. Plan to address your students’ questions during the read aloud of Light in the Dark.”
- Lesson 8 Assessment Tool - Lesson 8 Instructional Guidance document provides support for teachers in understanding what a “secure” understanding is using first-hand observations to construct an evidence-based account for why a light source is needed to see/read a book under covers that block light. They should also be able to use how a model represents the relationship between light, different materials, and seeing to explain how books under covers that block light can only be seen when illuminated by a light source.” There is guidance to support students who are still struggling with identifying a reason other than the object being illuminated as the reason we can see it.
- Lesson 9, Synthesize Section, Step 3, Constructing Explanations and Designing Solutions Callout: “Using observations as evidence is an important part of this practice. The discussion of each cover material helps connect students’ ideas to the observations made and data collected across this unit’s investigations. When students use the information about their observations from the Gotta-Have-It Checklist and Our Growing Ideas in their writing they are supporting their ideas with evidence.”
- Lesson 10, Connect Section, Step 4, Obtaining, Evaluating, and Communicating Information Callout: “Presenting and publishing student work is one way to help students view themselves as writers and provide students with opportunities to communicate information as scientists. Students will have opportunities to build on this practice in OpenSciEd Unit 1.2: How do objects make and use sound to communicate? (Sound Signals Unit) when they communicate information about engineering design ideas.”

Suggestions for Improvement: NA

II.E. Differentiated Instruction

Extensive

Provides guidance for teachers to support differentiated instruction by including:

- 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.
- Extra support (e.g., phenomena, representations, tasks) for students who are struggling to meet the targeted expectations.
- 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. Materials have been explicitly designed using Universal Design for Learning (UDL) principles, including providing extra support through access to alternate phenomena and opportunities to represent thinking through a variety of modalities. Differentiated supports are provided to ensure students equitably engage in sensemaking using the three dimensions. Appropriate teacher guidance is included in materials to indicate how the learning experience could be adapted or how scaffolds could be added to support all students where they are in their current understanding of each of the three dimensions. Support and teacher guidance are explicitly addressed within teacher guides in the gray sidebar callouts so that all teachers will recognize them. Materials provide a common learning sequence for all learners and clarify how to anticipate the needs of students who might struggle with any of the three dimensions within a particular activity. Materials provide examples of individualized learning strategies to support learners with specific needs, especially for visually impaired students within this unit, regarding light. Materials provide multiple access points and modalities for students to learn within the lesson. Materials provide examples and guidance to support reading, writing, listening, and speaking alternatives (e.g., translations, picture support, graphic organizers, non-linguistic, etc.). Materials provide suggestions for adaptations if the students begin the lesson with significantly higher/lower levels of proficiency than expected and offer support such as related phenomena throughout the materials for those struggling to meet the performance expectations. These supports include guidance on how to determine their understanding at that point in the lesson and how to help the student progress toward each element of the three dimensions in the targeted learning objective.

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.

- 1 1.1 Waves Light Unit Front Matter document provides a section titled “What unit-specific strategies are important for supporting equitable science learning in this unit?” that explains the OpenSciEd design based on Universal Design for Learning guidelines. “we acknowledge that you, the teacher, will still need to find ways to accommodate activities in the materials to better recognize and leverage your particular students’ assets, and better address student learning needs or the needs and resources in your classroom. There are many ways differentiation occurs in classroom settings. You can address students’ diverse learning needs in terms of student readiness, interest, and special learning needs and can make adjustments in terms of the content, the learning processes, and the student products that result from a learning experience. All Teacher Guides include UDL and differentiation guidance via callouts titled Broadening Access, Community Connections, Teaching Tips, and Literacy and Math Supports.” The document also provides unit-specific considerations about engaging students in the Scientists Circle routine, as well as the development of writing and communication skills, as well as reading skills.
- 1 1.1 Waves Light Unit Front Matter document includes a subsection in the unit-specific strategies for supporting equitable science learning titled “Accessing visual phenomena and developing an understanding of sight-related disciplinary core ideas” that offers guidance for ensuring equitable participation for those who may have visual impairments. “Provide books with enlarged text and/or images in high contrast for reading under covers in Lesson 1 Use specific and detailed language when describing investigation materials, procedures, and observations in all lessons. Provide detailed descriptions of important visual information that is occurring during an investigation. For example, describe what can be seen in the book (words, pictures, level of detail) while reading under each cover in Lesson 1. Name familiar objects as giving off light or not giving off light in the light source scavenger hunt in Lesson 2 to connect familiar objects to new science ideas. Describe details about the object (presence, absence, size, shape, color) in the pinhole box under different lighting conditions in Lesson 6. Provide a tactile model with textured elements that represent the different effects of placing materials in the path of a beam of light in Lessons 3, 4, 5 and 7.

- The K-5 Teacher Handbook describes a variety of strategies to support different differentiation with OpenSciEd instruction. Some of those sections include: building an equitable classroom culture for science, integrating literacy (includes support for readers, writers, and word development), using math to support science sensemaking, incorporating trauma-informed approaches, Universal Design for Learning (UDL), and supporting multilingual students.
- The Additional Accessibility Resources document provides guidance on additional strategies for accessibility with OpenSciEd instruction. One example is information on how to access alternative formats of OpenSciEd student files: “OpenSciEd units, once released, are sent to the National Instructional Materials Access Center (NIMAC), which is a federally-funded entity providing accessible file formats across K-12 instructional materials. NIMAC provides alternative formats, such as Braille or large print options, through partnerships, such as through the American Printing House (APH). These formats also sometimes include tactile graphics. Here are the instructions to search for alternative formats of unit materials...”

Differentiation strategies address the needs of students when an obvious need arises:

Emerging multilingual students learning English

- Lesson 1, Explore Section, Step 3, Broadening Access Callout: “When recording students’ ideas in the Notice and Wonder chart, it is important that students have their ideas recorded in alignment with the ways they shared them (e.g., using their own words, capturing gestures they might have used, etc.). Doing so not only helps students understand what is recorded in the chart, but also sends the message that their language resources and practices are valuable for the classroom community’s sensemaking work. This is an important message for all students to receive, and especially for those whose language resources are not always valued in school spaces, such as multilingual students.” (Lesson 1, Teacher Guide)
- Lesson 1, Synthesize Section, Step 5, Broadening Access Callout: “Think, Pair, Share allows students to take a few moments to form their thoughts (Think), discuss with a partner (Pair), then volunteer to explain their thinking to the class (Share). This structure is helpful for all students to formulate ideas, especially multilingual learners and children who are more comfortable sharing with one person rather than the whole class. Encourage student pairs to use whatever modalities of expression they choose: gestures, named languages other than English, etc.” (Lesson 1, Teacher Guide)
- Lesson 2, Navigate Section, Step 1, Broadening Access Callout: “Making the cover materials from Lesson 1 available supports students’ sensemaking by having resources to draw from in sharing their ideas. Students can also turn and talk to share ideas before sharing with the whole group for an opportunity to self-reflect and review their developing thoughts as they remind themselves of the exploration. This might promote confidence, particularly for multilingual students, which ultimately optimizes motivation to engage in class discussions.” (Lesson 2, Teacher Guide)
- Lesson 5, Synthesize Section, Step 2, Broadening Access Callout: “The Our Growing Ideas chart should capture 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, etc.), 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 5, Teacher Guide)
- Lesson 6, Connect Section, Step 5, Broadening Access Callout: “Support your students’ access to the information in these videos 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 6, Teacher Guide)

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

- Lesson 1, Explore Section, Step 2, Broadening Access Callout: "Provide multiple means of representation by describing the cover materials. You can allow students to touch and feel the materials, which will be especially beneficial for students with visual impairments (see additional recommendations in the Unit Overview). Having shared experiences and language to describe how the materials look and feel will also support all learners in having consistent and specific language to use when making and sharing their observations." (Lesson 1, Teacher Guide)
- Lesson 3, Navigate, Step 1, "To support active engagement, you could have children use a silent signal to indicate their agreement or disagreement with pairs as they are sharing. For instance, if they discussed the same thing in their partnership, they might show a signal indicating agreement (the sign for "same" in American Sign Language, for example). To sign "same" first hold up your dominant hand, palm facing out, with your thumb and pinkie finger sticking out and the rest of your fingers curled in to sign the letter Y. Then, slide the Y hand back and forth between you and the person you are agreeing with." (Lesson 3, Teacher Guide)
- Lesson 3, Explore, Step 4, "If there is a student(s) who is blind or has a visual impairment, you will need to adjust this exploration to ensure their equitable participation. Work with the student's case manager as needed, but ideas for providing multiple means of engagement include providing clear and detailed spoken descriptions of what happens when testing materials and providing a tactile model with textured elements that represent the different effects of placing materials in the path of a beam of light (some, none, or all light passing through)." (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, Broadening Access Callout: "Placing investigation materials in the middle of the circle for students to refer to supports equitable student discussion and enhances their sensemaking. Materials help elicit ideas as they engage students by stimulating their visual, auditory, and tactile senses, making learning and discussions more accessible and memorable." (Lesson 4, Teacher Guide)
- Lesson 5, Synthesize Section, Step 2, Teaching Tip Callout: As an option, you may have students circle the ideas and relationships they recognize in their models with a certain color or type of writing utensil as they review their models. This helps students make explicit connections between their ideas represented in their models and the evidence the class collectively gathered and recorded on Our Growing Ideas chart. Teaching Tip Students were introduced to new vocabulary (translucent, transparent, opaque, and shadow) at the end of Lesson 4. You can support students' use of new vocabulary by restating their sentences to include the vocabulary word or by demonstrating using the new words yourself. Broadening Access The Our Growing Ideas chart should capture 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, etc.), 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 5, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Broadening Access Callout: "Depending on the needs and interests of your students, you may consider alternative formats for the Light to Dark Investigation handout. Some possible options could include making a digital copy using available technology for students to drag and drop the images, have students record a video showing how they carried out the investigation with the materials, drawing a picture, or taking a photograph with a written description or voice-over of how they carried out the investigation, or some combination of these options." (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, Literacy Supports Callout: "Providing a space for a drawing and, as available, other visual displays such as a video recording (see suggestions in Our Class Book Setup) to clarify ideas supports SL.1.5. This allows students to incorporate visual displays with their oral and written language to enhance its meaning for a reader or listener." (Lesson 9, Teacher Guide)

- Lesson 10, Connect Section, Step 2, Broadening Access Callout: “Offering students an opportunity to work with peers by engaging in a Turn and Talk before the whole class discussion gives them a chance to use their linguistic and multimodal resources to express their ideas (and learn from other students’ uses of these resources too) before sharing their ideas in a larger discussion.” (Lesson 10, Teacher Guide)

Learners reading below grade level

- Lesson 2, Explore Section, Step 2, Literacy Supports Callout: “Adding visual displays of understanding, like drawings, along with their oral and written language on the Light Scavenger Hunt supports students in enhancing meaning for others who will be using or looking at their observations later in the lesson (SL.1.5).” (Lesson 2, Teacher Guide)

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

- Lesson 2, Explore Section, Step 2, Assessment Opportunity: “If students are not yet sure what objects light is coming from, ask them to compare an object they think light might be coming from to one they do not think light is coming from. Prompt, what is different between these objects? To start connecting to cause and effect, ask students to consider what would happen if they brought that object to a dark room, or what would happen if the light was turned off. Students may name objects that reflect, rather than produce light (the moon, car/bike reflectors) as light sources. Add these ideas and questions to the Notice and Wonder chart to revisit in Lesson 7.” (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3, Assessment Opportunity: “Formative assessment: In this discussion, look and listen for students’ sensemaking with the purpose of providing feedback and supporting students in planning an investigation to gather evidence about the effect of shining light on different materials. Look and listen for students suggesting ideas for how to use materials (putting the tray, parchment paper, and cardstock in the path of light (cause) and for how they will observe what happens to the light (effect). Use the Following Students’ Sensemaking 2 to record evidence of students’ developing sensemaking. If students need more support, revisit pages in the Scientists Plan and Carry Out Investigations book that connects to the part of the investigation the class is planning.” (Lesson 3, Teacher Guide)
- Lesson 3, Explore Section, Step 4, Assessment Opportunity: “If students are identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes light to pass through, guide them in comparing examples that challenge their thinking (e.g. thin plastic lid and thin cardstock). If students are still unsure of how to carry out the investigation, invite the student/group to test the materials one at a time, breaking the investigation into smaller steps, and pausing to clarify directions. If students make observations about dark spaces or shadows, add these ideas and questions to the class Notice and Wonder chart to build upon in Lesson 4.” (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 3, Assessment Opportunity: “If students group materials by thickness, color, or attribute other than light seen on the Light Lab Circle, problematize their existing thinking by showing counter examples that could help students identify a gap in their thinking (e.g., Pointing out the thick acrylic disk in the group where we saw all the light, and the book of a similar thickness that is in the group where we saw none of the light). If students need support in comparing, provide a second flashlight and Light Lab Circle handout. Have the group test two different types of materials at the same time and ask students what is similar or different on the two Light Lab Circle handouts.” (Lesson 4, Teacher Guide)
- Lesson 5 Assessment Tool - Lesson 5 Instructional Guidance document “Use the evidence you have gathered on the Following Students’ Sensemaking 2 tool in Lessons 3 and 4 and students’ Brighter and Dimmer Model to evaluate students’ progress toward the above assessment statement and plan your upcoming instruction accordingly. When you get to Lesson 7, focus on supporting students who are not yet secure in their sensemaking. Based on which of the statements below align with what you notice about

your students (most of the class, some of the class, or a few students), you may choose to take some or several of the next steps suggested here.” The prompts include support for students who are “Carrying out an investigation that is not yet supporting gathering data about the effects of placing materials in the path of a beam of light; Describing the same effect (e.g. all light passes through) of placing transparent, translucent, and/or opaque materials in the path of a beam of light; and Identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes different amounts of light to pass through or be stopped by a material.”

- Lesson 6, Explore Section, Step 3, Assessment Opportunity: “If students suggest that they can see an object that is not illuminated, provide a second experience with the pinhole box. Allow for extended viewing time with the pinhole covered to test ideas about eyes adjusting to the dark.” (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Assessment Opportunity: “If you notice students are testing materials in a way that does not support data collection to answer the lesson question (e.g., holding the flashlight away from the mirror or holding the materials the same way students did in Lesson 3 and 4), encourage the use of guided simple tests. “I hear you saying you have not noticed the light on the circle yet. Let’s try a different test by moving the mirror/foil or the flashlight.” Encourage students to describe the effect the mirror has on the beam of light in their own words (bounce, go another way, change direction, reflect). Support them in connecting these words to the scientific word reflected in the Connect component.” (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2, Literacy Supports Callout: “Some students may benefit from additional support as they engage in this written modeling task. Please see the “Supporting Literacy for all Students” section of the Teacher Handbook for ways to scaffold literacy tasks for students based on their individual needs.” (Lesson 8, Teacher Guide)
- Lesson 8 Assessment Tool - Lesson 8 Instructional Guidance document provides instructional guidance for students who are not yet secure in “Identifying a reason other than the object being illuminated as the reason we can see it (e.g., night vision, my eyes get used to the dark)” and offers possible next steps to support them “Before Lesson 9, consider doing the following options with small groups or individual students Re-read the Light in the Dark book from Lesson 6 with students/groups of students to compare and contrast dark and total darkness. Provide a second experience with the pinhole box. Allow for extended viewing time with the pinhole covered to test ideas about eyes adjusting to the dark. Turn off classroom lights and close the blinds to make the room dim. Have students do a new light source scavenger hunt to identify all the light sources still present. Use this experience to identify that dim/dark in the everyday sense is different from total darkness. During Lesson 9, consider having these students explain how to read under the blanket so they have an additional opportunity to demonstrate their understanding.”

