How Does Light Help Me See Things and Communicate with Others?
EQuIP Rubric for Science Evaluation

Developer/Curriculum: Next Generation Science Storylines
Unit Name: How Does Light help Me See Things and Communicate with Others?
Grade: 1
Date of Review: November 2019
Overall Rating (N, R, E/I, E): R
Category I: NGSS 3D Design Score (0, 1, 2, 3): 2
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 1
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score (0–9): 5
Click here to see scoring guidelines

This review was conducted by the Achieve Peer Review Panel using the EQuIP Rubric for Science.

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

Summary Comments

Thank you for your commitment to students and their science education. Achieve is glad to partner with you in this continuous improvement process. It is obvious that this unit was thoughtfully crafted. It is strong in several areas, including that the unit is engaging for students and has many opportunities for student collaboration. Students engage in multi-modal learning opportunities that create multiple experiences for students to develop their understandings of processes and ideas. There are instructional routines within the unit that support teachers and students to develop expectations and a variety of ways to do science. This unit positions students to be problem solvers and to note that scientific observations can and should be made about the world around them.

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During revisions, the reviewers recommend paying close attention to providing guidance to teachers for assessments, including sharing the rationale and specific learning targets directly connected with each assessment, and creating differentiation strategies for special populations of learners. The reviewers also note that this unit would benefit from some overall editing for clarification purposes.

Note that in the feedback below, black text is used for either neutral comments or evidence the criterion was met and purple text is used as evidence that the criterion was not met.

Category I. NGSS 3D Design

Score: 2

3: *At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C*
2: *At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C*
1: *Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C*
0: *Inadequate (or no) evidence to meet any criteria in Category I (A–F)*

I.A. Explaining Phenomena/Designing Solutions: Making sense of phenomena and/or designing solutions to a problem drive student learning.

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

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

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

Rating for Criterion I.A Explaining Phenomena/Designing Solutions: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that learning is driven by students making sense of phenomena and designing solutions to a problem because each lesson connects to the phenomena of light illuminating objects. Students continue to revisit the anchor phenomenon multiple times over the course of the unit. Students initially learn about light being necessary to see objects to develop further understandings about how to control light allowed in specific places and use that understanding to design solutions to a problem they identify.

The bulleted evidence below supports the adequate rating for this criterion because it includes examples of opportunities and support for students making sense of the phenomena:

- The unit begins with students experiencing the phenomenon that it's harder to see things when the lights are off. This leads to the question about whether we can see things without light, which drives the student learning in Lesson Set 1.

- Lesson 2 revolves around the phenomenon of shadows and is motivated by students' learning from Lesson Set 1. Student learning is directed at making sense of what kinds of materials make shadows.
- Lesson 3 focuses on the idea that people use light to communicate with each other, which resulted from students' observations during Lesson 2. Student problem solving is focused on designing a communication device that uses light to reduce noise in a certain place. Further, the science content knowledge that students learned in the previous lesson sets is necessary for them to design a solution.
- The phenomena and design problem are connected to each other in a logical way.
- An experience that helps students understand that it is difficult (if not impossible) to see when there is no light is in Lesson 4 with the video, "Lights Turning Off in Eagle Cave." Although students are not in a cave, they are able to make observations of the difference between when there are lights and when there is no light from the video.
- The T-chart on page 3 of the Teacher Guide, the Deck of Images, investigation of different materials, and Consensus Building Discussion in Lesson 5 provide sense-making opportunities for students. They figure out that light can be blocked to varying degrees (controlling shadows) and begin to understand applications for blocking light.
- Lesson 7 provides students with examples of the ways light can be used to communicate and Lesson 8 provides an opportunity to identify a problem that could be solved by using light as a communication tool. These lessons provide an engineering focus that is integrated with the disciplinary core ideas from PS4.B and PS4.C.

Suggestions for Improvement

The lesson sets seem largely independent of each other such that they are connected in a logical way but don't necessarily build on each other to support students as they make sense of the phenomena and design solutions to the problem. Consider how to make the lesson sets build upon each other or how to more clearly connect the experiences in Lesson Sets 2 and 3 back to the initial phenomenon.

I.B. Three Dimensions: 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.

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

Rating for Criterion I.B. Three Dimensions: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials give students opportunities to build understanding of grade-appropriate elements of the three dimensions because there is a reasonable match between the dimensions (elements) that are claimed and the evidence within the unit and sufficient elements of the dimensions met for the amount of time for the unit implementation. There are times when students are using the elements in service of figuring out the phenomena and some are being developed through the experiences of students in this unit.

In this unit, there are sufficient SEP, CCC, and DCI elements and a reasonable match between the elements claimed and those developed and used in the materials. Examples of evidence demonstrating how this criterion is focused on grade level-appropriate student use and development of each of the three dimensions are described below.

Science and Engineering Practices (SEPs): Extensive

The reviewers found extensive evidence that students have the opportunity to use or develop the SEPs in this unit because students are engaged in grade-level SEP elements as described in the descriptions of the targeted elements below. There are sufficient SEP elements for the length of the unit and there is a good match between the SEP elements that are claimed and the evidence for those SEP elements.

- Lesson 1 - *Carry out an investigation to make observations, and/or measurements to collect data that can be used to make comparisons.* Student Activity Sheet 2 in this lesson and the Building Understandings Discussion provides the opportunity for students to compare how many students could see the shapes and how many students could not see the shapes.
- *Make predictions based on prior experiences* - Lesson 1: Teacher Guide page 9 step 4. Teachers are asked to get initial ideas from students about why students were not able to see all the shapes at each station. The anticipated student responses reflect prior experiences, even if that was the investigation that just happened. On page 10 of the Teacher Guide for Lesson 1 step 6, students also generate initial explanations that also rely on prior experiences of being in dark places. Lesson 3 Teacher's Guide page 10: "Use these discoveries to make predictions about other places." The materials list this as **Constructing Explanations**, however, in Lesson 1 this appears to be a prediction. The **Constructing Explanations** SEP element may be claimed in Lesson 3 from page 10 of the Teacher's Guide when students respond to the two questions, "What did you discover about what you could see in the box when both the "window" and "door" were closed?" and "What does this tell you about light and what we can or can't see?"
- **Analyzing and Interpreting Data** - this unit has examples of the following elements: *Record information (observations, thoughts, and ideas).* Lesson 1, Lesson 7; *Use observations to describe patterns and/or relationships in the natural and designed world in order to answer scientific questions and solve problems.* Lesson 4, Lesson 8; *Compare predictions (based on prior experiences) to what occurred (observable events).* Lesson 2, Lesson 3, Lesson 6
- **Using Mathematics and Computational Thinking** - *Use counting and numbers to identify and describe patterns in the natural and designed world.* Student activity sheet part C in Lesson 1

provides students with the opportunity to use numbers to identify that more students could not see shapes in darker areas of the room and more students could see shapes in more lighted spaced in the room. Teacher' Guide, page 8 Step 3.

- **Engaging in Argument from Evidence** - *Construct an argument with evidence to support a claim.* Lesson 4 - Students arrived with evidence from home about the question, "Can we see anything when there is no light?" The final sentence at the bottom of Teacher Guide page 4 reads, "Most students will now have moved to the claim that they cannot see when there is no light." That claim is revisited on page 9 of the Teacher's Guide at step 6. Assessment 1 from this lesson and the student activity sheet would be opportunities for students to construct an argument.

Disciplinary Core Ideas (DCIs): Adequate

The reviewers found adequate evidence that students have the opportunity to use or develop the DCIs in this unit because students are engaged in grade level-appropriate DCIs as described in the elements of the targeted DCIs. There are sufficient DCIs for the length of the unit and there is a good match between the DCI elements that are claimed and the evidence that those DCI elements are fully and/or partially developed. There are multiple opportunities to develop the targeted DCI elements and students begin to use those DCI elements to define a problem and design a solution to the problem.

Evidence related to this criterion includes:

- **PS4.B** (first bullet) - *Objects can be seen only when light is available to illuminate them. Some objects give off their own light.* This DCI is labeled "Building Toward" in all lessons. The first part of the description is met with Lessons 1, 3, and 4. Students make observations about the second statement in Lesson 1 (student activity sheet 2), Lesson 2 step 4 (flashlight), Lesson 3 home sheet connection, Lesson 5 Teacher Guide page 7 step 3, and Lesson 7 - during the light and shadow hunt, which is the only place the idea is specifically discussed and observations recorded.
- **PS4.B** (second bullet) - *Some materials allow light to pass through them, others allow only some light through, and still others block all the light on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.* This DCI is labeled "Building Toward" in all lessons. There is evidence for this DCI in Lesson 2 student activity sheet and the Building Understanding Discussion, Lesson 3 day 2 part 3b and Building Understanding Discussion, Lesson 4 assessment #2, Lesson 5 right side of T-chart, deck of projected images, step 6, Lesson 6 step 2 and 3. Lesson 10 step 2 supports that mirrors can be used to redirect a light beam.
- **PS4.C** - *People also use a variety of devices to communicate over long distances.* Lesson 7 light hunt and questions in step 7 should provide evidence to students about using a device with light to communicate. This is also used in Lesson 8 step 1 during the discussion prompts and anticipated student responses about communicating down a hallway or across a room. In Lesson 10, the step 1 discussion prompt asks students to consider communicating around a corner without making a sound, Teacher Guide page 7 (New Design Problem).

Crosscutting Concepts (CCCs): Adequate

The reviewers found adequate evidence that students have the opportunity to use or develop CCC elements in this unit because there are sufficient crosscutting concepts supported throughout the unit as compared to its length. There is a reasonable match between the crosscutting concept elements that are claimed and the ones for which there is supporting evidence of student use.

The listed element descriptions and evidence for the crosscutting concept element use below are opportunities for students to use those concepts to support understanding:

- **Patterns:** *Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.*
    - Lesson 1 – In the Teacher Guide page 6, there are questions about what patterns students notices on the Shape Signs. However, that the sheets have stars or triangles is not a pattern to be used as evidence or at that point in the investigation to be used to describe phenomena.
    - Day 2 part 1b refers students to the patterns from the data of class observations, Teacher Guide page 9 step 5.
    - Part C of the student activity sheet develops a pattern with how many shapes students could see. Students should be able to use the tally to see a pattern that more students did not see the number of shapes that were actually on the sheet with the lights off. This is evidence of students using patterns as evidence and could be used to describe the phenomena in the discussion page 9 of Teacher's Guide.
    - Lesson 2 identifies Patterns when students analyze class results of the materials they categorized, but there is no guidance of what pattern would emerge other than relying on the definitions for opaque (blocks light), transparent (all light passes through), and translucent (some light passes through). There is no pattern to observe based on the material itself that would help with predicting the category before testing it, i.e., the paper is light or heavy, or the paper is a lighter color than another.
    - The Building Understandings Discussion does not mention patterns, Teacher Guide page 12. This activity with students may be an opportunity for students to use an element of the SEP **Analyzing and Interpreting Data** (several of the element descriptions are met with this activity).
    - Patterns is listed for Lesson 3 as students notice that their smaller scale classroom (the shoebox) allows light to enter in the same places as the classroom (windows and doors). This activity also may be an opportunity for students to use an element of the SEP **Developing and Using Models**.
    - Lesson 6 is an opportunity for students to observe patterns in the classification of materials and the kind of shadow it makes. These patterns are used later as evidence for the decisions made in their design work.
    - Step 4 of Lesson 6 is explicit about observing those patterns and using them to describe the phenomena.

- **Scale, Proportion, and Quantity:** *Relative scales allow objects and events to be compared and described.*
    - Lesson 2 Teacher's Guide page 13 step 8 there is a discussion of smaller scale models. Students are provided examples of bigger and small-scale items that are used to represent real-life objects. This idea is supported again in Lesson 3 Day 1 part 3a, Teacher's Guide page 5, in steps 1, 2, and 4.
- **Cause and Effect:**
    - *Events have causes that generate observable patterns*: In Lesson 1, students observe the shape sheets around the room with the lights off and then share their findings. Students discover the effect of low light on the ability to see the shapes. The observable pattern occurs when students notice the tallies of students who could see the same number of stars or triangles as was on the sheet.
    - *Simple tests can be designed to gather evidence to support or refute student ideas about causes.* This element is listed for Lesson 4 and it could be part of the explanation students use on the assessment. The concept of not seeing (effect) in a space with no light (cause) is support for students in Lesson 3 with the simple test of the shoebox when students can see if there is even a small amount of light and when they can't see when there is no light.
- **Structure and Function:** *The shape and stability of structures of natural and designed objects are related to their function(s).*
    - This element is listed in Lesson 1 end of day 2 and beginning of day 3, but there is no observable evidence of this element.

Suggestions for Improvement

SEPs:

- There is evidence for the SEP elements that are claimed somewhere within the unit. However, there are times that an SEP is claimed in one lesson and students do not use an element of that SEP in that lesson, but do use that element in another part of the unit. The reviewers suggest that the developers adjust the descriptions accordingly to more closely align with where students use the SEP elements. Additionally, the reviewers suggest that the developers consider making explicit mention of element(s) of **Developing and Using Models** in Lesson 3.
- Consider adding a table within the Front Matter for SEPs, similar to those on page 5 for DCIs and CCCs, to map out when students engage in different SEP elements throughout the unit.