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, Connect Section, Step 4, Teaching Tip Callout: “Extension Opportunities: For students who are ready for deeper exploration or have a high interest in shadows, suggest options for more exploration. Students can use sidewalk chalk outside to outline their shadows on a sunny day. You may prompt them, Is your body a transparent, translucent, or opaque object? Why do you think so? What caused your shadow to form? Students can make shadow puppets and use them to perform a shadow puppet skit. Students will apply ideas about the effects of shining light on materials when they choose materials that can successfully make a shadow and when they determine how to position their puppet and light source.” (Lesson 4, Teacher Guide)

- Lesson 5 Assessment Tool - Lesson 5 Instructional Guidance document provides extension options for students who “Are already secure in making and using observations about the amount of light transparent, translucent, and opaque materials allow to pass through. If this describes most or all of your class, consider the following extension options: Provide students with opportunities to explore further connections to everyday life and their communities during Lessons 8-10. Now that we understand how different materials let different amounts of light pass through, what does that help us do? If you were making a new pair of sunglasses, what type of material would you choose? Challenge students to test objects made of multiple materials to see how parts made of different materials interact with the light differently (e.g., a clear plastic water bottle with a white plastic cap). Explore whether their knowledge generalizes to cases that are not obviously connected to the anchor phenomenon (e.g., why we use sunglasses outside, choosing window covers or when to open/close window covers).”
- Lesson 5 Assessment Tool - Lesson 5 Instructional Guidance document provides extension options for students who “Are already noticing how reflective materials redirect light. If this describes most or all of your class, consider shortening the Play and Explore step of the Explore component in Lesson 7 or provide the open-ended exploration of mirrors, foil, and flashlights as a center during another time of day for the small group of students who need the opportunity to make observations of these materials. To differentiate for individuals or a small group, ask students to test Light Lab 2 materials or materials available in the classroom to determine if they are reflective.”
- Lesson 7, Explore Section, Step 3, Teaching Tip Callout: “Extension Opportunity: Students may be interested in further exploring the types of materials that redirect light. Using an investigation plan similar to the one used in this lesson, they can perform tests on Light Lab 2 or other chosen materials to determine if the effects are similar to what happened with the mirror and foil.” (Lesson 7, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Assessment Opportunity: “If students have gathered data about how to use the materials to shine a light on the circle, challenge them to find other reflective materials in the classroom or use the mirror/foil to illuminate different areas of the classroom.” (Lesson 7, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2, Teaching Tip Callout: “Extension opportunity: For students who enter the lesson with a secure understanding or who show a secure understanding during this task, ask questions like, “How would you change this model if it were a transparent/translucent cover? Or, if there were no mirror?” to see how their understanding of the cause-and-effect relationship between light sources and seeing extends to other types of materials they investigated in this unit. They may also draw this model on the back of their Reading Under Covers Model student assessment.” (Lesson 8, Teacher Guide)
- Lesson 8 Assessment Tool - Lesson 8 Instructional Guidance document provides instructional guidance for students who are “Already connecting how we need light from a light source under the covers that block light to see the book” and offers possible next steps to extend their learning “Consider suggesting that these students/groups of students write about the shower curtain or sheet for the informational text in Lessons 9-10 to bring together ideas across multiple DCIs to explain how the book is illuminated from light sources outside of the reading space because the material allows light to pass through it. Explore whether their knowledge generalizes to cases that are not obviously connected to the anchor phenomenon (e.g., why do we turn lights on when it is dark, why a blindfold is made of materials that block light).”

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 through explicit guidance and support that is provided to help them recognize what students figure out in a lesson, what questions are left unanswered, and what new questions could be answered in the next investigation. This is found in most lessons in the Synthesize and/or Navigate sections as students return to the Notice and Wonder chart and their “Our Growing Ideas” chart. Specific guidance and prompts are provided to help the teacher facilitate student sensemaking and foster their curiosity. Frequent guidance and tools are provided to teachers to support linking student engagement across lessons, including navigational routines in each lesson (Navigate, Connect, Explore, Synthesize, and Navigate), prompts and discussion frames, and guidance to help them gather and/or gently push for student questions that will be answered in subsequent lessons. Strategies are provided to support the teacher as they ensure student sensemaking is linked in all three dimensions and in connecting the phenomena across the lessons. Many of these strategies are provided in the Gray Sidebar Callout sections “Teaching Tips” and in the Lesson Assessment Guidance document.

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.).

- The front page of each lesson’s Teacher’s Guide provides the following informational sections to support the unit coherence: “what we do, what we figure out, building toward standards, in the previous lesson, and in the next lesson.”
- Most lessons begin and end with a Navigate Section (Lesson 1 does not begin with Navigate, and Lesson 10 does not end with Navigate.) The Navigate beginning sections prompts teachers to support students to “Recall Where We Left Off”. This supports students in recalling learning from the previous lesson and refreshes what they decided in the prior lesson they want to figure out next. The Navigate section at the end of lessons asks students to reflect on learning and ask questions for further investigation/learning.
- One strategy for student engagement is creating an authentic purpose for their work. Lesson 5, Synthesize Section, Step 2 and Step 3, Reflect on My Work and Develop a Model are examples of authentic purposes. In Step 2, students use a “My Growing Ideas Checklist” to keep track of the science ideas represented in their models. Students are led through a reflective discussion on their new science ideas and the relationships between light and materials they figured out in Lessons 2-4. Students then use the checklist to reflect on their initial models. In Step 3, students can choose to revise/add to their initial model or draw a new model using the “Brighter and Dimmer Model” handout. Students determine if their initial model has space for adding ideas or if they need to start over due to the change in their ideas since the initial model was developed. Another authentic purpose for the investigation and modeling comes in Lesson 9 when they begin to write a page for a class book to explain how someone could read under the covers

of different materials. Students write about what they learned and share it with an authentic audience in Lesson 10.

- Lesson 2, Navigate, Step 1, “Co-construct the lesson question. Use the Notice and Wonder chart to point out students’ noticings and wonderings related to light (and dark) from Lesson 1. Ask students to use a signal such as a raised hand or thumbs up if this is a question they are still wondering about or have ideas about. Then, use these noticings and wonderings to connect to today’s activities and co-construct a lesson question with students.” (Lesson 1, Teacher Guide)
- Lesson 2, Navigate, Step 6, “Return to our wonderings. Display the Notice and Wonder chart (refer to slide H) and remind students of the questions about light, dark, and where light was coming from that we pointed out at the beginning of this lesson. Use prompts similar to the ones below to support students in discussing what questions they have answered, what questions they still have, and what new questions they may want to add, identifying where we should go next to help us answer the unit question, How can we read under covers when it is dark?” (Lesson 2, Teacher Guide)
- Lesson 3, Explore, Step 3, “The previous discussion helps students connect their questions about cover materials to investigating different types of materials more broadly. Use the prompts provided in the Synthesize component later in this lesson to help students connect their observations in this investigation back to the cover materials from the anchoring phenomenon experience.” (Lesson 3, Teacher Guide)
- Lesson 6, Navigate, Step 1, “Turn and talk about our experiences last time. As a class, recall how we put together our ideas from Lessons 2-4 to explain why it was brighter or dimmer under different covers.” “Co-construct the lesson question. Use the questions students recalled about reading in the light and dark to connect to today’s activities and co-construct the lesson question.” (Lesson 6, Teacher Guide)

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

- Each lesson has a page in the Teacher’s Guide that provides “Lesson Assessment Guidance” to help the teacher understand how this lesson aligns with one or both of the unit assessment statements. This document provides what the students do (the three-dimensional learning goal), when and where to check for understanding, and how they can use the information gathered from the assessment. It will clarify the formal or informal assessment opportunities in the lesson and how the ideas in the lesson build on other ideas/lessons.
- Each lesson has a gray sidebar column on the right side of the Teacher Guide that provides callouts for various teacher supports, including “Teaching Tips” which include strategies to support sensemaking.
- Lesson 3, Synthesize, Step 5, “If you notice students bringing up observations or ideas about dark spaces or shadows- especially after they have investigated the cardstock and possibly the parchment paper - acknowledge these ideas and any related experiences students may share. Add questions about dark and shadows to the Notice and Wonder chart. Students will have opportunities to explore shadows as part of the effects of materials blocking light in Lesson 4. They can also use ideas about shadows to support their understanding of darkness in Lesson 6.” (Lesson 3, Teacher Guide)
- Lesson 4, Synthesize, Step 5, “If you notice students bringing up observations or ideas about reflective materials - especially after they have investigated the opaque materials, including foil - add these ideas to the class Notice and Wonder chart as wonders to explore in future lessons. These noticings and wonders will be especially useful in navigating into Lesson 7.” (Lesson 4, Teacher Guide)
- Lesson 4, Navigate, Step 6, “Facilitate a discussion. Display slide I and remind students of the models they made in Lesson 1 and the Scientists Can Explain Using Models book they read about how scientists use models to explain ideas. Consider displaying one or two student models or a class-created model during this discussion. Engage students in a discussion reflecting on what they know now that they didn’t

know before, and how they might use their understanding to construct new explanations during their next science lesson.” (Lesson 4, Teacher Guide)

Suggestions for Improvement: NA

II.G. Scaffolded Differentiation Over Time

Extensive

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

The reviewers found extensive evidence that materials provide explicit and gradual scaffolding over time to help ensure students build ownership and proficiency in the practices. There is a close match between targeted learning objectives and those developed by students during the learning experience. Materials help ensure that over time, students build toward ownership and proficiency in the practices. Scaffolding is explicitly reduced over time **for nearly all** of the SEP elements stated as targeted learning objectives. Supports are provided with guidance about adjustments for when and where to add and remove supports to move students toward independently knowing when to use and demonstrate proficiency with the SEPs.

5 1.1 Waves Light SEP-DCI-CCC-ELA-Math-Matrix document provides a table “Developing and Using Science and Engineering Practices (by Lesson)” that explains how students are engaged in each of the unit’s elements with a lesson-by-lesson description.

1 1.1 The Waves Light Front Matter Unit Overview document includes a section titled “Intentionally Developed Science and Engineering Practices” that describes the progression of each practice throughout the unit.

MOD: Developing and Using Models

MOD-P1: Distinguish between a model and the actual object, process, and/or events the model represents.

- Lesson 6, Explore Section, Step 2, “Introduce the pinhole box. Acknowledge how it would be really time-consuming to block all the light from all the light sources around our classroom to make it very dark. Share how sometimes scientists use a smaller version of an actual object or place to help figure things out when it would be hard to experience something in everyday life. Show students a pinhole box and display slide E. Explain that a pinhole box is a “tiny room” that has one tiny place for light to enter. Observe a pinhole box. Have students think, pair, share about the questions on slide E to consider how this pinhole box will help them make observations and then choose 1-2 students to share out with the whole group. Prompts to use: How is this pinhole box similar to our classroom? How is it different? Why do you think using a pinhole box could be helpful?” In the Gray Sidebar Callout for Developing and Using Models, they explain why this is important: “An important aspect of this practice is distinguishing between a model and the actual object. Allow students to compare the pinhole box to the classroom and consider how those differences (size, ability to block light) make it a useful model for making the observations needed today. Up to this

point in the unit, students developed and used drawn models.” (Lesson 6, Teacher Guide) **Students only have one opportunity to use this element in this unit. Students engage with this element of the practice in this lesson in small groups as a guided observation/investigation and do not have the opportunity to move towards more independent use of this element for their sensemaking in the unit.**

MOD-P2: Compare models to identify common features and differences.

Lesson 5 is the only claimed opportunity for students to develop this element. However, intentional scaffolding throughout the lesson takes the students from a whole-class discussion through partner discussions and into individual opportunities to compare their initial models to their new understandings. Though not claimed in the matrix, there is also evidence in Lesson 8 that students independently use this element.

- Lesson 5, Navigate Section, Step 1, “Turn and talk to compare our initial models. Provide each student with their completed Reading Under Covers Initial Model handout from Lesson 1. For each of the prompts below, have students turn and talk and then come back together as a class and have 1-2 pairs to share after each of the discussion prompts below. Prompts to use: Refer to slide C and read the statement “Scientists use models to figure out their ideas” Ask, ‘What ideas did you show with your model? Show and tell your partner.’ Refer to slide C and read the statement ‘Models help scientists show their thinking.’ How does this model show thinking about the cars moving far? Choose one example of how a student shared their thinking with their model and consider saying something like, I learned from some of you that _____ (drawing careful details like using a yellow crayon to show light) is a way to communicate an idea. What other ways did we help communicate ideas with our models? How are your initial models similar? How are they different? Could we use our models to help answer why it is brighter or dimmer under the different covers?” (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 2, students reflect on their initial models and how the evidence they collected from their previous investigations can help inform them of how to represent ideas about why it was brighter or dimmer under different cover materials. This reflection begins in a Scientists Circle as they revisit their Growing Ideas chart. They are introduced to the “My Growing Ideas Checklist” as a way to keep track of which science ideas are represented in their models. Students are led through a discussion to brainstorm the new science ideas and relationships between light and materials they have figured out in lessons 2-4 that could help them explain why it’s brighter or dimmer under the different covers using their model. The teacher uses specific prompts to help them reflect on these relationships. Then the teacher pauses the discussion to show them how to demonstrate looking for a light source in some sample models. After the demonstration, students are asked to complete that row on their checklist for their initial models. After they have completed that row on their checklist, they turn and talk with a partner about how they will show (idea) in their model or make it clearer if it’s already there. They return to a class discussion and repeat this process two more times for lesson 3 and lesson 4 ideas.
- Lesson 5, Synthesize Section, Step 3 “Introduce choice in developing the model. Explain that students can choose how they will make their drawn model. They can add to their Reading Under Covers Initial Model from Lesson 1 or draw a new model on the first page of the Brighter and Dimmer Model handout. Encourage students to use their My Growing Ideas Checklist to recall what their models still need to include. As needed, help students decide if there is space for adding ideas to their Reading Under Covers Initial Model handout. Students may want to start over if their ideas changed a lot or if there is no room for new writing or drawing.” (Lesson 5, Teacher Guide)
- Lesson 8, Synthesize, Step 2, “In Lesson 5, students used the My Growing Ideas Checklist student assessment as a support for checking how their model represented ideas and relationships they could later use as evidence to explain how it was brighter or dimmer under different covers. In this lesson, students become more independent in this practice when they explain a new aspect of the phenomena (needing light to see) using evidence from the model on the Reading Under Covers Model student assessment.”

Developing and Using Models Callout: “In Lesson 5, students used the My Growing Ideas Checklist student assessment as a support for checking how their model represented ideas and relationships they could later use as evidence to explain how it was brighter or dimmer under different covers. In this lesson, students become more independent in this practice when they explain a new aspect of the phenomena (needing light to see) using evidence from the model on the Reading Under Covers Model student assessment.” (Lesson 8, Teacher Guide)

MOD-P3: Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s)

- Lesson 1, Synthesize, Step 5, “Lead a think, pair, share and record student ideas. Display slide G and explain to students that we will share our thinking about what we could include in our models using a Think, Pair, Share (see broadening access callout). One by one, ask each question aloud and direct students to think first, then talk with a partner, and then share with the group about their ideas. As students share their ideas with the whole group, record their thinking using words and drawings on a chart with the title “Initial Model Ideas.” Developing and Using Models Callout: “Students previously developed models to represent relationships in unit kindergarten and here they build on that knowledge through representing initial ideas surrounding the relationship between cover material and light under the cover. Students can also represent amounts (more or less light) as part of showing this relationship. As these are initial models, students will continue to build on these representations in Lesson 5 of this unit. Use the Noticing Ideas in Student Models for examples of some of the expansive ways students can represent ideas in their models. (Lesson 1, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3 “Develop models using evidence from investigations. Transition students to independently develop their models or add to their Reading Under Covers Initial Model handout from Lesson 1. As students develop their models, remind them that they can look at the Our Growing Ideas Chart and My Growing Ideas Checklist to help us remember our decisions about what to include to explain why it was brighter or dimmer under the three covers.” Developing and Using Models Callout: “One important element of this practice is representing amounts and relationships (see Developing Models Supports for some examples. As students develop their models, support them in considering how they can represent amounts of light in their model and the relationship between cover material and the amount of light that passes through. While these elements may have appeared in their initial models, students should be encouraged to make them explicit in their models in this lesson.” (Lesson 5, Teacher Guide)
- Lesson 5 Assessment Tool - Developing Model Supports document provides examples of how students might represent ideas and relationships in their models. Prompts for possible next steps are provided if students “have represented an idea or relationship (in writing, drawing, verbally, and/or using gestures), but it needs clarification” and if “a student’s model represents science ideas (cover material, amount of light, light sources) but cause and effect relationships are not clearly represented in writing, drawing, verbally, and/or by using gestures.”
- Lesson 8, Synthesize, Step 2, “In Lesson 5, students used the My Growing Ideas Checklist student assessment as a support for checking how their model represented ideas and relationships they could later use as evidence to explain how it was brighter or dimmer under different covers. In this lesson, students become more independent in this practice when they explain a new aspect of the phenomena (needing light to see) using evidence from the model on the Reading Under Covers Model student assessment.” Developing and Using Models Callout: “In Lesson 5, students used the My Growing Ideas Checklist student assessment as a support for checking how their model represented ideas and relationships they could later use as evidence to explain how it was brighter or dimmer under different covers. In this lesson, students become more independent in this practice when they explain a new aspect of the phenomena (needing

light to see) using evidence from the model on the Reading Under Covers Model student assessment.” (Lesson 8, Teacher Guide)

INV: Planning and Carrying Out Investigations

INV-P2: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.