DCIs:

- The evidence for the listed DCIs could be marked extensive if more explicit connections were made to develop PS4.B *Some objects give off their own light*. Students have opportunities within the unit to understand that idea; for example, any time students are attempting to make a shadow or block light, questions about what is making the light and where the light comes from could be part of the Building Understanding Discussions. However, it is only made explicit once in the unit and may only be partially developed for students' understanding. Additionally, the phenomenon

driving Lesson Set 2 is shadows, but the relevant DCI is not addressed in Lesson 7 (and the authors do not claim it is addressed). Consider moving Lesson 7 into Lesson Set 3 because it sets the stage for the design problem.

CCCs:

- There are times when a CCC element is claimed but only the CCC category (e.g., "Cause and Effect") is used. Also, some CCC elements are claimed in the unit and may not be in the lesson where they are listed, but are used in other lessons. The reviewers suggest adjusting the descriptions to address these concerns. In Lesson 1, the materials claim students will use the crosscutting concept of Structure and Function on Lesson 1 -Student Activity Sheet 2. While students might use an element of this CCC for this task, the reviewers suggest that the authors consider ways to make it more explicit so that it is more likely that students will use this element. For example, consider providing prompts such as, "You suggested covering the windows with curtains. What makes curtains a good choice for blocking out light?"

Overall:

- The "Alignment With Standards" section is missing in Lessons 10 and 11. The reviewers suggest adding this section in these lessons, as it's helpful to the reader.

I.C. Integrating the Three Dimensions: Student sense-making of phenomena and/or designing of solutions requires student performances that integrate elements of the SEPs, CCCs, and DCIs.

Rating for Criterion I.C. Integrating the Three Dimensions: Extensive

(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that student performances integrate elements of the three dimensions in service of figuring out phenomena or designing solutions to problems because students are using and developing grade-appropriate elements of each of the three dimensions to make sense of the phenomena. Students actively use elements of the dimensions to participate in discourse and produce artifacts that support understanding.

The bullets below describe evidence to support the extensive integration of the three dimensions in many lessons in this unit. The SEPs and CCCs support the investigation and understanding of the DCIs in explicit student performances. There is some time spent developing the understanding of the CCC and SEP elements from prior experiences within the lesson, and students use them to construct meaning, investigate, and support progression in understanding scientific ideas.

- Student Activity Sheet 1 part B supports developing understanding of DCI PS4.B. As students make sense of that for themselves and then combine it with the experience of other students in part C and during the discussions in Lesson 1 steps 2–4, a pattern emerges of students not seeing as many shapes in the places in the classroom with less light. This investigation also allows students to engage with an element of the SEP **Planning and Carrying Out Investigations** as they collect their data to make comparisons.
- Lesson 3 allows students opportunities to engage in an element of the crosscutting concept of Scale, Proportion, and Quantity (*Relative scales allow objects and events to be compared and described*) in understanding how their model classroom relates to the actual classroom. Students engage in elements of the SEPs of **Developing and Using Models** and **Planning and Carrying Out Investigations** when they make their observations and compare what they can see with and without any light, which supports understanding of an element of the DCI PS4.B.
- Students **analyze and interpret data** from their investigation to describe patterns in the relationships to answer scientific questions and solve problems. The data they analyze is collected on their Student Activity Sheet 1 and Student Activity Sheet 2. Students are using their own observations and making/checking predictions about materials that make shadows by blocking all or some light. The elements of the SEP and CCC provide support for student sense-making about the second element of PS4.B.

Suggestions for Improvement

The reviewers suggest considering ways to improve integration of the three-dimensions in Lessons 4 and 7.

I.D. Unit Coherence: 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.

Rating for Criterion I.D. Unit Coherence: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that lessons fit together coherently to target a set of performance expectations because student expectations are developed within each lesson and unanswered questions are brought forward to future lessons. Students answer questions by connecting evidence garnered from investigations and there is some cultivation of new questions that arise from related phenomena.

Students reconsider the phenomena more than once throughout the unit and consider the evidence they have gathered to explain them.

Lessons within the unit build upon each other based on student questions and progress towards explaining the phenomena. The bullets listed below describe how coherence is evidenced in the science ideas and concepts students explore throughout the unit:

- There is progress from each lesson as noted on the first page of each Teacher Guide. The Guide shows how each lesson fits with previous and next lessons in addition to what students figure out articulated in the bottom right corner. Students begin each investigation with questions that were previously developed. In the beginning of the unit, all students' ideas were honored and considered by the whole class. For example, in Lesson 1, students' ideas about the question, "Can we see anything when there is no light in a place, like a room?" are posted on the board. Step 7 acknowledges the disagreement of predictions, moving students to the next investigation. As the students develop more understanding in Lesson 3, they are positioned to argue and explain why they are not able to see anything inside their box when no light is allowed in, which becomes evidence and provides opportunities to develop understandings about cause and effect relationships. This is an opportunity for students to go back to their initial phenomena experiences through the use of a model and attempt an explanation, which may or may not demonstrate an understanding of the DCI. This is a strong example of unit coherence.
- Lesson 6 asks every student to figure out and record the relationship of the material to the kind of shadow it makes. They use their observations to make predictions for other materials. Lesson 7 provides all students with an opportunity to figure out how light can be used for communication during the light and shadow hunt and in the Building Understandings Discussion. Each student is provided a student activity sheet to record what they saw, what they noticed about it, and what they wondered about it. The movie provides additional examples or reinforces examples that may have been observed. Lesson 8 expects all students to create a plan to design a device to communicate a message. All students are routinely expected to figure something out by making observations and communicating their understandings. This is a strong example of unit coherence.

  Students' discussions and questions are brought from one lesson to another. There are examples of questions and ideas from previous lessons moving the unit forward in Lessons 2, 4, 6, 8, 9, and 10. However, there are examples in the lessons where the teacher directs the questions more than students' ideas do.

Suggestions for Improvement

- Consider ways to adjust the Lesson Sets so that one more clearly drives the next.
- Consider ways to adjust Lessons 9 and 10 so there is a clear need to bring in mirrors to communicate around a corner.

- Consider providing more opportunities for students to develop the question(s) that each lesson targets. This is an interesting unit for students, and they have lots of previous experiences with light, darkness, and shadows. Students may be able to develop the questions to investigate if they were given the stimulus to do so. The practice of asking questions takes time to develop and students may need guidance, so the teachers could provide question suggestions, but could be advised to use them only if students don't arrive at their own similar questions.
    - For example, Lesson 7 suggests the prompt "What could we do to figure out other ways that light and shadow are used in our world?" By observing some of the signs that are in the movie for lesson 7, students may be able to say that light can tell you something, like to stop (red light). The teacher would be able to show them a flashlight that blinks or has multiple colors. Students would wonder why the flashlight is able to do that. Further questioning could be about other messages lights communicate. Students would know some and through their light hunt and the movie, may learn about more.