- Lesson 3, Explore Section, Step 3, Planning and Carrying Out Investigations Callout: “This is the first time students collaboratively plan and carry out investigations in this unit. Use the discussion prompts to encourage the class to think through each aspect of the investigation plan and consider why following the plan will help them produce data that can serve as the basis for evidence to answer their question. This whole group collaborative discussion will support students in planning investigations in small groups and partnerships later in the unit.” Step 5, Planning and Carrying Out Investigations Callout: “At the end of this lesson, students may claim that all or no light can pass through a material (2 categories of effects) or may claim that all, some, or no light can pass through (3 categories of effects). It is not necessary to come to consensus at this point, instead focus on supporting students in their use of evidence and recognizing how sometimes we need more evidence to answer our questions. Use the opportunity to add questions to the Notice and Wonder chart and motivate investigating more materials in Lesson 4.” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, students work to carry out an investigation to collect data to answer the question, “What happens when we shine the same light on different materials?” They use materials tested in Lesson 3 and six new materials to gather more evidence. They discuss the new materials and make connections between them and those used in the previous investigation. They carry out the investigation, as agreed upon with prompting from the teacher, in small groups.
- Lesson 7, Explore Section, Step 2, Planning and Carrying Out Investigations Callout: “Students collaboratively planned and carried out investigations in Lessons 3 and 4 as a class and with small groups. In this lesson they progress to working in partnerships. Consider extending the planning in the Scientists Circle if most of the class needs more support. See the extension opportunity in the next part of the Explore as an option for students already proficient in this practice.” (Lesson 7, Teacher Guide)

INV-P4: Make observations (firsthand or from media) to collect data that can be used to make comparisons.

- Lesson 3, Synthesize Section, Step 5, Planning and Carrying Out Investigations Callout: “At the end of this lesson, students may claim that all or no light can pass through a material (2 categories of effects) or may claim that all, some, or no light can pass through (3 categories of effects). It is not necessary to come to consensus at this point, instead focus on supporting students in their use of evidence and recognizing how sometimes we need more evidence to answer our questions. Use the opportunity to add questions to the Notice and Wonder chart and motivate investigating more materials in Lesson 4.” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, Planning and Carrying Out Investigations Callout: “Students continue to engage in the work of this practice by considering what they might observe with new materials and what their data will mean for answering their scientific questions about light and materials. As students plan and later investigate, you may provide their completed Light Lab Observations handout from Lesson 3 to use as a scaffold for making observations and deciding how to group materials.” (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 2 “Transition to making observations. Using the ideas and language used by the class, confirm with them an investigation plan in which they will make observations of an object inside the pinhole box with different amounts of light (none, some, a lot) to compare what they could see.

Get ready to transition students into the small groups they will work with to make their observations.”
(Lesson 6, Teacher Guide)

INV-P6: Make predictions based on prior experiences.

- Lesson 3, Explore Section, Step 4, “Turn and talk about what might happen to the light. Share with students that scientists often use their experiences to think about what they might observe before carrying out their investigations. Have students briefly turn and talk about the questions below to make predictions about what they may observe. How are the materials similar to our cover materials? What do you think you will see when you shine light on the square of parchment paper? The square of cardstock? The plastic lid?” Planning and Carrying Out Investigations Callout: “This is the first time in this unit that students are using their prior experiences to make predictions. Students will build on the use of this practice in OpenSciEd Unit 1.3: How do patterns of the Sun, Moon, and stars affect what we see in the sky and our everyday events? (Sky Patterns Unit) when we define a prediction as a claim about what we think will happen and students begin using patterns in observable data as the justification for their predictions.” (Lesson 3, Teacher Guide) **Students engage with this element of the practice in this lesson as a quick turn and talk before the investigation, and it is the only use of this element for their sensemaking in the unit.**

CEDS: Constructing Explanations and Designing Solutions

CEDS-P1: Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

- Lesson 1, Explore Section, Step 2, Constructing Explanations and Designing Solutions Callout: “This is the first time in this unit that students are making first-hand observations to create an evidence-based account. Support students in planning what types of observations they will make to help explain what happens (how well they can see the letters and pictures, differences in how easy or hard it is to see the book under different covers). Students will continue to make observations to use as evidence to explain how to read under covers in this unit; they will have additional opportunities to develop their use of this element in unit 1.4.” (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2, students make observations of where light comes from inside and outside of the classroom through a Light Scavenger Hunt. “Support students in connecting to their previous shared experience of recording observations on the Notice and Wonder chart in Lesson 1. Show students the space where they can write words and add drawings about where they notice the light is coming from inside in the first column and outside in the second column.” Synthesize Section, Step 5, Constructing Explanations and Designing Solutions Callout: “In Lesson 1 students developed initial explanations based on their experiences and observations. In this Lesson, teacher promoting makes explicit for students how scientists explain phenomena using evidence. The separate prompts for sharing claim and evidence is done purposefully to support students as they gain experience having scientific discussions and identifying the difference between claim and evidence and how the two work together to form a scientific explanation. As students continue to engage in science discussions, they will work towards sharing their claims and evidence at the same time while constructing their explanations.” (Lesson 2, Teacher Guide)
- Lesson 5, Synthesize Section, Step 4 “Gather in a Scientists Circle. Gather students in a Scientists Circle with their model on either their Brighter and Dimmer Model handout or their Reading Under Covers Initial Model handout for a Consensus Discussion about why it was brighter or dimmer under different cover materials.”... “Facilitate a consensus discussion. Facilitate the Consensus Discussion to collectively construct an explanation to add to the Lesson 5 row of Our Growing Ideas chart. During this discussion, support students in finding areas of agreement and follow up to ask what evidence supports those ideas.” (Lesson 5, Teacher Guide)

- Lesson 6, Connect Section, Step 5, Constructing Explanations and Designing Solutions Callout: “In previous lessons, students made and used first-hand observations from their investigations as evidence to support their explanations on Our Growing Ideas chart. In this lesson, students also make observations while viewing the Can We See in Total Darkness? video. When completing Our Growing Ideas chart later in the Synthesize, emphasize how scientists can also use observations from media, like this video, as evidence when constructing their explanations.” (Lesson 6, Teacher Guide)
- Lesson 8, Synthesize Section, Step 3, “Gather in a Scientists Circle. Gather students in a Scientists Circle with their Reading Under Covers Model student assessment for a Consensus Discussion about how to read under covers that block light. Explain to students that our goal in this discussion is to agree on what we have figured out so far.” Teaching Tip Callout: “The purpose of a Consensus Discussion is to collectively work towards a more complete explanation, celebrating what we have figured out so far and that our ideas have changed and grown based on evidence. Help students take stock of their progress by updating the class explanation on the Lesson 8 row of Our Growing Ideas chart. Provide the Discussion Supports for students to use during their discussion with peers.” “Continue the discussion about students’ evidence. Remind students that we always use evidence to support our claims in science. Evidence is the observations, data, or information that helps answer the scientific question. Point to each claim that students made, and ask students what evidence we have that supports that claim. As students share, continue to support them in responding to and building off of one another’s ideas. Then, add photos and artifacts to the column titled, “How did we figure it out?” (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, Constructing Explanations and Designing Solutions Callout: “Using observations as evidence is an important part of this practice. The discussion of each cover material helps connect students’ ideas to the observations made and data collected across this unit’s investigations. When students use the information about their observations from the Gotta-Have-It Checklist and Our Growing Ideas in their writing they are supporting their ideas with evidence.” (Lesson 9, Teacher Guide)
- Lesson 10, Synthesize Section, Step 3, Assessment Opportunity: “Summative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 10 (aligned to Assessment Statement 2) with the purpose of summatively assessing students explanation for how they are able to see/read a book because of light passing through or being moved to under the cover so the space is illuminated. Refer to the Class Book Scoring Guidance tool and the Assessment Guidance at the beginning of the lesson to support students who are still completing their written explanation in this lesson.” (Lesson 10, Teacher Guide)

Suggestions for Improvement

- Consider revising the claims on MOD-P1 and INV-P6 to be “opportunities for practice” in this unit, as students only have one discrete opportunity to engage in that element. While the callouts indicate further development in future units, this criterion is focused on whether there is a change in how independently students use SEP elements from the beginning to the end of the unit.

CATEGORY III

Monitoring NGSS Student Progress

III.A. Monitoring 3D Student Performance

III.B. Formative

III.C. Scoring Guidance

III.D. Unbiased Tasks/Items

III.E. Coherent Assessment System

III.F. Opportunity to Learn

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 students have opportunities to demonstrate they have reached or exceeded all targeted learning objectives and are using grade-appropriate elements of the three dimensions to show what they have figured out about a phenomenon. Formal assessment tasks primarily focus on figuring out aspects of phenomena, require students to sensemake using the three dimensions targeted as learning objectives, and provide all students with equitable opportunities to show what they know. Formal tasks are driven by well-crafted phenomena that are able to elicit rich student performances, with most scenarios based on specific, real-world, puzzling events, instances, or problems to solve. Most tasks are focused on sensemaking, requiring student reasoning to connect their existing understanding and abilities to new information to construct a new understanding of the scenario presented, and thus demonstrate knowledge-in-use. Student performances produce artifacts of integrating the three dimensions in service of sensemaking. Materials routinely elicit direct, observable evidence that students are integrating the three dimensions in varied ways, and students routinely produce artifacts with evidence of using the grade-appropriate elements of the three dimensions that are targeted in learning objectives. Students see assessments as connected to what and how they are learning, as assessments are similar in style and context to student learning activities.

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

- Lesson 1, Synthesize Section, Step 5, teachers are given the opportunity to use the Reading Under Covers Initial Model as an opportunity to “to gather evidence about learning goal 1.B (aligned to Assessment Statement 2), with the purpose of determining any supports students may need in representing their developing ideas about the relationship between cover material and the amount of light under the cover.” (Lesson 1, Teacher Guide)
- Lesson 2, Explore Section, Step 2, students are introduced to a Light Scavenger Hunt and how they will record observations during the investigation. “Demonstrate how to engage in a scavenger hunt. Prompt students to look around the room for where light might be coming from in the classroom. Invite a couple of students to share what they observe and record the observation of where light might be coming from on a class copy of the Light Scavenger Hunt handout. Find where light is coming from. Give students about 15 minutes to complete their scavenger hunt. If you can, take students outside for some of this time to find where light is coming from outside. If you cannot go outside, encourage students to look out the windows for where light comes from outside. Use the associated prompts to engage partners in sensemaking discussions about their observations. Encourage students to use the observations they have recorded and/or gestures to demonstrate their sensemaking.” (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 7, students are encouraged to “read aloud any wonders that could have been answered by the investigation and work as a class to add a check or some other annotation to indicate if they have been answered.” Then the teacher “briefly remind students of any questions, wonderings, or areas of disagreement that may have emerged while carrying out the investigation with the three materials” Then students are encouraged “to consider how testing additional materials can help them gather more evidence to answer their questions about materials and light.” (Lesson 3, Teacher Guide)
- Lesson 4, Explore Section, Step 2, “Gather in the Scientist Circle. Gather students in the Scientists Circle to briefly share ideas for how they could carry out an investigation to collect the necessary data they need

to answer their question, What happens when we shine the same light on different materials? Prompt students, If we want to figure out, What happens when we shine the same light on different materials, what would we need? Turn and talk with a partner. (different types of materials, flashlights). Introduce Light Lab 2 materials. Tell students you have brought the materials we tested last lesson (plastic lid, square of parchment paper, and square of cardstock) and six new materials that can be used to help us gather more data to answer our question about what happens when we put different materials in the path of light. Display slide C and use it along with the physical materials to show and name each new material one by one (square of foil, acrylic disk, square of colored plastic, and teacher/class-chosen transparent, translucent, and opaque materials) before placing them in the middle of the Scientists Circle for students to see, refer to, and manipulate during discussion.” (Lesson 4, Teacher Guide)

- Lesson 5, Synthesize Section, Step 3, after students have created models individually and then are sharing their models with a partner, teachers use prompts that allow them to quickly determine whether students understand the lesson learning goal: “Use evidence from investigations to create a model that explains the effect of placing objects made of different materials in the path of a beam of light.” Teacher prompts include: Can you show and tell me about your model? Why do you think it was brighter or dimmer under the different cover materials? How did you show/tell about that? Feel free to use your body, hands, and model to explain why it was brighter or dimmer. I see you included (light source). Why is it important to include a (light source) in your model? I see you are working on showing how much light passes through each material. How much light could you show passing through the shower curtain? I see you included (cover materials) and used yellow and black crayon. Can you tell me more about what those colors mean? I see you included (way to show how light passes/does not pass through a material). How does that help you explain why it was brighter/dimmer under the cover?” (Lesson 5, Teacher Guide)
- Lesson 6, Explore Section, Steps 2, 3, and 4, students plan and conduct an investigation to explore a pinhole box, make/record/share observations to answer “Can we see in the dark? Why or why not? They discuss what causes them to see an object. “These individual and small group discussions while students carry out their investigation, provide opportunities to gather evidence about learning goal 6, with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about whether an object is visible without light...If students suggest that they can see an object that is not illuminated, provide a second experience with the pinhole box. Allow for extended viewing time with the pinhole covered to test ideas about eyes adjusting to the dark.”
- Lesson 7, Explore Section, Step 3, “Collaboratively plan an investigation with reflective materials. Have students remain in a Scientists Circle and have one set of investigation materials available for them to reference for this discussion. Display slide F and tell students that, as scientists, we will plan an investigation to gather data to answer our questions about how we can make it light where it is dark using our materials. Students will use a flashlight, foil, a mirror, and a paper circle like the one they used in their Light Lab investigations.” (Lesson 7, Teacher Guide)

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

- Lesson 2, Synthesize Section, Step 5, “Turn and talk to connect students’ ideas to the unit question. Remind students of the unit question, How can I read under covers when it’s dark? Ask students to turn and talk about how today’s investigation - finding different light sources inside and outside of the classroom - relates to the unit question. Then, ask students to share their ideas.” (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 4, teachers use prompts that allow teachers to quickly determine whether students are building an understanding of the lesson learning goal: “Plan and conduct an investigation to gather evidence about the effect of placing different materials in the path of a beam of light.” Teachers are provided prompts to use that focus on the effect of light shining on different materials, why students

grouped materials together, and how they were similar and different. In addition, teacher prompts asked how a student would test a new material to glean how they would plan an investigation. (Lesson 3, Teacher Guide)

- Lesson 4, Synthesize Section, Step 5, students “consider what the data we gathered in our investigation means for us in terms of whether or not we have answered our lesson question... ‘What happens when we shine the same light on different materials?’” (Lesson 4, Teacher Guide)
- Lesson 5, Lesson Assessment Guidance, “This is a key formative assessment opportunity where you will take stock of students’ progressing sensemaking around Assessment Statement 2 (aligned to 1-PS4-3) using their Brighter and Dimmer Model student assessment and evidence from Lessons 3-4 captured on the Following Students’ Sensemaking 2 tool. This is also an opportunity for students to reflect on their current sensemaking using their model with the support of the My Growing Ideas Checklist reflective tool. Use lesson discussion prompts and additional guidance in the Developing Models Supports tool to support students in using the checklist to make changes and/or additions to their models. Refer to the Lesson 5 Instructional Guidance for instructional guidance suggestions based on students’ current sensemaking.” (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3, “Students’ Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to develop a model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials.” (Lesson 5, Teacher Guide)
- Lesson 8, Lesson Assessment Guidance “This is a key formative assessment opportunity where you will take stock of students’ progressing sensemaking around Assessment Statement 1 (aligned to 1-PS4-2) using their Reading Under Covers Model student assessment and evidence recorded on the Following Students’ Sensemaking 1 tool.” “Students’ Reading Under Covers Model student assessments and the surrounding discussion provide an opportunity to gather evidence about Learning Goal 8 (aligned to Assessment Statement 1), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to use gestures, pointing, and spoken language in addition to any written words on the page to explain why they circled different representations in the model to explain how to read under covers that block light.” (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 5, “As students complete the Reading Under Covers Book handout, you have an opportunity to individually assess Learning Goal 9a. (aligned to Assessment Statement 1) and Learning Goal 9b. (aligned to Assessment Statement 2). Look and listen for students to explain their ideas drawing on evidence from their observations during investigations, Reading Under Covers Lesson 4 Model handout and Reading Under Covers Lesson 8 Model handout, and unit informational texts. Support students’ three-dimensional thinking by connecting claims they make about their topic and suggestions to help with evidence from the unit. Refer to the Following Student Sensemaking tool as well as the assessment guidance at the beginning of this teacher guide.” (Lesson 9, Teacher Guide)

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

- Lesson 2, Lesson Assessment Guidance, teachers are encouraged to “Use these formative assessment opportunities to determine how students’ three-dimensional thinking around Assessment Statement 1 (aligned to 1-PS4-2) is progressing. It is okay if students are identifying reflectors (e.g., the moon, reflective tape) as a light source in this Lesson. Students will have an opportunity to clarify these ideas in Lesson 7. As ideas about reflectors and needing light to see come up throughout the lesson, add them as wonders to the Notice and Wonder chart.” Teachers are guided in “What to look and listen for: Look for evidence that students are **making observations** of **where light is coming from** inside and outside of the classroom.

Students should begin to **use their observations to explain** that **light comes from objects that give off light (light sources)** and it is bright (**effect**) when there is a **light source** present (**cause**).” (Lesson 2, Teacher Guide)

- Lesson 4, Lesson Assessment Guidance, “Use these formative assessment opportunities to determine how students’ three-dimensional thinking around Assessment Statement 2 (aligned to 1-PS4-3) is progressing... Students will be applying what they figured out across Lessons 2-4 to **develop models** in Lesson 5, so it is important that they can **describe the effects** of **light shining on transparent, translucent, and opaque materials**. If students need more support, consider providing additional experiences before moving on to Lesson 5.” (Lesson 4, Teacher Guide)
- Lesson 5, Lesson Assessment Guidance, teachers are guided in “What to look and listen for: Students drawing, writing, verbally explaining, acting out, and/or gesturing ideas about: **Representations** of the **three different cover materials**. **Amount of light (or absence of light)** that was visible under each cover. **Representations of light from a light source passing through or being stopped (effect) by the covers (cause)**. **Representations** of the **effects** of light passing through or being stopped by a material: It is bright when **all the light passes through**. It is dimmer when **some light passes through**. It is dimmest/dark/there is a shadow when **no light passes through**. Students will not be expected to show a secure understanding of redirecting light until Lesson 7.” (Lesson 5, Teacher Guide)
- Lesson 7, Lesson Assessment Guidance, “This assessment is a formal opportunity to gather summative information about your students’ progress...when students plan and carry out their investigation in pairs and record their observations on the Light to Dark Investigation handout. What to look and listen for: Students **carrying out their plan** in small groups in order to **make and record observations** about **what happens** to the **beam of light: Shining the flashlight onto the material**. **Placing the material into the path of light (cause)**. **Observing light bouncing off the reflective material** to illuminate the circle (**effect**). Evidence of students’ ideas may be expressed in words, drawings, written or spoken descriptions, movement and/or gestures.” (Lesson 7, Teacher Guide)
- Lesson 9, Lesson Assessment Guidance, “Use this information to determine if students need more time and/or support with **constructing their explanation** before Lesson 10. If needed, students should be given the time to complete their class book page prior to Lesson 10 when the class will assemble the book, **share their explanations**, and use their page to come to a consensus about **needing light to see**. If students need more support with explaining **cause-and-effect relationships** between **light, cover material, and being able to read** you may consider providing sentence starters or frames; Having a set of unit investigation materials, including the covers, available for students to retest and manipulate. Use the self reflection opportunity to make decisions about reorganizing into small groups, checking in with individual students, and making decisions about whether more time will be needed to complete the individual book pages.” (Lesson 9, Teacher Guide)
- Lesson 10, Lesson Assessment Guidance, “This assessment is a formal opportunity to gather summative information about your students’ progress. For this lesson, you will use the evidence gathered on the Class Book Scoring Guidance tool to make a summative claim about students’ understanding of Assessment Statement 1 (aligned to 1-PS4-2). If you have not yet checked off evidence for all three boxes for certain students, make sure to talk individually with those students about their Reading Under Covers Book so they have an opportunity to explain their thinking and inform your summative assessment of their progress. This is the final formal assessment opportunity for the practice of **constructing explanations** and crosscutting the concept of **cause-and-effect** in this unit. Students will have additional opportunities to develop constructing explanations and cause-and-effect 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 or structured guidance in those units.” (Lesson 10, 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 materials embed formative assessment processes throughout the unit that evaluate student learning to inform instruction. Some opportunities are called formative assessments in the materials, and they include explicit support for the next instructional steps. The materials include explicit, frequent, and varied support for formative assessment processes, including support with real-time instructional adjustment based on student responses and offer guidance for student self-assessment throughout the formative assessment processes. The formative assessment processes provide varied support for student thinking across all three dimensions, and the processes attend to multiple aspects of student equity with some modality options for students to demonstrate their thinking. Additional “instructional guidance” documents and annotated student work samples provide teachers with information about proficiency levels and guidance on instructional next steps.

Materials include explicit, frequent, and varied supports for formative assessment processes. The Lesson Assessment Guidance section in each lesson’s Teacher Guide provides the lesson’s three-dimensional learning goal, names the type of assessment(s) in the lesson, tells teachers “where to check for understanding” in specific lesson components, and provides some multimodal student responses or “look fors/listen fors” within the three-dimensions to support teachers in noticing how students are engaging in sensemaking. The “How can I use this assessment information?” section includes suggestions for providing feedback to students based on their progress with the lesson’s three-dimensional learning goal and suggestions for possible instructional next steps/adjustments to support students in working toward proficiency or in extending their learning.

Each lesson Teacher Guide contains yellow assessment callout boxes within the sequence of instruction to signal to teachers that an assessment opportunity is coming up in the following component. The callouts specify the type of assessment (ongoing, embedded, formative opportunities, or key formative assessment opportunities), the purpose, where to look for feedback guidance, and support with instructional decisions. Some examples of these callouts:

- Lesson 1, Explore Section, Step 3 “Pre-assessment: This discussion provides an opportunity to gather evidence about learning goal 1.A (aligned to Assessment Statement 1), with the purpose of determining any support students may need in upcoming lessons as they continue to make observations to refine their explanations about what caused it to be easier or harder to read under different cover materials. Accept all student ideas and refer to the Assessment Guidance at the beginning of the lesson.” (Lesson 1, Teacher Guide)
- Lesson 1, Synthesize Section, Step 5, “Pre-assessment: The Reading Under Covers Initial Model handout provides an opportunity to gather evidence about learning goal 1.B (aligned to Assessment Statement 2), with the purpose of determining any supports students may need in representing their developing ideas about the relationship between cover material and the amount of light under the cover. Accept all student ideas and refer to the Assessment Guidance at the beginning of this lesson.” (Lesson 1, Teacher Guide)

- Lesson 3, Explore Section, Step 4, “Formative assessment: Individual and small group discussions and Light Lab Observations provide an opportunity to gather evidence about learning goal 3 (aligned to Assessment Statement 2), to support students in carrying out their planned investigation. Use suggested follow-ups to help students clarify and communicate their ideas about the effect of placing each material in the path of light. Use the Following Students’ Sensemaking 2 tool to record evidence of students’ developing sensemaking. If students are identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes light to pass through, guide them in comparing examples that challenge their thinking (e.g. thin plastic lid and thin cardstock). If students are still unsure of how to carry out the investigation, invite the student/group to test the materials one at a time, breaking the investigation into smaller steps, and pausing to clarify directions. If students make observations about dark spaces or shadows, add these ideas and questions to the class Notice and Wonder chart to build upon in Lesson 4.” (Lesson 3, Teacher Guide)
- Lesson 5, Synthesize Section, Step 2, “Self-reflection: Students’ use of the My Growing Ideas Checklist to review their own models, provides an opportunity for self-reflection, with the purpose of supporting students in evaluating and improving the accuracy and completeness of their models (in explaining why it was brighter or dimmer under the three cover materials). Remind students that they have the opportunity to use the class’s updated Our Growing Ideas chart to support their thinking on how to complete their models in the next Synthesize step. Also, refer to the Assessment Guidance at the beginning of the lesson.” (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3, “Key formative assessment: Students’ Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to develop a model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials. Be sure to prompt for and notice how students use spoken words in any language, actions, and/or gestures to explain ideas that might not be captured in their writing/drawing alone. Have a copy of the Developing Models Supports tool available for guidance on providing specific feedback. Refer to the Lesson 5 Instructional Guidance and Assessment Guidance at the beginning of the lesson to determine next steps.” (Lesson 5, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, “Self-Reflection: These prompts offer an opportunity for students to use the Gotta-Have-It Checklist to reflect on their Reading Under Covers Book with the purpose of supporting students in celebrating what evidence they have used so far and determining next steps for their writing. Refer to the Assessment Guidance at the beginning of the lesson.” (Lesson 9, Teacher Guide)

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

- Lesson 2, Explore Section, Step 2 “Formative assessment: Partner discussions and the Light Scavenger Hunt handout provide an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in **clarifying and communicating their ideas about where light comes from**. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. If students are not yet sure what objects light is coming from, ask them to compare an object they think light might be coming from to one they do not think light is coming from. Prompt, what is different between these objects? To start connecting to **cause and effect** ask students to consider what would happen if they brought that object to a dark room, or what would happen if the light was turned off. Students may name objects that reflect, rather than produce light (the moon, car/bike reflectors) as light sources. Add these ideas and questions to the Notice and Wonder chart to revisit in Lesson 7. In the Connect use information from the Light in Our Communities book to help clarify what objects are light sources and how they make light.” (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 3 “Formative assessment: In this discussion, look and listen for students’ sensemaking with the purpose of providing feedback and supporting students in **planning an investigation**

to gather evidence about the effect of shining light on different materials. Look and listen for students suggesting ideas for how to use materials (putting the tray, parchment paper, and cardstock in the path of light (cause) and for how they will observe what happens to the light (effect). Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If students need more support, revisit pages in the Scientists Plan and Carry Out Investigations book that connects to the part of the investigation the class is planning." (Lesson 3, Teacher Guide)

- Lesson 4, Explore Section, Step 2 "Formative assessment: Small group discussions during the Light Lab 2 Investigation is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using their data to compare how much light materials allow to pass through them. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If students group materials by thickness, color, or attribute other than light seen on the Light Lab Circle, problematize their existing thinking by showing counter examples that could help students identify a gap in their thinking (e.g., Pointing out the thick acrylic disk in the group where we saw all the light, and the book of a similar thickness that is in the group where we saw none of the light) If students need support in comparing, provide a second flashlight and Light Lab Circle handout. Have the group test two different types of materials at the same time and ask students what is similar or different on the two Light Lab Circle handouts. If students have grouped all materials, encourage them to test items of choice from around the classroom to add to their data." (Lesson 4, Teacher Guide)
- Lesson 4, Explore Section, Step 3, "Formative assessment: This discussion of the Light Lab Floor Data chart is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using their data to compare how much light materials allow to pass through them. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If groups placed materials in different places, use prompts like "Can you tell us more about what you noticed?" and "Why did your group place that material in that group?" to uncover their reasoning. Provide opportunities for students to retest and relocate materials throughout the discussion." (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 3, "Formative assessment: These individual and small group discussions while students carry out their investigation, provide opportunities to gather evidence about learning goal 6, with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about whether an object is visible without light. Students should not be able to see the object with the pinhole covered, they should be able to see the object in some detail with the pinhole uncovered, and they should see the object most clearly when the inside of the box is illuminated using the flashlight. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking." (Lesson 6, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, "Formative assessment: Student's individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated..." (Lesson 9, Teacher Guide)

Two "Following Student Sensemaking Tools" are provided in the unit to support teachers in gathering evidence of students' ongoing sensemaking aligned with the unit's performance expectations. These are designed to help teachers look for evidence of three-dimensional sensemaking across a variety of modalities.

- Lesson 2 Assessment Tool - Following Student Sensemaking 1 document allows teachers to document evidence of students' progress through Lessons 2, 6, 8, and 9 with Assessment Statement 1 "Students can use observations to make an evidence-based account that objects in the dark can only be seen when illuminated by a light source. (aligned to PE 1-PS4-2)."

- Lesson 3 Assessment Tool - Following Student Sensemaking 2 document allows teachers to document evidence of students' progress through Lessons 3, 4, 5, and 7 with Assessment Statement 2 "Students can collaboratively plan and conduct an investigation to gather evidence that can be used to answer questions about the effect of placing different materials in the path of a beam of light. (aligned to PE 1-PS4-3)."

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

- Lesson 2, Synthesize Section, Step 5, "Formative assessment: The Building Understandings discussion is an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using their observations to collaboratively construct an evidence-based account for how objects that make light make spaces brighter on Our Growing Ideas chart. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking. Use the associated prompts and suggested follow-ups to support students in developing a claim that is supported by evidence from the Light Source Scavenger Hunt and the Light in Our Communities book. To support students' use of evidence, provide the sentence starters, "We did _____ to figure that out" or "We know that because _____." (Lesson 2, Teacher Guide)
- Lesson 3, Explore Section, Step 4, "Formative assessment: Individual and small group discussions and Light Lab Observations provide an opportunity to gather evidence about learning goal 3 (aligned to Assessment Statement 2), to support students in carrying out their planned investigation. Use suggested follow-ups to help students clarify and communicate their ideas about the effect of placing each material in the path of light. Use the Following Students' Sensemaking 2 tool to record evidence of students' developing sensemaking. If students are identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes light to pass through, guide them in comparing examples that challenge their thinking (e.g. thin plastic lid and thin cardstock). If students are still unsure of how to carry out the investigation, invite the student/group to test the materials one at a time, breaking the investigation into smaller steps, and pausing to clarify directions. If students make observations about dark spaces or shadows, add these ideas and questions to the class Notice and Wonder chart to build upon in Lesson 4." (Lesson 3, Teacher Guide)
- Lesson 4, Connect Section, Step 4, "Formative assessment: Discussion of the infographic is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using information from the infographic to make sense of continued areas of uncertainty in their data about light passing through different materials. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. Use the Types of Materials infographic as a visual aid for the different effects of shining light on materials as students retest Light Lab 2 materials. Support students in comparing what they observe happening with a given material with the images on the infographic. Invite students to test items of choice from around the classroom to add to the class' shared data." (Lesson 4, Teacher Guide)
- Lesson 6, Explore Section, Step 3, "Formative assessment: These individual and small group discussions while students carry out their investigation, provide opportunities to gather evidence about learning goal 6, with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about whether an object is visible without light. Students should not be able to see the object with the pinhole covered, they should be able to see the object in some detail with the pinhole uncovered, and they should see the object most clearly when the inside of the box is illuminated using the flashlight. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking. If students suggest that they can see an object that is not illuminated, provide a second experience with the pinhole box. Allow for extended viewing time with the pinhole covered to test ideas about eyes adjusting to the dark." (Lesson 6, Teacher Guide)
- Lesson 6, Connect Section, Step 6, "Formative assessment: The interactive read-aloud of the Light in the Dark book provides opportunities to gather evidence about learning goal 6 (aligned to Assessment

Statement 1), to provide feedback and support students in overcoming ideas that it is possible to see an object in total darkness. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking. If students have ideas that their eyes adjust to the dark, use the suggestions in the discussion tables to support students in recognizing how light sources can be present when it seems "dark" and when our eyes adjust, it is to those light sources and not to darkness. If students need support in understanding how there can be light sources when it is "dark," turn off classroom lights and close the blinds. Have students conduct a new light source scavenger hunt to identify all the light sources still present that are allowing us to see. Also connect to any experiences students shared or want to share about light sources found from their Out-of-School Light Source Scavenger Hunt community connection." (Lesson 6, Teacher Guide)

- Lesson 9, Synthesize Section, Step 3, "Formative assessment: Student's individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated. Use the following suggestions to provide feedback and determine next steps before moving on to Lesson 10. Refer to the Gotta-Have-It Checklist and Our Growing Ideas chart to support students in incorporating more evidence into their explanations. Provide sentence starters or frames to help students clarify ideas: I can read/see the book because _____. The _____ is what causes me to see the book. _____ because _____. Allow for additional first hand opportunities to test ideas with investigation materials, including the covers, in order to provide concrete examples for students to write about." (Lesson 9, Teacher Guide)

The two key-formative assessment opportunities (Lesson 5 and Lesson 8) have an Instructional Guidance document that provides examples of annotated student work, sample responses, look/listen fors, and guidance with noticing of where students may need support in their sensemaking, suggestions for providing feedback, and suggestions for instructional modifications to upcoming lessons.