I.E. Multiple Science Domains: When appropriate, links are made across the science domains of life science, physical science and Earth and space science.

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

Rating for Criterion I.E. Multiple Science Domains: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the phenomena driving the lesson can be fully addressed within the one domain on which the unit is focused. Students are able to make sense of the phenomena using multiple experiences from the lessons within the physical science domain.

There is evidence that the materials sufficiently address the learning through the use of a single science domain while incorporating the engineering:

- Students begin in Lesson 1 with a shape hunt. Students may have ideas at this point in the unit that it is difficult to see without much light. Lesson 3 provides a model for students to use to control the light entering the shoebox and may be where students determine some light is needed to see something. By Lesson 4 with the cave video, students have more convincing experiences that they can see nothing without some light. These lessons provide students the opportunities to make sense of the phenomena and address the element description of the K-2 grade band for PS4.B.
- Lesson 2 and Lesson 8 provide students experiences with controlling the amount of light entering a room or passing through some material and reinforces the idea that it is very difficult to see

without light. These lessons provide students opportunities to make sense of the phenomena and support understanding the element description for PS4.B.

Suggestions for Improvement

- Consider ways to modify the student performances in Lesson Set 3 so that students have to clearly articulate how they are using what they know (PS DCIs) to inform their designs (ETS DCIs).

- Depending on unit sequencing, some students may arrive with information about LS1.A which may be connected to the physical science elements addressed in this unit.

I.F. Math and ELA: 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.

Rating for Criterion I.F. Math and ELA: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials provide grade-appropriate connections to mathematics, English language arts (ELA), history, social studies, or technical standards because students use grade-level mathematics and ELA-Literacy skills to investigate and explain their understanding of the phenomena. Students have opportunities for verbal discourse with various partners, small group, and whole class. The materials make explicit connections to the ELA-Literacy and mathematics standards in the guidance to teachers.

Listed below are specific examples of instances when grade-appropriate, cross-curricular connections were mentioned within the unit. However, the student tasks did not strongly align to the cited standards.

- Lesson 1 lists four mathematics content standards. The reviewers found evidence for partial connections to 1.MD.C.4 in that students are answering questions about the total number of data points, and how many in each category, and how many more or less are in one category than in another. The lesson has the teacher organizing and representing the data. The teacher also appears to be asking the questions about the data. In the additional guidance in the Teacher's Guide page 8, students could add up the results to compare to the number of students in the class. If that guidance is used, it is evidence supporting the connection to 1.OA.C.6.
- The reviewers found no evidence to support 1.G.A.2 - students discuss the shape and identify it as a rectangular prism. The standards states: *Compose three-dimensional shapes to create a composite shape, and compose new shapes from the composite shape.*
- Lesson 3 states it connects to 1.G.A.2 - *Compose three-dimensional shapes to create a composite shape, and compose new shapes from the composite shape.* The reviewers found evidence that

students discuss the shape of the box to represent their classroom in step 2, but this evidence is insufficient to claim the geometry standard is introduced, taught, practiced, or used.

- ELA-Literacy standards claimed in lessons include 1.SL1.1a–c, 1.SL1.4. Lessons 1–7 Building Understanding Discussion and Sharing Designs in Lesson 8 and 9 are evidence of students using 1.SL.1.1a–c and 1.SL1.4. The reviewers are uncertain about 1.SL1.1a as no mention of the agreed upon rules for discussions was included, although they may be implied by the way the teacher facilitates the discussions.
- Lesson 4 has evidence for 1.W.8 - *With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question*. Students complete Assessment #1 and Assessment #2, which is evidence of that writing standard, though it is not listed.

Suggestions for Improvement

- Consider including opportunities for students to use mathematics and ELA-Literacy standards in those lessons where they are currently lacking, as this section is a strength of the unit overall.
- Students who struggle to build on others' talk in conversations (1.SL1.1b) may be supported by using sentence stems; the reviewers suggest incorporating some of these supports. The Building Understanding Discussions may also be evidence for including 1.SL.1.3.
- The reviewers suggest listing ELA-Literacy standard 1.W.2 in Lesson 4 because students engage in argument from evidence.
- The reviewers suggest including a sheet on which students can organize classroom data and respond to questions about that data. Having discussions about the data supports students' ability to analyze data.

Overall Category I Score (0, 1, 2, 3): 2

Unit Scoring Guide – Category I
Criteria A–F
3: At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C
2: At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C
1: Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C
0: Inadequate (or no) evidence to meet any criteria in Category I (A–F)

Category II. NGSS Instructional Supports

Score: 2

Criteria A-G:

3: *At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria*

2: *Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A*

1: *Adequate evidence for at least three criteria in the category*

0: *Adequate evidence for no more than two criteria in the category*

II.A. Relevance and Authenticity: Engages students in authentic and meaningful scenarios that reflect the practice of science and engineering as experienced in the real world.

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

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

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.

Rating for Criterion II.A. Relevance and Authority: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials engage students in authentic and meaningful scenarios that reflect the real world because the materials provide support to teachers to help students make connections to their own lives. These connections provide motivation for students to engage in the learning. Students experience phenomena firsthand, and this firsthand experience serves to develop understanding. The unit provides some opportunities for students to connect some of their own questions and prior experiences to the targeted learning.

The examples below provide evidence of how the materials support teachers in making the learning experiences relevant and authentic for students:

- Lesson 1 Step 4 provides evidence that students can connect the phenomena to their own experiences. The Suggested Prompts ask students to begin thinking about why the shapes are harder to see at some stations when the lights are off. The Step 5 Suggested Prompts provide evidence of the teacher eliciting prior experiences: “Can you think of a time when you had a hard time seeing something because it was too dark?”
- Under the guidance for Strategies for Building Understandings Discussion E (Lesson 1 Teacher’s Guide page 9), the teacher is guided to facilitate transformation of disagreements about what students are able to see into a question they want to investigate: “What can we see in the dark?”
- Students complete a Home Sheet Connection in Lesson 3 and use the information from that sheet in Lesson 4. The sheet asks them to find a place in their home with no light and record what they can see, and to think of places in the world with no light. This is evidence that the materials support students to make connections between the targeted learning and their own lives.

- The video of the cave with no lights from Lesson 4, the slides with images from Lesson 5, and the Light and Shadow Hunt in Lesson 7 are examples of the materials supporting teachers to help students make connections to their own lives.

Suggestions for Improvement

The following suggestions could improve the relevance and authenticity of the unit overall:

- Students could write about or create a list of times when it was hard for them to see but their sense of sight was important (e.g., when they take out the garbage after dark, or play sports in the evening hours when the daylight is fading).
- Connections could be made to community or cultural events (such as hunting, Hanukkah, trick-or-treating, etc.) as times when light and light sources are important.

II.B. 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.

Rating for Criterion II.B. Student Ideas: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials provide students with opportunities to both share their ideas and thinking and to respond to feedback on their ideas because classroom discourse focuses on explicitly expressing and clarifying student reasoning. Students have opportunities to share ideas and feedback with each other directly. Students discuss their own and each other's ideas and can describe connections or disparate ideas.

The evidence listed below highlights places in the materials where students have opportunities to share their ideas and get feedback from teachers and peers:

- Students develop new understandings about what they can see in the dark. During Lesson 1 Day 1 in step 4, students share initial ideas about which shapes they could and could not see (Teacher's Guide page 9, Strategies for Building Understanding Discussion). It is expected at this step that students have conflicting ideas about what they can see in the dark. In Day 2 step 5, students relate prior experiences about seeing in the dark (documented on chart paper) and step 6 has students generating initial explanations. After students investigate dark spaces in their homes in the Home Connections Sheet in Lesson 3, student ideas continue to build toward the understanding that they cannot see anything without light. Step 8 in Lesson 3 resolves the idea that they need some light to see, for most students. The final paragraph in the Teacher's Guide (page 10) states, "If there are some students who argue that they could still see inside the box, the optional part 3C provides an additional experience to help them assimilate the new

understanding with their original thoughts." This is a strong example of how students' thinking changes over time.

- Lesson 5 step 1 elicits student thinking about when they want to block out some light. Students contribute their ideas to a T-chart, which serves as an artifact of their evolved thinking and use in Lessons 6–8.
- Lessons 8 and 9 have strong evidence for students' ideas driving instruction, using reasoning and reflective thinking to change ideas over time, and opportunities for multi-modal feedback from teachers and peers. Lesson 8 step 1 has students identifying and defining problems that can be solved in their school. The Teacher's Guide (page 8) prompts teachers to ask students which is the biggest problem and which problem they most want to solve. There are two steps in the lesson for them to brainstorm how to send messages (Student Activity Sheet 1) and device designs (Student Activity Sheet 2). Students begin on their own and then work with a partner, though both partners will draw and write (elaborate) their ideas individually. Students get feedback from the teacher (orally and on Activity Sheet 2) and from their classmates in Lesson 8 (step 3, Teacher's Guide page 13 and step 3, Teacher's Guide page 15).
- Lesson 9 Student Activity Sheet 1 has students evaluate each other's designs. Students discuss the ideas in a Building Understanding Discussion in step 3 (Teacher's Guide page 5). Student Activity Sheet 2 allows students to use what they learned from viewing each other's devices to create a new design. This uses a reflective process and an opportunity to see how their thinking has changed over time.

Suggestions for Improvement

Consider including specific examples of strategies teachers can use to provide feedback on student work and additional opportunities for student-to-student feedback.

II.C. Building Progressions: 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.

Rating for Criterion II.C. Building Progressions: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the materials identify and build on students' prior learning in all three dimensions because the materials make little to no connection between expected prior learning and the learning in the unit. However, the materials do make clear the expected level of proficiency students should have with all three dimensions for the core learning in the unit. Because one of the criterion elements is not met the review team determined this criterion to be inadequate.

The evidence listed below describes instances where the materials do and do not identify how learning progresses through the unit:

- The Unit Front Matter makes clear the expected level of proficiency students should have with all three dimensions for the core learning in the unit and provides suggestions for adaptations. The descriptions are found on page 8 in the Assessment Resources. Additionally, those descriptions are found in each lesson in the assessment guidance descriptions. Possible adaptations are given within lessons as notes in the right margin, labeled Assessment Opportunity, Differentiation Strategies and Alternate Activities, or Additional Guidance.
- There is no evidence of expected prior learning in lesson materials, front matter, or other guidance documents. The expected prior learning currently has to be inferred.

Suggestions for Improvement

Consider clearly describing the expected prior learning/proficiencies in each dimension and providing a logical progression from the expected prior learning through the learning targeted in the materials for all three dimensions, but particularly for SEPs and CCCs.

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

Rating for Criterion II.D. Scientific Accuracy: Extensive

(None, Inadequate, Adequate, Extensive)

The reviewers found extensive evidence that the materials use scientifically accurate and grade-appropriate scientific information because all science ideas included in the materials are accurate and there is strong support for teachers in terms of ways to clarify potential alternate conceptions that they (or their students) may have. Materials allow for the fact that students might express scientifically inaccurate ideas as they are learning that are resolved as students continue to investigate and clarify their understandings.

The evidence below notes places in the materials where it is clear that students are learning accurate and grade-appropriate information:

- In Lesson 1, students are able to experience what it is like to see objects when there is little light. An alternate conception may be that when the lights are off, there is no light. Step 3 of this lesson (Teacher's Guide page 8) suggests turning on the light to see how many shapes are on the sheets. Step 7 of this lesson constructs a record of consensus and disagreement about what students can see in the dark. Lesson 3 allows students to understand the difference between when there is little light and when there is no light using the shoebox model. Step 8 facilitates a Building Understanding Discussion where most students understand that they could see nothing when there is no light, but there is a note that if some students still argue they would be able to see

inside the box there is an optional part (3c) to support students understanding they can see nothing when there is no light to illuminate objects. Lesson 4 provides additional experiences about when there is no light vs. little light.

- Lesson 2 provides students opportunities to investigate ways to block light. Students initially may believe that materials either do block light (are opaque) or do not (transparent), which could be the alternate conception of how light is observed. However, this lesson introduces the idea of translucent materials, or those that partially block light. This alternate conception comes into students' ideas again in Lesson 6 when students investigate whether all materials make a shadow. This is where students learn about what the shadows look like with the different materials blocking all, some, or none of the light.
- The Getting Reading: Teacher Preparation section of each lesson provides Alternate Student Conceptions (middle column) that may arise during the lesson (see Lesson 1 page 3, Lesson 2 page 3, and Lesson 6 page 4 as examples).

Suggestions for Improvement

N/A

II.E. Differentiated Instruction: Provides guidance for teachers to support differentiated instruction by including:

Appropriate reading, writing, listening, and/or speaking alternatives (e.g., translations, picture support, graphic organizers, etc.) for students who are English language learners, have special needs, or read well below the grade level.

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.