- Lesson 5, Synthesize Section, Step 3, "Key formative assessment: Students' Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to develop a model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials. Be sure to prompt for and notice how students use spoken words in any language, actions, and/or gestures to explain ideas that might not be captured in their writing/drawing alone. Have a copy of the Developing Models Supports tool available for guidance on providing specific feedback. Refer to the Lesson 5 Instructional Guidance and Assessment Guidance at the beginning of the lesson to determine next steps." (Lesson 5, Teacher Guide)
- Lesson 8, Synthesize Section, Step 2, "Key formative assessment: Students' Reading Under Covers Model student assessments and the surrounding discussion provide an opportunity to gather evidence about Learning Goal 8 (aligned to Assessment Statement 1), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to use gestures, pointing, and spoken language in addition to any written words on the page to explain why they circled different representations in the model to explain how to read under covers that block light. Refer to the Following Students' Sensemaking 1 tool and the Assessment Guidance at the beginning of the lesson." (Lesson 8, 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 that the materials provide appropriate guidance to support teachers in interpreting student performance, monitoring student progress, and providing information to enable modification of instruction and providing ongoing targeted feedback to individual students. The materials provided a rubric for each assessment goal that provides guidance to teachers regarding what to look for/listen for in specific lessons, along with corresponding annotated student work samples from specified lessons and possible feedback to support teachers with guiding student progress with the assessment learning goals. Teachers are provided support to track student progress toward the two three-dimensional assessment goals, and guidance is provided to support students in self-assessment of their progress toward the goals over time. Scoring guidance for key formative assessments and summative assessments includes noted student work samples to demonstrate a range of student responses that would support teacher interpretation of student progress on the goals.

- The Lesson Assessment Guidance section in each lesson's Teacher Guide provides the lesson's three-dimensional learning goal, names the type of assessment(s) in the lesson, tells teachers "where to check for understanding" in specific lesson components, and provides some multimodal student responses or "look fors/listen fors" within the three-dimensions to support teachers in noticing how students are engaging in sensemaking. The "How can I use this assessment information?" section includes suggestions for providing feedback to students based on their progress with the lesson's three-dimensional learning goal and suggestions for possible instructional next steps/adjustments to support students in working toward proficiency or in extending their learning.
- Each lesson Teacher Guide contains yellow assessment callout boxes within the sequence of instruction to signal to teachers that an assessment opportunity is coming up in the following component. The callouts specify the type of assessment (ongoing, embedded, formative opportunities or key formative assessment opportunities), the purpose, where to look for feedback guidance, and support with instructional decisions. (See III.B for additional evidence)
- Two "Following Student Sensemaking Tools" are provided in the unit to support teachers in gathering evidence of students' ongoing sensemaking aligned with the unit's performance expectations. These are designed to help teachers look for evidence of three-dimensional sensemaking across a variety of modalities. Each provides a checklist of listen/look fors and a place for teachers to track notes of what students say, write, draw, gesture, or do for the three-dimensional learning goals in the selected lessons. A chart is provided giving possible evidence of student sensemaking based on what students might say and/or what students might gesture/manipulate. Examples of what students might write/draw in Lesson 2 and Lesson 6 are provided and followed with possible feedback. **However, there is no guidance to the teacher regarding the proficiency level of the student's sensemaking.**
 - Lesson 2 Assessment Tool - Following Student Sensemaking 1 document allows teachers to document evidence of students' progress through Lessons 2, 6, 8, and 9 with Assessment Statement 1 "Students can use observations to make an evidence-based account that objects in the dark can only be seen when illuminated by a light source. (aligned to PE 1-PS4-2)."
 - Lesson 3 Assessment Tool - Following Student Sensemaking 2 document allows teachers to document evidence of students' progress through Lessons 3, 4, 5, and 7 with Assessment Statement

2 “Students can collaboratively plan and conduct an investigation to gather evidence that can be used to answer questions about the effect of placing different materials in the path of a beam of light. (aligned to PE 1-PS4-3).”

The two key-formative assessment opportunities (Lesson 5 and Lesson 8) have an Instructional Guidance document that provides examples of annotated student work, sample responses, look/listen fors, and guidance with noticings of where students may need support in their sensemaking, suggestions for providing feedback, and suggestions for instructional modifications to upcoming lessons.

- Lesson 5 Assessment Tool - Developing Model Supports document provides annotated student examples to support teachers with interpretation of individual student sensemaking progress based on the model developed in lesson 5. Examples of “Not Yet Secure, Secure with Prompting, and Secure” are provided with possible feedback to support the student. Further guidance is given for instructional next steps regarding the inclusion of model components, representations of ideas or relationships in the model, and unclear science ideas understandings as represented in the model.
 - Lesson 5, Synthesize Section, Step 3, “Key formative assessment: Students’ Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to develop a model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials. Be sure to prompt for and notice how students use spoken words in any language, actions, and/or gestures to explain ideas that might not be captured in their writing/drawing alone. Have a copy of the Developing Models Supports tool available for guidance on providing specific feedback. Refer to the Lesson 5 Instructional Guidance and Assessment Guidance at the beginning of the lesson to determine next steps.”
- Lesson 8 Assessment Tool - Lesson 8 Instructional Guidance document supports teachers with interpretation of secure understandings of “using first-hand observations to construct an evidence-based account for why a light source is needed to see/read a book under covers that block light.” Annotated examples are provided for “Not Yet Secure”, “Secure with Prompting” and “Secure” along with possible feedback to support the student. Further guidance is provided to support struggling students and to offer possible extensions.
 - Lesson 8, Synthesize Section, Step 2, “Key formative assessment: Students’ Reading Under Covers Model student assessments and the surrounding discussion provide an opportunity to gather evidence about Learning Goal 8 (aligned to Assessment Statement 1), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to use gestures, pointing, and spoken language in addition to any written words on the page to explain why they circled different representations in the model to explain how to read under covers that block light. Refer to the Following Students’ Sensemaking 1 tool and the Assessment Guidance at the beginning of the lesson.”

Two explicit opportunities for students to engage in self reflection (assessment) occur in Lesson 5 and Lesson 9. In Lesson 5, students use a co-created model checklist to reflect on their progress in developing their models and have an opportunity to change/revise their models based on their reflections. The Teacher Guide provides guidance for supporting the students in this process through the lesson activities, information in the Lesson Assessment Guidance section, and specific teaching tip callouts highlighting strategies to support the process. In Lesson 9, students have the opportunity to use their co-created Gotta-Have-It Checklist to reflect on their page of the “Reading Under Covers Book” and celebrate their progress with their explanations. The Teacher Guide

supports the students through this process in the lesson activities, including prompts to support their reflection with kinesthetic responses and ending with a partner turn-and-talk to share their reflections.

- Lesson 5, Synthesize Section, Step 2, “Self-reflection: Students’ use of the My Growing Ideas Checklist to review their own models, provides an opportunity for self-reflection, with the purpose of supporting students in evaluating and improving the accuracy and completeness of their models (in explaining why it was brighter or dimmer under the three cover materials). Remind students that they have the opportunity to use the class’s updated Our Growing Ideas chart to support their thinking on how to complete their models in the next Synthesize step. Also, refer to the Assessment Guidance at the beginning of the lesson.”
- Lesson 9, Synthesize Section, Step 3, “Self-Reflection: These prompts offer an opportunity for students to use the Gotta-Have-It Checklist to reflect on their Reading Under Covers Book with the purpose of supporting students in celebrating what evidence they have used so far and determining next steps for their writing. Refer to the Assessment Guidance at the beginning of the lesson.”

Summative assessment opportunities are included in Lessons 7 and 10, with scoring guidance for interpreting student work and annotated student work samples as additional guidance in additional resource documents for each lesson. These documents provide a range of student samples and suggested prompts for providing feedback and evaluating student ideas. Both summative assessment opportunities are explicitly noted in the Teacher’s Guide through the yellow assessment callouts.

- Lesson 7 Assessment Tool Summative Guidance document gives examples of “not yet secure”, “secure with prompting” and “secure” with possible next steps for instruction related to specific DCI, SEP, and CCC elements.
 - Lesson 7, Explore Section, Step 3, Assessment Opportunity Callout: “Summative assessment: Pair conversations and their Light to Dark Investigation handout provides an opportunity to gather evidence about learning goal 7 (aligned to Assessment Statement 2), with the purpose of summatively assessing students’ collaborative use of planning and carrying out investigations. Students should be using this practice to gather data that can be used as evidence to answer questions about how some materials can redirect light and therefore make it light where it is dark. Use the discussion prompts and guidance below during this assessment moment: If you notice students are testing materials in a way that does not support data collection to answer the lesson question (e.g., holding the flashlight away from the mirror or holding the materials the same way students did in Lesson 3 and 4), encourage the use of guided simple tests. “I hear you saying you have not noticed the light on the circle yet. Let’s try a different test by moving the mirror/foil or the flashlight.” Encourage students to describe the effect the mirror has on the beam of light in their own words (bounce, go another way, change direction, reflect). Support them in connecting these words to the scientific word reflected in the Connect component. If students have gathered data about how to use the materials to shine a light on the circle, challenge them to find other reflective materials in the classroom or use the mirror/foil to illuminate different areas of the classroom.”
- The Lesson 10 Assessment Tool—Class Book Scoring Guidance document provides a checklist template for teachers to use when scoring the individual student book pages in relation to their evidence of sensemaking. Annotated student work samples and checklists are provided to give guidance regarding possible feedback. **However, guidance is limited to possible feedback within the sections of the checklist, and no possible proficiency “levels” are related to the guidance provided.**
 - Lesson 10, Synthesize Section, Step 3, Assessment Opportunity Callout, “Summative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 10 (aligned to Assessment Statement 2) with the purpose of

summatively assessing students explanation for how they are able to see/read a book because of light passing through or being moved to under the cover so the space is illuminated. Refer to the Class Book Scoring Guidance tool and the Assessment Guidance at the beginning of the lesson to support students who are still completing their written explanation in this lesson.”

Suggestions for Improvement

- Consider adding proficiency levels (such as those found in other assessment and instructional guidance documents in the unit: “not yet secure, secure with prompting, secure”) to the annotated student examples and feedback in the two Following Sensemaking Tools and the Class Book Scoring Guidance for Lesson 10 to support teachers with interpreting student performance.

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 tasks and items for measuring student learning are sensitive to the variety of students in the nation’s classrooms. The materials use grade-appropriate text and provide tasks that do not assume all students know culturally specific knowledge. The materials often allow students to demonstrate learning through a variety of modalities. Materials leverage students’ funds of knowledge within assessment opportunities, make connections between scenarios and their own experiences, and encourage them to use their home languages and/or their preferred modality to express their thinking.

Multiple modes of communication

- Lesson 1, Explore Section, Step 3, Broadening Access Callout: “When recording students’ ideas in the Notice and Wonder chart, it is important that students have their ideas recorded in alignment with the ways they shared them (e.g., using their own words, capturing gestures they might have used, etc.). Doing so not only helps students understand what is recorded in the chart, but also sends the message that their language resources and practices are valuable for the classroom community’s sensemaking work. This is an important message for all students to receive, and especially for those whose language resources are not always valued in school spaces, such as multilingual students. Prompts to Use Try to use your words, body, or hands to share what you noticed about the differences in covers?” (Lesson 1, Teacher Guide)
- Lesson 2, Synthesize Section, Step 5, Teaching Tip Callout: “Whenever possible, use photographs or images from your classroom, copies of handouts, and drawings alongside your written responses, as evidence on Our Growing Ideas chart. Doing so ensures all students can use this chart as a tool to recall their growing ideas around the unit phenomenon over the course of the unit. Sample images can be found on the Printable Chart Images teacher reference.” (Lesson 2, Teacher Guide)
- Lesson 3, Navigate Section, Step 1, Broadening Access Callout: “To support active engagement, you could have children use a silent signal to indicate their agreement or disagreement with pairs as they are sharing. For instance, if they discussed the same thing in their partnership, they might show a signal indicating agreement (the sign for “same” in American Sign Language, for example). To sign “same” first hold up

your dominant hand, palm facing out, with your thumb and pinkie finger sticking out and the rest of your fingers curled in to sign the letter Y. Then, slide the Y hand back and forth between you and the person you are agreeing with. (Lesson 3, Teacher Guide)

- Lesson 4 Explore Section, Step 3 “Make sense of data. Prompts to use: Let’s discuss the materials we added to the ‘we see all of the light on the circle’ group. What happened when you tested them? What did you observe? How did you know to put them in that group? Ideas to look and listen for Students may use their hands to show light hitting an object and going through, scattering, bouncing back, or light being stopped. ‘I could see all of the light on the circle. The whole circle was bright.’ Feel free to use words, your bodies, and previous drawings to express your ideas!” (Lesson 4, Teacher Guide)
- Lesson 6, Connect Section, Step 5, Broadening Access Callout: “Support your students’ access to the information in these videos 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. Literacy Supports The illustrations in *Light in the Dark* book are essential for students to understand the key idea that there is a difference between dark and total darkness. Students identify light sources in the images to determine whether the children in the book are in total darkness. Through this work, students learn that images have meaning in a text and that it is important to understand how that meaning supports the author’s point of view which offers an opportunity for practicing RI.1.7” (Lesson 6, Teacher Guide)

Supports success for all students

- Lesson 1, Explore Section, Step 2, Broadening Access Callout: “Provide multiple means of representation by describing the cover materials. You can allow students to touch and feel the materials, which will be especially beneficial for students with visual impairments (see additional recommendations in the Unit Overview). Having shared experiences and language to describe how the materials look and feel will also support all learners in having consistent and specific language to use when making and sharing their observations. Teaching Tip Throughout this unit, you will notice explicit teacher moves to support coherence for students. Even when introducing classroom agreements, students should understand how or why the steps they are taking help them work as scientists and figure out answers to questions they have about the world.” (Lesson 1, Teacher Guide)
- Lesson 2, Navigate Section, Step 1, Broadening Access Callout: “Making the cover materials from Lesson 1 available supports students’ sensemaking by having resources to draw from in sharing their ideas. Students can also turn and talk to share ideas before sharing with the whole group for an opportunity to self-reflect and review their developing thoughts as they remind themselves of the exploration. This might promote confidence, particularly for multilingual students, which ultimately optimizes motivation to engage in class discussions.” Broadening Access Callout: “It is valuable to use students’ ideas and language as you co-construct the lesson question with your students. It offers an opportunity for students to make connections between the work they have done in previous lessons and the work they will be doing during this lesson. It also allows them to see that their words and language are welcome and useful in science.” (Lesson 2, Teacher Guide)
- Lesson 4, Connect Section, Step 4 “Gather information from an infographic. Add lesson vocabulary words to the Word Wall. Remind students that we read about three new science words from the Types of Materials infographic, “transparent,” “translucent,” “opaque,” and “shadow.” Ask students to recall the definitions and provide examples. Refer back to the infographic to support students in developing their definitions: opaque means allows no light to pass through, translucent means allows some light to pass through, transparent means allows all light to pass through, and a shadow is a shape made when an object blocks the light. You may have students lay the word wall cards on the Light Lab Floor Data chart as labels

for the appropriate groups. It may be useful to capture a photo before moving the words to the Word Wall before transitioning to the Synthesize.” (Lesson 4, Teacher Guide)