Rating for Criterion II.E. Differentiated Instruction: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the materials provide guidance for teachers to support differentiated instruction because differentiation only addresses supporting students' science ideas and does not differentiate the ways students experience the learning opportunities or how their understanding is assessed. There is guidance to support students to do the same things with some support. There is mention of differentiation in the materials, although there is no evidence of specific ways to differentiate (such as using alternatives for speaking/listening or writing).

The evidence listed below highlights places in the materials that do and do not provide differentiation support for users:

- Items described in the "Differentiation Strategies" section of the Teacher Supports & Notes are frequently engagement strategies rather than differentiation strategies. Listed below are a few examples; note that this list is not exhaustive:
    - Lesson 1 page 10 suggests students write their experiences on a sticky note rather than share their experiences aloud. This is an alternate way to conduct the activity rather than differentiation.
    - Lesson 2 page 11 states, "You may want to use tally marks and class counting together…" This is an alternate way to conduct the activity rather than differentiation.
    - Lesson 2 page 12 states "This could be another good opportunity for making connections to multiple common core math standards in grade one."
    - Lesson 3 page 7 suggests giving students choice of materials, which is an engagement strategy rather than a differentiation strategy.
- Differentiation suggestions are listed for students struggling with the content in the Assessment Guidance provided in each lesson and in the Front Matter in the column headed by the question "What to do if your students need more support?"

Suggestions for Improvement

- Consider incorporating sentence stems to support speaking and writing skills.
- Consider providing specific strategies to support English learners.
- Consider including explicit supports for students who are reading or writing below grade level.
- Consider providing suggested extensions for learners who have already met grade-level expectations. The optional extension activity mentioned in Lesson 9 is currently confusing in terms of where to find that information, so this could be clarified.
- Students would benefit from a word/object wall where vocabulary or frequently used words and objects are posted for students to refer to throughout the unit.
- One opportunity to differentiate an assessment could be to modify the assessment in Lesson 4, which expects students to transfer their understanding about light being necessary to see to a new situation (a cave), such that students could show their knowledge via an example with which they have direct experience. Students could be assessed orally based on their descriptions of what they can see and what could be changed in the model classroom so that they can see. While that may not be necessary for all students, it would be helpful for students who may have difficulty understanding the cave concept.

II.F. Teacher Support for Unit Coherence: Supports teachers in facilitating coherent student learning experiences over time by:

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.).

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

Rating for Criterion II.F. Teacher Support for Unit Coherence: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials support teachers in facilitating coherent student learning experiences over time because students have an opportunity to engage in asking questions about phenomena that they feel they need to address in upcoming lessons, and future investigations are focused on answering these student-generated questions. In most lessons, students make progress towards elements of each dimension that help the student also make progress on the questions connected to the phenomena. Part of what students figure out is the next question(s) to pursue in the next lessons.

The evidence below notes places in the materials where there are explicit connections amongst the ideas within the lessons. Coherence is built in these examples through the routines and processes of the units, which are included in the examples below:

- Students have opportunities to ask questions about the phenomena during lessons when planning investigations (for example, Lesson 2, step 2, Teacher's Guide page 6) and during Building Understanding Discussions (for example, Lesson 1, step 4 Teacher's Guide page 9 where the discrepant experiences can be turned into a question to investigate and Lesson 2, step 8 Teacher's Guide page 12).
- When students are doing the investigation in Lesson 8 to complete the student activity sheets, experiencing their device and others' devices, students must ask questions about devices (see Teacher's Guide page 10 Supporting students in critiquing design solutions).
- Students cultivate new questions at the ends of lessons to use in the next investigation. At the end of Lesson 1 (step 13, Teacher's Guide page 14), students have shared ideas in the Gallery for blocking light in the classroom and this step has students clarifying next steps, which are to investigate if their ideas will make the room as dark as possible. Lesson 2 step 7 (Teacher's Guide page 13) has students identifying the problem with their attempt at making the room as dark as possible. Lesson 2 (Teacher's Guide page 15) anticipates that students will ask about how to make a model of their classroom so they can block all the light from entering.

Suggestions for Improvement

Providing additional clarity on how the lesson sets connect would be helpful to both the teacher and students.

II.G. Scaffolded differentiation over time: 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.

Rating for Criterion II.G. Scaffolded Differentiation Over Time: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the materials support teachers in helping students engage in the practices as needed and gradually adjust supports over time. The gradual release of supports over time is not explicit in the directions to teachers. Supports are made as suggestions and there is no mention from one lesson to the next that if students make progress toward the intended learning targets that they should require less support than in previous lessons.

The examples of evidence are parts of the unit that intentionally provide support to learners for accessing the ideas, skills, and processes for making sense of the phenomena. There are no examples of explicit directions about which scaffolds should be reduced or how scaffolds are adjusted throughout the materials so that students are increasingly responsible for making sense of the phenomena and solving the problem:

- Some supports are provided by offering optional activities that reinforce understandings being developed by each lesson. An example of an optional activities is in Lesson 3, Teacher's Guide page 11. The optional activities are another way to develop understanding or reinforce a prior experience and do not provide explicit guidance about how to gradually reduce supports.
- The Teacher Handbook provides multiple ways to provide support for students, including Instruction Routines and ways to support different Types of Discussions. Section J of the handbook is How Can Teacher Support Differentiated Instruction. This discusses the Universal Design for Learning that is embedded in the lessons of this unit. It calls out the icon for Differentiated Support in the Teacher's Notes and Supports in the teacher's guide for each lesson. There is no explicit guidance to consider ways to reduce supports over the course of the unit.
- The lessons provide prompts to include ways for teachers to model a variety of ways for students to engage in the SEPs. For example, Lesson 1, Teacher's Guide page 7 models ways students should approach each station to make the observations of the shapes, Lesson 1, Teacher's Guide page 10 suggests having students record their ideas on a post-it note prior to sharing publicly, In Lesson 2, Teacher's Guide page 11 provides support for breaking students into small groups and how to help students do that. There is no guidance from one lesson to the next, that if the teacher used a scaffolded differentiation strategy, what they might do during the next lesson to reduce the support necessary for students to understand an idea or engage with a practice.

Suggestions for Improvement

- The "look fors" are a strength and helpful for teachers. Consider adding to this section some information on how student performance is expected to change as the unit progresses and students get more experience with the targeted dimensions.
- The reviewers also suggest considering ways to have a gradual release of responsibility with **Planning and Carrying Out Investigations**, such that students have more opportunities to participate in planning investigations.

Overall Category II Score (0, 1, 2, 3): 1

Unit Scoring Guide – Category II
Criteria A-G:
3: At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria
2: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A
1: Adequate evidence for at least three criteria in the category
0: Adequate evidence for no more than two criteria in the category

Category III. Monitoring NGSS Student Progress

Score: 2

Criteria A–F:

***3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion*

***2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A*

***1**: Adequate evidence for at least three criteria in the category*

***0**: Adequate evidence for no more than two criteria in the category*

III.A. Monitoring 3D student performances: 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.

Rating for Criterion III.A. Monitoring 3D Student Performances: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials elicit direct, observable evidence of students using practices with core ideas and crosscutting concepts to make sense of phenomena or design solutions because all science ideas are scientifically accurate, most scenarios and associated phenomena and problems are engaging, the majority of tasks involve a phenomenon, and multiple modalities (e.g., graphs, diagrams) are included in most tasks. SEP elements are routinely used in service of sense-making and there's a reasonable match between the SEPs developed and used in the unit and the SEPs that are assessed in the materials.

The evidence noted by the reviewers describes parts of the materials where students are discussing, writing, planning, investigating, reflecting, sharing, evaluating, and changing their designs. These are

pieces of evidence for this criterion because they provide evidence to the user that students are sense making:

- Direct, observable evidence of three-dimensional learning is in Student Activity sheets in Lesson 1, 2, 8, 9, Home Connection Sheet in Lesson 3, Assessments in Lesson 4, and the Pre/Post Assessment for the unit. These pages provide information for students conducting an investigation that relates directly to the DCIs. During the Building Understanding Discussions, teachers elicit direct, observable evidence of students using SEP and CCC elements to develop understandings about the DCI elements. For example, in Lesson 3, students demonstrate the ability to plan and carry out an investigation that meets the element descriptions listed in the lesson and the CCC elements listed in that lesson as they discuss their observations to make sense of what they can see when no light enters the model.

Suggestions for Improvement

Consider including more opportunities for students to create a visual representation of their thinking.

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

Rating for Criterion III.B. Formative: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials embed formative assessment processes throughout that evaluate student learning and inform instruction because materials include explicit supports for formative assessment processes with many opportunities built into instructional materials. Support for teacher interpretations and adjusting next steps exist within the materials. Formative assessments are tied to multiple dimensions, and clearly build from student engagement with the dimensions.

The evidence for this criterion is found in places within the materials where users are directed to monitor students' understanding by evaluating responses to evidence shared, questions that are learner-developed, or student performances or written descriptions:

- Formative assessment opportunities are explicitly called-out in the materials. They occur regularly throughout lessons and within the unit. They are built into instructional sequences. For example, each lesson has a section titled Assessment Guidance and what to look for or what students would be doing. Also, under the column Teacher Supports and Notes, assessment opportunities are embedded into the lessons. See Lesson 1 pages 7, 8, 10, and 12 and Lesson 6 page 10.
- The Teacher Handbook has a section titled What Are the Assessment Resources in a NextGen Science Storyline? that provides a description of the formative assessments and how to use them.

- Each lesson has a section called Assessment Guidance that describes students' performances to meet parts of the three-dimensional description. To the right of that information is guidance to the teacher and strategies for students who need additional support. For example, see Lesson 2 Teacher's Guide page 4.

Suggestions for Improvement

- Consider addressing issues of cultural and linguistic diversity in the formative assessment opportunities, such as providing sentence stems and a word wall to support language development.
- Formative assessment requires that the performance or responses are evaluated and then a planned response can be made in order to advance learning along the progression. This rating could be strengthened by being explicit about which students' responses meet the targeted learning at specific locations within the unit and what to do when students do not meet that expectation and how to respond when they do or go beyond.

III.C. Scoring guidance: 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.

Rating for Criterion III.C. Scoring Guidance: Inadequate

(None, Inadequate, Adequate, Extensive)

The reviewers found inadequate evidence that the included rubrics and scoring guidelines help the teacher interpret student performance for all three dimensions because assessment targets are unclear from the scoring guidance and minimal guidance is provided for students and teachers to interpret student progress, although there is more guidance for formative assessments than summative assessment opportunities. The majority of summative and formative assessment opportunities are focused on a single dimension (DCIs), which is a subset of the dimensions claimed to be assessed.

The evidence provided as examples are parts of the materials where users are able to locate some scoring guidance. The examples also note places where the guidance may not be sufficient. These examples show anticipated responses that provide ways to support the students who responded as anticipated:

- Formative assessment opportunities are called out in the materials, however specific scoring guidance to determine student achievement is not provided. For example, each lesson has a section titled Assessment Guidance and what to look for or what students would be doing. There is no direction provided about what level of performance the anticipated student responses would be evaluated to meet.
- The Teacher Handbook has a section titled What Are the Assessment Resources in a NextGen Science Storyline? which provides a description of the formative assessments and how/when to use those. As noted previously, this would be another location to place specific scoring guidance

about how to interpret the student performances unique to each unit, but that scoring guidance is not currently included.

- Each lesson has a section called Assessment Guidance that describes students' performances to meet parts of the three-dimensional description. To the right of that information is guidance to the teacher and strategies for students who need additional support. For an example, see Lesson 2, Teacher's Guide page 4. However, there is no guidance for students who may be exceeding expected performances. Opportunities for students to monitor their own progress towards their learning goals are also not present in the materials.

Suggestions for Improvement

- Consider including exemplar student responses for student pages as well as formative and summative assessments.
- Consider including a rubric or other scoring guidance for the pre/post assessment.
- Consider including scoring guidance within the lesson at point of use, rather than in the front matter, to make it more accessible for teachers.
- Consider incorporating ways for students to monitor their progress towards the learning goals, either through teacher feedback or self-assessments.
- Providing guidance to help the teacher determine which students need more support based on their performance would be beneficial to these materials.

III.D. Unbiased tasks/items: Assesses student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students.

Rating for Criterion III.D. Unbiased Task/Items: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples because vocabulary (science and non-science) is grade level appropriate and the amount of text in tasks/items is grade appropriate, representations or scenarios are culturally neutral or support teachers to be aware of the limitations of the scenario for reaching all students, and tasks/items provide a variety of ways for students to convey their understandings.

The bulleted examples below provide evidence of where in the unit vocabulary development happens at a grade-appropriate level. These examples also provide evidence of culturally-neutral experiences students use to make sense of the phenomena and solve a problem.

- The amount of text and vocabulary is grade level appropriate. Scientific terminology is called out in the Getting Ready: Teacher Preparation column on the right side of pages. See Lesson 2, Teacher's Guide page 3 for an example. Although this is an introduction of scientific vocabulary,

students can connect the words to the ideas. For example, in Lesson 2, students are working with words: transparent, translucent, and opaque and optionally, reflective. The Student Activity sheet for the lesson provides the description of what students might see right above the word. The words are introduced in context when students need a way to describe what they saw.