- Lesson 8, Synthesize Section, Step 2, Broadening Access Callout: “To support students’ various needs, guide appropriate goal-setting for this assessment with individual students needing additional support by motivating them to plan clear procedures for completing the task. You might provide previous models, Our Growing Ideas chart, or a checklist like the Model Checklist handout. This can help break goals into smaller short-term objectives and give students time and space to think about and plan their explanation for how the parts of their model make it easier to read/see.” (Lesson 8, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, Literacy Supports Callout: “As students write their explanations on the Reading Under Covers Book, the lines and option to add sentence starters provide students with the opportunity to produce complete sentences to explain their ideas. This supports SL.1.6 as students produce complete sentences that are appropriate to the task and situation. This helps students present their ideas coherently to their chosen audience for the class book. Scientists also need to do this when sharing their thinking with others.” (Lesson 9, Teacher Guide)

Multiple modalities and student choice

- Lesson 3, Navigate Section, Step 6, Teaching Tip Callout: “Make note of materials students are interested in testing at the end of this lesson. If readily available, prioritize choosing materials from the ones shared by students for use in Lesson 4. You may also consider choosing materials that allow students to answer questions added to the Notice and Wonder chart (e.g., materials of the same color or thickness that let different amounts of light through).” (Lesson 3, Teacher Guide)
- Lesson 6, Navigate Section, Step 1 “Recall where we left off. Take an initial stance on seeing without light. Introduce the “Can we see without light?” chart (refer to slide D) and explain that this chart can help us keep track of our ideas about the lesson question throughout this lesson. Give each student a sticky note and have them place it under the column that best represents their thinking at the beginning of the lesson. Remind them that these are some of our first ideas and it is ok if we are not sure or if we disagree.” then, in Lesson 6, Explore Section, Step 4, “Make senses of data, Take a movement break and move our sticky notes. After this brief analysis of the class data, provide a short movement break and use this time to let students move their sticky notes.” (Lesson 6, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Broadening Access Callout: “Depending on the needs and interests of your students, you may consider alternative formats for the Light to Dark Investigation handout. Some possible options could include making a digital copy using available technology for students to drag and drop the images, have students record a video showing how they carried out the investigation with the materials, drawing a picture, or taking a photograph with a written description or voice-over of how they carried out the investigation, or some combination of these options.” (Lesson 7, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, Literacy Supports Callout: “Providing a space for a drawing and, as available, other visual displays such as a video recording (see suggestions in Our Class Book Setup) to clarify ideas supports SL.1.5. This allows students to incorporate visual displays with their oral and written language to enhance its meaning for a reader or listener. Show students the Reading Under Covers Book handout (refer to slide D) that they will use to compose their page of the class book. Point out that there is a space for an image, such as an illustration or model. They can illustrate something new or they can glue or tape one of their completed models in that spot. Also, point out the space to write their explanation.” (Lesson 9, Teacher Guide)
- Lesson 9, Synthesize Section, Step 3, Broadening Access Callout: “Provide multiple means of engagement by offering students the choice and autonomy to write about the cover material that interests them most. This empowers learners to take charge of their own learning. You may consider having students choose at this point in the lesson or you may have students give their preference prior to this step of the Synthesize

so you can help organize students by cover material prior to beginning the writing.” (Lesson 9, 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 throughout the materials, the variety of assessments gives the teacher and student feedback about the degree to which the intended three-dimensional learning is accomplished. Assessments are connected to learning objectives and require students to apply grade-appropriate elements of the three dimensions to make sense of the phenomena. The materials explicitly describe how the different types of assessment work together to provide regular feedback to teachers to inform instruction and to students to inform learning. All four of the assessment types are present, and assessment opportunities are found throughout the learning experience. The purpose and rationale of the assessment are coherent across the materials.

Matches three-dimensional learning objectives

- In Lesson 1, the three-dimensional learning objective is 1a **Make first-hand observations of how** well a **book can be seen (effect) with different amounts of light available (cause)** under covers made of different materials. The discussion around the anchoring phenomenon provides an opportunity to pre-assess students with the purpose of determining any support students may need in upcoming lessons as they continue to **make observations to refine their explanations** about what **caused** it to be **easier or harder to read under different cover materials**.
- In Lesson 1, the three-dimensional learning objective is 1b **Develop** an initial **model to represent** how covers made of **different materials cause** the space under the cover to appear **lighter or darker based on how much light passes through**. The development of an initial model of the anchoring phenomenon provides an opportunity to pre-assess with the purpose of determining any supports students may need in **representing their developing ideas** about the **relationship between cover material and the amount of light under the cover**.
- In Lesson 2, the three-dimensional learning objective is **Make firsthand observations** about **where light is coming from to construct an evidence-based account** that **objects that give off light (cause) make a space brighter (effect)**. Students **use their observations** from the light source scavenger hunt to collaboratively **construct an evidence-based account** for **how objects that make light (cause) make spaces brighter (effect)** on their Our Growing Ideas chart.
- In Lesson 3, the three-dimensional learning objective is **Plan and conduct an investigation to gather evidence** about **the effect of placing different materials in the path of a beam of light**. Students work **collaboratively to plan and carry out** a Light Lab Observation and work to clarify and communicate their ideas about **the effect of placing each material in the path of light**.
- In Lesson 4, the three-dimensional learning objective is **Make observations to collect data that can be used to make comparisons of how much light** from a flashlight **passes through or is blocked (effect) by**

placing different materials in its path (cause). Students gather data in the Light Lab 2 and use their data to compare how much light (effect) materials (cause) allow to pass through them. They are introduced to an infographic that helps them make sense of continued areas of uncertainty in their data about light passing through (effect) different materials (cause).

- In Lesson 5, the three-dimensional learning objective is Develop a model to represent the amount of light different cover materials allow to pass through them causing it to be brighter or dimmer in the space under the covers. Students reflect on their own initial models and determine how to best explain why it was brighter or dimmer under the three cover materials. They have the choice to revise their initial model or develop a new model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials.
- In Lesson 6, the three-dimensional learning objective is Make observations of an object in a pinhole box with and without a light source to use as evidence to explain how an object in a dark pinhole box can be seen only when illuminated with a light source. Students carry out an investigation with a pinhole box to clarify and communicate their ideas about whether an object is visible without light. They engage in an interactive read-aloud of the Light in the Dark book to support students in overcoming ideas that it is possible to see an object in total darkness.
- In Lesson 7, the three-dimensional learning objective is Plan and conduct investigations collaboratively to gather evidence to support that mirrors can be used to redirect a beam of light to places that are dark. Students collaboratively plan and carry out an investigation to gather data that can be used as evidence to answer questions about how some materials (like foil and mirrors) can redirect light and therefore make it light where it is dark.
- In Lesson 8, the three-dimensional learning objective is Use a model that represents the relationship between light and seeing to explain how illuminating a book in a dark space (cause) makes the book easier to see (effect). Students develop a model to represent their understanding and explanation of how to read under covers that block light. These models will be used to support the writing of their class book in lessons 9 and 10.
- In Lesson 9, the three-dimensional learning objective is Construct an evidence-based account of how a book can be seen (effect) under a cover that allows all, some, or no light to pass through only if light is available to illuminate it (cause). Students work individually to synthesize their learning by constructing a class book page that uses evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated.
- In Lesson 10, the three-dimensional learning objective is Communicate an evidence-based account of how a book can be seen (effect) under a cover that allows all, some, or no light to pass through only if light is available to illuminate it (cause). Student's individual explanation on Reading Under Covers Book is an opportunity to summatively assess students' explanation for how they are able to see/read a book (effect) because of light passing through or being moved under the cover so the space is illuminated (cause).

Pre-, formative, summative, and self-assessment

Pre-Assessment

- Lesson 1, Explore Section, Step 3 "Pre-assessment: This discussion provides an opportunity to gather evidence about learning goal 1.A (aligned to Assessment Statement 1), with the purpose of determining any support students may need in upcoming lessons as they continue to make observations to refine their explanations about what caused it to be easier or harder to read under different cover materials. Accept all student ideas and refer to the Assessment Guidance at the beginning of the lesson."
- Lesson 1, Synthesize Section, Step 5, "Pre-assessment: The Reading Under Covers Initial Model handout provides an opportunity to gather evidence about learning goal 1.B (aligned to Assessment Statement 2), with the purpose of determining any supports students may need in representing their developing ideas

about the relationship between cover material and the amount of light under the cover. Accept all student ideas and refer to the Assessment Guidance at the beginning of this lesson.”

Formative Assessment

Key Formative Assessments:

- Lesson 5, Synthesize Section, Step 3, “Key formative assessment: Students’ Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to develop a model that represents the relationship between the cover material and the amount of light passing through to explain why it was brighter or dimmer under the different cover materials. Be sure to prompt for and notice how students use spoken words in any language, actions, and/or gestures to explain ideas that might not be captured in their writing/drawing alone. Have a copy of the Developing Models Supports tool available for guidance on providing specific feedback. Refer to the Lesson 5 Instructional Guidance and Assessment Guidance at the beginning of the lesson to determine next steps.”
- Lesson 8, Synthesize Section, Step 2, “Key formative assessment: Students’ Reading Under Covers Model student assessments and the surrounding discussion provide an opportunity to gather evidence about Learning Goal 8 (aligned to Assessment Statement 1), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to use gestures, pointing, and spoken language in addition to any written words on the page to explain why they circled different representations in the model to explain how to read under covers that block light. Refer to the Following Students’ Sensemaking 1 tool and the Assessment Guidance at the beginning of the lesson.”

Ongoing Formative Assessments

- Lesson 2, Explore Section, Step 2 “Formative assessment: Partner discussions and the Light Scavenger Hunt handout provide an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about where light comes from. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. If students are not yet sure what objects light is coming from, ask them to compare an object they think light might be coming from to one they do not think light is coming from. Prompt, what is different between these objects? To start connecting to cause and effect ask students to consider what would happen if they brought that object to a dark room, or what would happen if the light was turned off. Students may name objects that reflect, rather than produce light (the moon, car/bike reflectors) as light sources. Add these ideas and questions to the Notice and Wonder chart to revisit in Lesson 7. In the Connect use information from the Light in Our Communities book to help clarify what objects are light sources and how they make light.
- Lesson 2, Synthesize Section, Step 5, “Formative assessment: The Building Understandings discussion is an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using their observations to collaboratively construct an evidence-based account for how objects that make light make spaces brighter on Our Growing Ideas chart. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. Use the associated prompts and suggested follow-ups to support students in developing a claim that is supported by evidence from the Light Source Scavenger Hunt and the Light in Our Communities book. To support students’ use of evidence, provide the sentence starters, “We did ____ to figure that out” or “We know that because ____.”
- Lesson 3, Explore Section, Step 3 “Formative assessment: In this discussion, look and listen for students’ sensemaking with the purpose of providing feedback and supporting students in planning an investigation to gather evidence about the effect of shining light on different materials. Look and listen for students

suggesting ideas for how to use materials (putting the tray, parchment paper, and cardstock in the path of light (cause) and for how they will observe what happens to the light (effect). Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If students need more support, revisit pages in the Scientists Plan and Carry Out Investigations book that connects to the part of the investigation the class is planning."

- Lesson 3, Explore Section, Step 4, "Formative assessment: Individual and small group discussions and Light Lab Observations provide an opportunity to gather evidence about learning goal 3 (aligned to Assessment Statement 2), to support students in carrying out their planned investigation. Use suggested follow-ups to help students clarify and communicate their ideas about the effect of placing each material in the path of light. Use the Following Students' Sensemaking 2 tool to record evidence of students' developing sensemaking. If students are identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes light to pass through, guide them in comparing examples that challenge their thinking (e.g. thin plastic lid and thin cardstock). If students are still unsure of how to carry out the investigation, invite the student/group to test the materials one at a time, breaking the investigation into smaller steps, and pausing to clarify directions. If students make observations about dark spaces or shadows, add these ideas and questions to the class Notice and Wonder chart to build upon in Lesson 4."
- Lesson 4, Explore Section, Step 2 "Formative assessment: Small group discussions during the Light Lab 2 Investigation is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using their data to compare how much light materials allow to pass through them. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If students group materials by thickness, color, or attribute other than light seen on the Light Lab Circle, problematize their existing thinking by showing counter examples that could help students identify a gap in their thinking (e.g., Pointing out the thick acrylic disk in the group where we saw all the light, and the book of a similar thickness that is in the group where we saw none of the light) If students need support in comparing, provide a second flashlight and Light Lab Circle handout. Have the group test two different types of materials at the same time and ask students what is similar or different on the two Light Lab Circle handouts. If students have grouped all materials, encourage them to test items of choice from around the classroom to add to their data."
- Lesson 4, Explore Section, Step 3, "Formative assessment: This discussion of the Light Lab Floor Data chart is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using their data to compare how much light materials allow to pass through them. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. If groups placed materials in different places, use prompts like "Can you tell us more about what you noticed?" and "Why did your group place that material in that group?" to uncover their reasoning. Provide opportunities for students to retest and relocate materials throughout the discussion."
- Lesson 4, Connect Section, Step 4, "Formative assessment: Discussion of the infographic is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using information from the infographic to make sense of continued areas of uncertainty in their data about light passing through different materials. Use the Following Students' Sensemaking 2 to record evidence of students' developing sensemaking. Use the Types of Materials infographic as a visual aid for the different effects of shining light on materials as students retest Light Lab 2 materials. Support students in comparing what they observe happening with a given material with the images on the infographic. Invite students to test items of choice from around the classroom to add to the class' shared data."
- Lesson 6, Explore Section, Step 3, "Formative assessment: These individual and small group discussions while students carry out their investigation, provide opportunities to gather evidence about learning goal

6, with the purpose of providing feedback and supporting students in clarifying and communicating their ideas about whether an object is visible without light. Students should not be able to see the object with the pinhole covered, they should be able to see the object in some detail with the pinhole uncovered, and they should see the object most clearly when the inside of the box is illuminated using the flashlight. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking."

- Lesson 6, Connect Section, Step 6, "Formative assessment: The interactive read-aloud of the Light in the Dark book provides opportunities to gather evidence about learning goal 6 (aligned to Assessment Statement 1), to provide feedback and support students in overcoming ideas that it is possible to see an object in total darkness. Use the Following Students' Sensemaking 1 tool to record evidence of students' developing sensemaking. If students have ideas that their eyes adjust to the dark, use the suggestions in the discussion tables to support students in recognizing how light sources can be present when it seems "dark" and when our eyes adjust, it is to those light sources and not to darkness. If students need support in understanding how there can be light sources when it is "dark," turn off classroom lights and close the blinds. Have students conduct a new light source scavenger hunt to identify all the light sources still present that are allowing us to see. Also connect to any experiences students shared or want to share about light sources found from their Out-of-School Light Source Scavenger Hunt community connection."
- Lesson 9, Synthesize Section, Step 3, "Formative assessment: Student's individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated..."
- Lesson 9, Synthesize Section, Step 3, "Formative assessment: Student's individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in using evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated. Use the following suggestions to provide feedback and determine next steps before moving on to Lesson 10. Refer to the Gotta-Have-It Checklist and Our Growing Ideas chart to support students in incorporating more evidence into their explanations. Provide sentence starters or frames to help students clarify ideas: I can read/see the book because _____. The _____ is what causes me to see the book. _____ because _____. Allow for additional first hand opportunities to test ideas with investigation materials, including the covers, in order to provide concrete examples for students to write about."

Summative Assessment

Summative assessment opportunities are included in Lessons 7 and 10, with scoring guidance for interpreting student work and annotated student work samples as additional guidance in additional resource documents for each lesson. These documents provide a range of student samples and suggested prompts for providing feedback and evaluating student ideas. Both summative assessment opportunities are explicitly noted in the Teacher's Guide through the yellow assessment callouts.