- Investigations are culturally neutral. Students use materials and contexts of their classroom experiences. Students are able to make home connections with dark places and talk about their own experiences with dark places (Lesson 3). Students are able to use light and shadow hunt in their own area in addition to the slides provided (Lesson 7). While some students may not have previously experienced a cave setting, subsequent Building Understandings Discussions can support all students to understand these ideas.

Suggestions for Improvement

Consider Including multicultural elements in the phenomenon. One example may be to include student ideas that may arise, such as why it is not safe to hunt in the dark, where hunting may be specific to some cultures and not others. In some places, parks close at dusk and there could be safety concerns because of the darkness.

III.E. Coherent Assessment system: Includes pre-, formative, summative, and self-assessment measures that assess three-dimensional learning.

Rating for Criterion III.E. Coherent Assessment System: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning because materials include assessments that sometimes connect to learning goals and require students to apply appropriate elements of the three dimensions to make sense of the phenomenon and solve the problem. Many of the tasks are three-dimensional and use of a variety of measures (e.g., performance tasks, discussion questions, problem-based tasks. The unit includes pre/formative/summative assessments. However, the reviewers determined that the unit doesn't provide rationale for the assessments.

These bulleted examples are evidence of different types of assessments and describe their connections to learning. Included in the evidence examples are appropriate elements of the three dimensions that students used to make sense of the phenomena and solve the problem:

- This unit includes an opportunity for either a Pre/Post (growth) assessment or the embedded assessment pieces in Lesson 1 if the teacher doesn't like the trade-offs associated with giving a Pre-test that is the same as the Post-test. Additionally, there are peer- and self-assessment opportunities associated with Lessons 8 and 9. There are multiple formative opportunities within each lesson, and Lesson 4 has summative assessment pieces.

- Students are able to demonstrate understanding in a variety of ways in the unit. Assessment opportunities include informal writings including Student Activity Sheets, post-it note contributions to developing class ideas, etc. Students also participate in Building Understanding Discussions where oral responses can demonstrate their understanding. Teachers conference with students about design ideas in Lesson 8. During investigations, the teacher is encouraged to listen in to student dialogue for important ideas or shifting ideas from students.
- While there is a variety of assessment types and measures, there is not a carefully mapped out rationale for all three dimensions.

Suggestions for Improvement

Consider clarifying the three-dimensional assessment rationale, explaining the purpose and rationale for how and why student learning is measured across the materials for all three dimensions of the intended learning goals. A description of how each task will measure student learning and provide feedback to teachers to inform instruction and students to inform learning would be necessary to increase the rating for this criterion.

III.F. Opportunity to learn: Provides multiple opportunities for students to demonstrate performance of practices connected with their understanding of disciplinary core ideas and crosscutting concepts and receive feedback

Rating for Criterion III.F. Opportunity to learn: Adequate

(None, Inadequate, Adequate, Extensive)

The reviewers found adequate evidence that the materials provide multiple opportunities for students to demonstrate performance of practices connected with their understanding of core ideas and crosscutting concepts because for key, claimed learning in the unit, there are at least two student performances that provide students with the opportunity to demonstrate understanding and teacher/students are engaged in multiple modalities of feedback—written/oral feedback is provided in timely fashion from teacher and peers. Students are provided opportunities to utilize feedback to construct new learning.

The bulleted examples below are evidence of the opportunity for students to learn in this unit. These examples show where evidence of learning exists and where feedback has been provided to students who can use it to reflect or assimilate new information/understandings. Student performances are noted in these examples:

- Students have the opportunity to demonstrate their learning at the end of each lesson set: Lesson 4 has an assessment, Lesson 7 has a concluding discussion after the Light and Shadow Hunt, and Lessons 9 and 11 ask students to design, build, and communicate about their devices.
- Students have opportunities to receive feedback (written and verbal) from peers during Lesson Set 3.

- Students are provided multiple opportunities to demonstrate understanding with claimed learning for the unit. For example, Lesson 4 has two assessments that can provide evidence that students understand that objects can be seen only when light is available to illuminate them. That same evidence may be produced during the Building Understanding Discussion in Lesson 3 step 8. The same evidence could also be produced by students in the post assessment.
- Students receive multiple modalities of feedback in this unit from teachers, self, peers, and from the audience in their classroom for Lesson 11. This feedback may be in the form of (Building Understanding Discussions) oral responses, questions, collaborative discussions, teacher conferencing (Lesson 8) etc. Students have regular opportunities to receive feedback from their teacher, though it is primarily verbal (during discussions).

Suggestions for Improvement

Consider ways for students to receive and utilize multi-modal feedback across a series of performances to demonstrate new or changed thinking.

Overall Category III Score (0, 1, 2, 3): 2

Unit Scoring Guide – Category III
Criteria A–F: **3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion **2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A **1**: Adequate evidence for at least three criteria in the category **0**: Adequate evidence for no more than two criteria in the category

Overall Score

Category I: NGSS 3D Design Score (0, 1, 2, 3): 2
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 1
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score: 5
Overall Score (E, E/I, R, N): R

Scoring Guides for Each Category
Unit Scoring Guide
Category I (Criteria A–F): **3:** At least adequate evidence for all of the unit criteria in the category; extensive evidence for criteria A–C **2:** At least some evidence for all unit criteria in Category I (A–F); adequate evidence for criteria A–C **1:** Adequate evidence for some criteria in Category I, but inadequate/no evidence for at least one criterion A–C **0:** Inadequate (or no) evidence to meet any criteria in Category I (A–F)
Category II (Criteria A-G): **3:** At least adequate evidence for all criteria in the category; extensive evidence for at least two criteria **2:** Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A

1: Adequate evidence for at least three criteria in the category **0:** Adequate evidence for no more than two criteria in the category
Category III (Criteria A–F): **3**: At least adequate evidence for all criteria in the category; extensive evidence for at least one criterion **2**: Some evidence for all criteria in the category and adequate evidence for at least five criteria, including A **1**: Adequate evidence for at least three criteria in the category **0**: Adequate evidence for no more than two criteria in the category

Overall Scoring Guide
E: Example of high quality NGSS design—*High quality design for the NGSS across all three categories of the rubric; a lesson or unit with this rating will still need adjustments for a specific classroom, but the support is there to make this possible; exemplifies most criteria across Categories I, II, & III of the rubric. (total score ~8–9)* ***E/I: Example of high quality NGSS design if Improved—****Adequate design for the NGSS, but would benefit from some improvement in one or more categories; most criteria have at least adequate evidence (total score ~6–7)* ***R: Revision needed—****Partially designed for the NGSS, but needs significant revision in one or more categories (total ~3–5)* ***N: Not ready to review****—Not designed for the NGSS; does not meet criteria (total 0–2)*