- Lesson 7 Assessment Tool - Summative Guidance document gives examples of "not yet secure" and "secure with prompting" with possible next steps for instruction related to specific DCI, SEP, and CCC elements.
 - Lesson 7, Explore Section, Step 3, Assessment Opportunity Callout: "Summative assessment: Pair conversations and their Light to Dark Investigation handout provides an opportunity to gather evidence about learning goal 7 (aligned to Assessment Statement 2), with the purpose of summatively assessing students' collaborative use of planning and carrying out investigations. Students should be using this practice to gather data that can be used as evidence to answer

questions about how some materials can redirect light and therefore make it light where it is dark. Use the discussion prompts and guidance below during this assessment moment: If you notice students are testing materials in a way that does not support data collection to answer the lesson question (e.g., holding the flashlight away from the mirror or holding the materials the same way students did in Lesson 3 and 4), encourage the use of guided simple tests. “I hear you saying you have not noticed the light on the circle yet. Let’s try a different test by moving the mirror/foil or the flashlight.” Encourage students to describe the effect the mirror has on the beam of light in their own words (bounce, go another way, change direction, reflect). Support them in connecting these words to the scientific word reflected in the Connect component. If students have gathered data about how to use the materials to shine a light on the circle, challenge them to find other reflective materials in the classroom or use the mirror/foil to illuminate different areas of the classroom.”

- The Lesson 10 Assessment Tool—Class Book Scoring Guidance document provides a checklist template for teachers to use when scoring the individual student book pages in relation to their evidence of sensemaking. Annotated student work samples and checklists are also provided to give guidance regarding possible feedback.
 - Lesson 10, Synthesize Section, Step 3, Assessment Opportunity Callout, “Summative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 10 (aligned to Assessment Statement 2) with the purpose of summatively assessing students explanation for how they are able to see/read a book because of light passing through or being moved to under the cover so the space is illuminated. Refer to the Class Book Scoring Guidance tool and the Assessment Guidance at the beginning of the lesson to support students who are still completing their written explanation in this lesson.”

Self Assessment

Two explicit opportunities for students to engage in self reflection (assessment) occur in Lesson 5 and Lesson 9. In Lesson 5, students use a co-created model checklist to reflect on their progress in developing their models and have an opportunity to change/revise their models based on their reflections. The Teacher Guide provides guidance for supporting the students in this process through the lesson activities, information in the Lesson Assessment Guidance section, and specific teaching tip callouts highlighting strategies to support the process. In Lesson 9, students have the opportunity to use their co-created Gotta-Have-It Checklist to reflect on their page of the “Reading Under Covers Book” to reflect on and celebrate their progress with their explanations. The Teacher Guide provides guidance for supporting the students through this process in the lesson activities, including prompts to support their reflection with kinesthetic responses and ending with a partner turn-and-talk to share their reflections.

- Lesson 5, Synthesize Section, Step 2, “Self-reflection: Students’ use of the My Growing Ideas Checklist to review their own models, provides an opportunity for self-reflection, with the purpose of supporting students in evaluating and improving the accuracy and completeness of their models (in explaining why it was brighter or dimmer under the three cover materials). Remind students that they have the opportunity to use the class’s updated Our Growing Ideas chart to support their thinking on how to complete their models in the next Synthesize step. Also, refer to the Assessment Guidance at the beginning of the lesson.”
- Lesson 9, Synthesize Section, Step 3, “Self-Reflection: These prompts offer an opportunity for students to use the Gotta-Have-It Checklist to reflect on their Reading Under Covers Book with the purpose of supporting students in celebrating what evidence they have used so far and determining next steps for their writing. Refer to the Assessment Guidance at the beginning of the lesson.”

The coherent three-dimensional assessment system rationale is clearly described

- 4 1.1 Waves Light Assessment System Overview document provides a section titled “Unit Assessment Plan by Assessment Type” with a table that details the types of assessment opportunities that occur in the unit and the purpose of each assessment. The table provides links to the assessment tool and any related assessment documents for the teacher along with descriptions of the purpose of the assessment, lessons where specific assessments occur, and links to related assessment materials. The document also provides a section, “Lesson-by-Lesson Assessment Opportunities” that lists the assessment opportunities for the three-dimensional learning goals in each lesson and provides lesson assessment guidance, like that found in the Lesson Assessment Guidance section of each lesson’s Teacher Guide.
- The Lesson Assessment Guidance section in each lesson’s Teacher Guide provides the lesson’s three-dimensional learning goal, names the type of assessment(s) in the lesson, tells teachers “where to check for understanding” in specific lesson components, and provides some multimodal student responses or “look fors/listen fors” within the three-dimensions to support teachers in noticing how students are engaging in sensemaking. The “How can I use this assessment information?” section includes suggestions for providing feedback to students based on their progress with the lesson’s three-dimensional learning goal and suggestions for possible instructional next steps/adjustments to support students in working toward proficiency or in extending their learning.
- Each lesson Teacher Guide contains yellow assessment callout boxes within the sequence of instruction to signal to teachers that an assessment opportunity is coming up in the following component. The callouts specify the type of assessment (ongoing, embedded, formative opportunities or key formative assessment opportunities), the purpose, where to look for feedback guidance, and support with instructional decisions. (See III.B for evidence statements if needed)
- Two “Following Student Sensemaking Tools” are provided in the unit to support teachers in gathering evidence of students’ ongoing sensemaking aligned with the unit’s performance expectations. These are designed to help teachers look for evidence of three-dimensional sensemaking across a variety of modalities. Each provides a checklist of listen/look fors and a place for teachers to track notes of what students say, write, draw, gesture, or do for the three-dimensional learning goals in the selected lessons. A chart is provided giving possible evidence of student sensemaking based on what students might say and/or what students might gesture/manipulate. Examples of what students might write/draw in Lesson 2 and Lesson 6 are provided and followed with possible feedback.

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 multiple opportunities are provided for students to apply feedback related to targeted learning objectives from one assessment to improve performance in the next assessment. The opportunities to demonstrate their learning are iterative, with growth opportunities in between. The feedback loops are multi-modal and are explicitly described in the materials.

Multiple, interconnected opportunities over time

- The Navigate section at the beginning of Lessons 2, 3, 4, 5, 6, 7, 8, and 9 revisits student ideas and what they've figured out in the previous investigations or formative assessment opportunities as they recall and connect their ideas found in the class Notice and Wonder Chart and/or the class Our Growing Ideas chart. The Navigate section at the end of Lessons 1, 2, 3, 4, 5, 6, 7, and 8 help the students consider where to go next as they review their Growing Ideas chart and/or the Notice and Wonder chart. All of these provide multiple, interconnected opportunities over time for growth and clarification of ideas between lessons and assessments.

Assessment Statement 1: *Students can use observations to make an evidence-based account that objects in the dark can only be seen when illuminated by a light source.* (aligned to PE 1-PS4-2)

- Multiple opportunities exist for students to develop models. Students encounter the anchoring phenomena and create initial models about reading under covers in Lesson 1. In Lesson 5, students consider their initial model from Lesson 1 to consider what ideas they need to add to that model, either by adding to it or beginning a new model. Students are using the model to explain the same ideas, but now, they have additional experiences from Lessons 2-4 to support their understanding. In Lesson 8, students are using models to explain a different idea: how to make it easier to read under covers that block light. They review what they know about models and what features need to be included to be a good scientific model. They use their experiences from previous lessons to support the development of this model, and then students use these models as resources for their class book pages in Lesson 9.
- Students use a variety of ways to figure out they need light in order to see and use the information as evidence to construct explanations. Students obtain information about light from investigations, books, videos, an infographic, and a newspaper. They are introduced to vocabulary and learn to apply the new words in their writing, models, and classroom word wall. Students read books or parts of books in Lesson 1, Lesson 2, Lesson 3, Lesson 6, and Lesson 8. Students read an infographic in Lesson 4 and a newspaper article in Lesson 7. Students experience a video in Lesson 6. These opportunities are connected through the Disciplinary Core Ideas and support students in understanding that books or informational texts/ sources can confirm our investigations in the classroom. These experiences are also connected to the class book that students produce in Lesson 9 as they write to explain how to read under a cover of a specific type of material as a way to communicate their learning to others.
- In Lesson 1, the three-dimensional learning objective is 1a **Make first-hand observations of how well a book can be seen (effect) with different amounts of light available (cause)** under covers made of different materials.
 - Students are introduced to the anchoring phenomenon "What happens when we try to read under covers?" and they engage in a shared experience of reading under different cover materials. They create a class Notice and Wonder chart to record their observations and questions and then explain their ideas in an initial model about the differences when reading under the various cover materials.
 - Lesson 1, Explore Section, Step 3 "Pre-assessment: This discussion provides an opportunity to gather evidence about learning goal 1.A (aligned to Assessment Statement 1), with the purpose of determining any support students may need in upcoming lessons as they continue to **make observations to refine their explanations** about what **caused** it to be **easier or harder to read under different cover materials**. Accept all student ideas and refer to the Assessment Guidance at the beginning of the lesson."
- In Lesson 2, the three-dimensional learning objective is **Make firsthand observations about where light is coming from to construct an evidence-based account that objects that give off light (cause) make a space brighter (effect)**.

- Students go on a scavenger hunt to observe where light comes from. They also read a book about light sources in different communities and discuss how a light source can make a space brighter.
- Lesson 2, Explore Section, Step 2 “Formative assessment: Partner discussions and the Light Scavenger Hunt handout provide an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in **clarifying and communicating their ideas** about **where light comes from**. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. If students are not yet sure what objects light is coming from, ask them to compare an object they think light might be coming from to one they do not think light is coming from. Prompt, what is different between these objects? To start connecting to **cause and effect** ask students to consider what would happen if they brought that object to a dark room, or what would happen if the light was turned off. Students may name objects that reflect, rather than produce light (the moon, car/bike reflectors) as light sources. **Add these ideas and questions** to the Notice and Wonder chart to revisit in Lesson 7. In the Connect use information from the Light in Our Communities book to help clarify what objects are light sources and how they make light.
- Lesson 2, Synthesize Section, Step 5, “Formative assessment: The Building Understandings discussion is an opportunity to gather evidence about Learning Goal 2 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in **using their observations** to collaboratively **construct an evidence-based account** for **how objects that make light (cause) make spaces brighter (effect)** on Our Growing Ideas chart. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. Use the associated prompts and suggested follow-ups to support students in developing a claim that is supported by evidence from the Light Source Scavenger Hunt and the Light in Our Communities book. To support students’ use of evidence, provide the sentence starters, “We did _____ to figure that out” or “We know that because _____.”
- In Lesson 6, the three-dimensional learning objective is **Make observations** of an object in a pinhole box with and without a light source **to use as evidence to explain how an object in a dark pinhole box can be seen only when illuminated with a light source**.
 - Students observe an object illuminated by different amounts of light in a pinhole box. They connect the observations to a video and a book about children trying to see with little to no light and use evidence to explain whether we need light to see.
 - Lesson 6, Explore Section, Step 3, “Formative assessment: These individual and small group discussions while students **carry out their investigation**, provide opportunities to gather evidence about learning goal 6, with the purpose of providing feedback and supporting students in **clarifying and communicating their ideas** about **whether an object is visible without light**. Students should not be able to see the object with the pinhole covered, they should be able to see the object in some detail with the pinhole uncovered, and they should see the object most clearly when the inside of the box is illuminated using the flashlight. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking.”
 - Lesson 6, Connect Section, Step 6, “Formative assessment: The interactive read-aloud of the Light in the Dark book provides opportunities to gather evidence about learning goal 6 (aligned to Assessment Statement 1), to provide feedback and support students in **overcoming ideas that it is possible to see an object in total darkness**. Use the Following Students’ Sensemaking 1 tool to record evidence of students’ developing sensemaking. If students have ideas that their eyes adjust to the dark, use the suggestions in the discussion tables to support students in recognizing how light sources can be present when it seems “dark” and when our eyes adjust, it is to those light sources and not to darkness. If students need support in understanding how there can be light

sources when it is “dark,” turn off classroom lights and close the blinds. Have students conduct a new light source scavenger hunt to identify all the light sources still present that are allowing us to see. Also connect to any experiences students shared or want to share about light sources found from their Out-of-School Light Source Scavenger Hunt community connection.”

- In Lesson 8, the three-dimensional learning objective is **Use a model that represents** the relationship between light and seeing to explain how **illuminating a book in a dark space (cause)** makes the book **easier to see (effect)**.
 - Students put pieces together to answer the question, “How can we use a model to explain how to make it easier to read under covers that block light?” They use the Notice and Wonder chart and their Our Growing Ideas chart to recall what they have figured out about light sources and how we need light to see. They use a model to explain how to make it easier to read under covers that block light and make connections through a book and their own experiences about using light sources to see in dark places.
 - Lesson 8, Synthesize Section, Step 2, “Key formative assessment: Students’ Reading Under Covers Model student assessments and the surrounding discussion provide an opportunity to gather evidence about Learning Goal 8 (aligned to Assessment Statement 1), with the purpose of providing feedback to students and guiding instruction in upcoming lessons. Encourage students to use gestures, pointing, and spoken language in addition to any written words on the page to explain why they circled different **representations in the model** to **explain how to read under covers that block light**. Refer to the Following Students’ Sensemaking 1 tool and the Assessment Guidance at the beginning of the lesson.”
- In Lesson 9, the three-dimensional learning objective is **Construct an evidence-based account** of how a **book can be seen (effect)** under a cover that **allows all, some, or no light to pass through** only if **light is available to illuminate it (cause)**.
 - Students put pieces together to answer the unit question, “How can we explain how to read under covers when it is dark?” through the creation of a class book. They begin the work in Lesson 9 by creating a “Gotta-have-it checklist” and then writing their own explanations for one of the cover materials.
 - Lesson 9, Synthesize Section, Step 3, “Formative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in **using evidence to explain how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated...**”
 - Lesson 9, Synthesize Section, Step 3, “Formative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 9 (aligned to Assessment Statement 1) with the purpose of providing feedback and supporting students in **using evidence** to explain **how they are able to see/read a book because of light passing through or being moved under the cover so the space is illuminated**. Use the following suggestions to provide feedback and determine next steps before moving on to Lesson 10. Refer to the Gotta-Have-It Checklist and Our Growing Ideas chart to support students in incorporating more evidence into their explanations. Provide sentence starters or frames to help students clarify ideas: I can read/see the book because _____. The _____ is what causes me to see the book. _____ because _____. Allow for additional first hand opportunities to test ideas with investigation materials, including the covers, in order to provide concrete examples for students to write about.”
 - Lesson 9, Synthesize Section, Step 3, “Self-Reflection: These prompts offer an opportunity for students to use the Gotta-Have-It Checklist to reflect on their Reading Under Covers Book with the

purpose of supporting students in **celebrating what evidence** they have used so far and determining next steps for their writing. Refer to the Assessment Guidance at the beginning of the lesson.”

Assessment Statement 2: Students can **collaboratively plan and conduct an investigation to gather evidence that can be used to answer questions** about the **effect of placing different materials in the path of a beam of light**. (aligned to PE 1-PS4-3)

- Multiple opportunities exist for students to plan and carry out investigations designed to answer questions about light sources, how some materials interact with light, and how to use light in dark places. These investigations lead to opportunities for students to make sense of their own data, data from other groups, and their whole class. Students plan and conduct an investigation in Lesson 3, Lesson 4, and Lesson 7. They first plan an investigation as a class, then plan an investigation in a small group, and finally plan an investigation with a partner. These experiences spiral the ideas about how to use materials, such as how to hold materials, use the materials, and keep consistent with the distance materials are apart. Students also learn during the investigations ways to make observations and how to record those observations. In Lessons 3, 4, and 6, students make and record observations during investigations to collect data that can be used to make comparisons. Students also experience discrepancies in data as they make sense of their experiences and figure out that materials can be retested when they are not sure about ideas or results. The results of these investigations serve as evidence for the explanation they write about needing light to see on their book page in Lesson 9.
- In Lesson 1, the three-dimensional learning objective is 1b **Develop** an initial **model to represent** how covers made of **different materials cause** the space under the cover to appear **lighter or darker based on how much light passes through**.
 - Students are introduced to the anchoring phenomenon “What happens when we try to read under covers?” and they engage in a shared experience of reading under different cover materials. They create a class Notice and Wonder chart to record their observations and questions and then explain their ideas in an initial model about the differences when reading under the various cover materials.
 - Lesson 1, Synthesize Section, Step 5, “Pre-assessment: The Reading Under Covers Initial Model” handout provides an opportunity to gather evidence about learning goal 1.B (aligned to Assessment Statement 2), with the purpose of determining any supports students may need in **representing their developing ideas** about the **relationship between cover material and the amount of light under the cover**. Accept all student ideas and refer to the Assessment Guidance at the beginning of this lesson.”
- In Lesson 3, the three-dimensional learning objective is **Plan and conduct an investigation to gather evidence** about **the effect of placing different materials in the path of a beam of light**.
 - Students read about how scientists plan and carry out investigations and then work to collaboratively plan and carry out an investigation to test what happens when different materials are placed under light from the same light source. They share their data and consider additional data they need to answer their questions about light shining on materials.
 - Lesson 3, Explore Section, Step 3 “Formative assessment: In this discussion, look and listen for students’ sensemaking with the purpose of providing feedback and supporting students in **planning an investigation to gather evidence** about **the effect of shining light on different materials**. Look and listen for students suggesting ideas for how to use materials (putting the tray, parchment paper, and cardstock in the path of light (cause) and for how they will observe what happens to the light (effect). Use the Following Students’ Sensemaking 2 to record evidence of students’ developing sensemaking. If students need more support, revisit pages in the Scientists Plan and Carry Out Investigations book that connects to the part of the investigation the class is planning.”

- Lesson 3, Explore Section, Step 4, “Formative assessment: Individual and small group discussions and Light Lab Observations provide an opportunity to gather evidence about learning goal 3 (aligned to Assessment Statement 2), to support students in **carrying out their planned investigation**. Use suggested follow-ups to help students clarify and communicate their ideas about **the effect of placing each material in the path of light**. Use the Following Students’ Sensemaking 2 tool to record evidence of students’ developing sensemaking. If students are identifying a reason other than transparency/opacity (e.g., thickness or color) for what causes light to pass through, guide them in comparing examples that challenge their thinking (e.g. thin plastic lid and thin cardstock). If students are still unsure of how to carry out the investigation, invite the student/group to test the materials one at a time, breaking the investigation into smaller steps, and pausing to clarify directions. If students make observations about dark spaces or shadows, add these ideas and questions to the class Notice and Wonder chart to build upon in Lesson 4.”
- In Lesson 4, the three-dimensional learning objective is **Make observations to collect data that can be used to make comparisons of how much light** from a flashlight **passes through or is blocked (effect) by placing different materials in its path (cause)**.
 - Students revisit their investigation plan to decide how they can collect more data about the effects of placing materials in a beam of light. They test and sort materials based on what they observe happens with the light and then gather information from an infographic to determine which materials are transparent, translucent, or opaque.
 - Lesson 4, Explore Section, Step 2 “Formative assessment: Small group discussions during the Light Lab 2 Investigation is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in **using their data to compare how much light (effect) materials (cause) allow to pass through them**. Use the Following Students’ Sensemaking 2 to record evidence of students’ developing sensemaking. If students group materials by thickness, color, or attribute other than light seen on the Light Lab Circle, problematize their existing thinking by showing counter examples that could help students identify a gap in their thinking (e.g., Pointing out the thick acrylic disk in the group where we saw all the light, and the book of a similar thickness that is in the group where we saw none of the light) If students need support in comparing, provide a second flashlight and Light Lab Circle handout. Have the group test two different types of materials at the same time and ask students what is similar or different on the two Light Lab Circle handouts. If students have grouped all materials, encourage them to test items of choice from around the classroom to add to their data.”
 - Lesson 4, Explore Section, Step 3, “Formative assessment: This discussion of the Light Lab Floor Data chart is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in **using their data to compare how much light (effect) materials (cause) allow to pass through them**. Use the Following Students’ Sensemaking 2 to record evidence of students’ developing sensemaking. If groups placed materials in different places, use prompts like “Can you tell us more about what you noticed?” and “Why did your group place that material in that group?” to uncover their reasoning. Provide opportunities for students to retest and relocate materials throughout the discussion.”
 - Lesson 4, Connect Section, Step 4, “Formative assessment: Discussion of the infographic is an opportunity to gather evidence about Learning Goal 4 (aligned to Assessment Statement 2), with the purpose of providing feedback and supporting students in using information from the infographic to make sense of continued areas of uncertainty in **their data about light passing through (effect) different materials (cause)**. Use the Following Students’ Sensemaking 2 to record evidence of students’ developing sensemaking. Use the Types of Materials infographic as a visual aid for the different effects of shining light on materials as students retest Light Lab 2 materials.

Support students in comparing what they observe happening with a given material with the images on the infographic. Invite students to test items of choice from around the classroom to add to the class' shared data."

- In Lesson 5, the three-dimensional learning objective is **Develop a model to represent the amount of light different cover materials allow to pass through them causing** it to be brighter or dimmer in the space under the covers.
 - Students put pieces together to answer the question, "Why is it brighter or dimmer under different cover materials?" They review their first ideas about reading under covers using their Lesson 1 Initial Models. Students self-reflect about how to add or clarify ideas represented in their models using a checklist developed from Our Growing Ideas chart. Then students develop models that explain why it is brighter or dimmer under different cover materials.
 - Lesson 5, Synthesize Section, Step 2, "Self-reflection: Students' use of the My Growing Ideas Checklist to review **their own models**, provides an opportunity for self-reflection, with the purpose of supporting students in evaluating and improving the accuracy and completeness of their models (in explaining **why** it was **brighter or dimmer under the three cover materials**). Remind students that they have the opportunity to use the class's updated Our Growing Ideas chart to support their thinking on how to complete their models in the next Synthesize step. Also, refer to the Assessment Guidance at the beginning of the lesson."
 - Lesson 5, Synthesize Section, Step 3, "Key formative assessment: Students' Brighter and Dimmer Model and the surrounding discussions provide an opportunity to gather evidence about Assessment Statement 2, with the purpose of supporting students in using their My Growing Ideas Checklist to **develop a model** that represents **the relationship between the cover material and the amount of light passing through** to **explain why it was brighter or dimmer under the different cover materials**. Be sure to prompt for and notice how students use spoken words in any language, actions, and/or gestures to explain ideas that might not be captured in their writing/drawing alone. Have a copy of the Developing Models Supports tool available for guidance on providing specific feedback. Refer to the Lesson 5 Instructional Guidance and Assessment Guidance at the beginning of the lesson to determine next steps."
- In Lesson 7, the three-dimensional learning objective is **Plan and conduct investigations collaboratively to gather evidence to support that mirrors can be used to redirect a beam of light** to places that are dark.
 - Students plan and carry out an investigation of what happens when light shines on a reflective surface. They read a newspaper article about using reflective materials when it is dark and add new experiences and ideas about reflective materials to their Our Growing Ideas chart.
 - Lesson 7, Explore Section, Step 3, Assessment Opportunity Callout: "Summative assessment: Pair conversations and their Light to Dark Investigation handout provides an opportunity to gather evidence about learning goal 7 (aligned to Assessment Statement 2), with the purpose of summatively assessing **students' collaborative use of planning and carrying out investigations**. Students should be using this practice to **gather data** that **can be used as evidence** to answer questions about how **some materials can redirect light** and therefore make it light where it is dark. Use the discussion prompts and guidance below during this assessment moment: If you notice students are testing materials in a way that does not support data collection to answer the lesson question (e.g., holding the flashlight away from the mirror or holding the materials the same way students did in Lesson 3 and 4), encourage the use of guided simple tests. "I hear you saying you have not noticed the light on the circle yet. Let's try a different test by moving the mirror/foil or the flashlight." Encourage students to describe the effect the mirror has on the beam of light in their own words (bounce, go another way, change direction, reflect). Support them in connecting these words to the scientific word reflected in the Connect component. If students have gathered data

about how to use the materials to shine a light on the circle, challenge them to find other reflective materials in the classroom or use the mirror/foil to illuminate different areas of the classroom.”

- In Lesson 10, the three-dimensional learning objective is **Communicate an evidence-based account** of how a **book can be seen (effect)** under a cover that **allows all, some, or no light to pass through** only if **light is available to illuminate it (cause)**.
 - Students put unit pieces together to answer the question, “How can we use our class book to communicate about our reading under covers to members of our community?” They select specific text features to organize their individual pages into a class book and collaboratively assemble the book. They communicate their ideas to a selected audience by sharing/presenting their class book. Finally, they wrap up the unit by coming to consensus to answer the unit question.
 - Lesson 10, Synthesize Section, Step 3, Assessment Opportunity Callout, “Summative assessment: Student’s individual explanation on Reading Under Covers Book is an opportunity to gather evidence about Learning Goal 10 (aligned to Assessment Statement 2) with the purpose of summatively assessing **students explanation** for **how they are able to see/read a book (effect) because of light passing through or being moved to under the cover so the space is illuminated (cause)**. Refer to the Class Book Scoring Guidance tool and the Assessment Guidance at the beginning of the lesson to support students who are still completing their written explanation in this lesson.”

Multi-modal feedback loops

Feedback from the teacher is delivered during class discussions or in small group interactions. During discussions, teacher feedback includes using student language and gestures on charts that are recorded for the class to use and revoicing student ideas as a way to position students as scientists. This gesture/action is feedback to students that their ideas are welcome and valuable. Examples include:

- Lesson 1, Explore Section, Step 3, Broadening Access Callout: “When recording students’ ideas in the Notice and Wonder chart, it is important that students have their ideas recorded in alignment with the ways they shared them (e.g., using their own words, capturing gestures they might have used, etc.). Doing so not only helps students understand what is recorded in the chart, but also sends the message that their language resources and practices are valuable for the classroom community’s sensemaking work. This is an important message for all students to receive, and especially for those whose language resources are not always valued in school spaces, such as multilingual students.” (Lesson 1, Teacher Guide)
- Lesson 2, Navigate Section, Step 1, Broadening Access Callout: “It is valuable to use students’ ideas and language as you co-construct the lesson question with your students. It offers an opportunity for students to make connections between the work they have done in previous lessons and the work they will be doing during this lesson. It also allows them to see that their words and language are welcome and useful in science.”(Lesson 2, Teacher Guide)
- Lesson 10, Connect Section, Step 4 “Share our book with school/community. Then, have students present their individual pages while encouraging them to either present in their home languages and/or provide any examples, community knowledge, and/or stories that are relevant to their audience for when they need to read in the dark. This can strengthen students’ science identities as their histories and ways of knowing are valued and relevant in their individual pages.” (Lesson 10, Teacher Guide)

Feedback from the teacher is verbally delivered through class discussion or small group interactions. Multiple opportunities are provided throughout the unit for students to demonstrate progress with the Crosscutting Concept of Cause and Effect. Discussion frames in lessons provided teachers with support for prompts to use, ideas to look/listen for, and follow-up responses. The teacher often supported the students in thinking about the cause and effect relationship and used specific prompts to foster this opportunity. Examples include:

- Lesson 1, Synthesize Section, Step 5 “Develop an initial model. What does this _____ in your model show? Can you point to which drawing shows the _____ cover? Can you point to which drawing shows the cover that was lightest/darkest? What about the one that was easiest/hardest? Can you tell me more about why you used _____ color here? What other words or pictures could you add to explain that idea? Are there other reasons that could have happened?” (Lesson 1, Teacher Guide)
- Lesson 3, Explore Section, Step 4, Cause and Effect Callout: “In Lesson 2 students performed simple tests as a class to gather evidence to support or refute ideas about light sources making a space brighter. Support students in building on that use by encouraging them to retest their Light Lab 1 materials as needed in their small group to notice the effect each material has on the beam of light. Students will continue to develop their use of this Crosscutting Concept in Lesson 4 as they test and sort materials by the effect of placing them in the path of a flashlight beam in order to gather more evidence. What happened when you shined the flashlight on the plastic lid? What happened when you shined the flashlight on the parchment paper? What happened when you shined the flashlight on the cardstock? What do you think caused _____ to happen?” (Lesson 3, Teacher Guide)
- Lesson 7, Explore Section, Step 3, Cause and Effect Callout: “Students previously performed simple tests to gather evidence about what caused different amounts of light to appear beyond different materials. They build on that here in developing their investigation plan by using simple tests to gather evidence about what causes light to redirect into a certain place when shined on mirrors and foil. They will also progress in their use of this crosscutting concept while testing ideas about causes in the context of engineering in OpenSciEd Unit 1.2: How do objects make and use sound to communicate? (Sound Signals Unit). What happens when you shine the flashlight on the foil/mirror? What do you think is causing the light to go onto the paper circle? A cause explains why something happens. What causes the light to reach the paper circle? How does the flashlight beam get to the paper circle on the wall? What evidence do you have for your idea? An effect explains what happened. So, if we have a beam of light and we put foil or a mirror in its path, what will the effect be?” (Lesson 7, Teacher Guide)

Feedback from the teacher is delivered through class discussions, small group discussions, and 1:1 interactions that emphasize acceptance of diverse ideas/explanations and acceptance of revisions for students’ thinking.

Examples include:

- Lesson 3, Navigate Section, Step 6 “Revisit our Notice and Wonder chart. Revisit our wonders. Take 1-2 minutes to read aloud any wonders (refer to slide H) that could have been answered by the investigation and work as a class to add a check or some other annotation to indicate if they have been answered. Then briefly remind students of any questions, wonderings, or areas of disagreement that may have emerged while carrying out the investigation with the three materials.” (Lesson 3, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3 “Develop a model. Engage in one-on-one discussions while students develop models. As students are developing their models, check in with individual students using the prompts below. Since student responses will vary, you should adjust the examples as needed to match the components students included in their actual models and the evidence and strategies specifically added to your class’ Our Growing Ideas chart.” (Lesson 5, Teacher Guide)
- Lesson 6, Synthesize Section, Step 7, Community Connections Callout: “Consider connecting to the classroom agreement “We look, listen, and respond to each other’s ideas” to support students in their work respectfully agreeing and disagreeing with one another’s ideas using evidence to decide on a class claim to add to Our Growing Ideas chart.” (Lesson 6, Teacher Guide)

Feedback from peers is developed over the unit through ‘Think-Pair-Shares’ and different opportunities for students to share ideas. Examples include:

- Lesson 5, Navigate Section, Step 1 “Recall where we left off. Turn and talk to compare our initial models. Provide each student with their completed Reading Under Covers Initial Model handout from Lesson 1. For each of the prompts below, have students turn and talk and then come back together as a class and have 1-2 pairs to share after each of the discussion prompts below.” (Lesson 5, Teacher Guide)
- Lesson 5, Synthesize Section, Step 3 “Develop a model. Use models to explain. Have students turn and talk with a neighbor about how they answered the question Why is it brighter or dimmer under different cover materials? using their model and/or written explanation. Use the prompts below to support their partner discussions. Show and tell your partner about your model that explains why it was brighter or dimmer under the different cover materials. What is one thing that is the same about your explanation? What is one thing different you notice about your explanation?” (Lesson 5, Teacher Guide)
- Lessons 9 and 10 are designed as summative assessments. Students have the opportunity to respond to feedback when they write an explanation of something they learned in the unit for their selected audience, community members who need to do things when it is dark.
 - Students receive peer feedback in Lesson 9, Synthesize Section, Step 3 “Write to explain Reconfigure to partners. Have students reconfigure so they are sitting with a partner writing about the same cover material. Think, pair, share to plan writing. Give partners 1-2 minutes to quietly think about what details from the Gotta-Have-It Checklist they want to include in their writing. Then give partners about 5 minutes to tell their partner what they plan to write to help them organize their ideas before putting them onto paper.” After the Think, Pair, Share, students write and draw their pages individually. Then they self-reflect on their explanations: “Once students have had about 10 minutes to write, display slide E and the Gotta-Have-It Checklist. Explain to students that we will be pausing to use the Gotta-Have-It Checklist to reflect on the progress we made today. For each item on the checklist, ask students to give a thumbs up if they have done that item and a hand-up if they are still working on it or have things they would like to add or change. Explain that this is a way to help us figure out what we still need to work on for the rest of our writing time today. Turn and talk about ideas for next steps. Once students have reflected on their progress, have them briefly turn and talk with a partner about what they will work on next to finish their explanation for the class book. Have a few students share with the class. Continue writing to explain. Provide students with the remaining time to follow through with the next steps in their writing.” (Lesson 9, 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

<p>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.</p>	<p>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)</p> <p>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)</p> <p>R: Revision needed—Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3-5)</p> <p>N: Not ready to review—Not designed for the NGSS; does not meet criteria (total 0-2)</p>	Overall rating below:
		E