Sounds - Grade 1
EQuIP Rubric for Science Evaluation

Developer/Curriculum: CA NGSS Early Implementation Initiative
Unit Name: Sounds
Grade: First (1)
Date of Review: January 2020
Overall Rating (N, R, E/I, E): E/I
Category I: NGSS 3D Design Score (0, 1, 2, 3): 2
Category II: NGSS Instructional Supports Score (0, 1, 2, 3): 2
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
*Total Score (0–9): **6***
Click here to see scoring guidelines

This review was conducted by the Achieve 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	Adequate	**C. Building Progressions**	Adequate	**C. Scoring Guidance**	Inadequate
D. Unit Coherence	Adequate	**D. Scientific Accuracy**	Inadequate	**D. Unbiased Tasks/Items**	Adequate
E. Multiple Science Domains	Adequate	**E. Differentiated Instruction**	Adequate	**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	Adequate		

Summary Comments

Thank youfor your commitment to students and their science education. Achieve is glad to continue to partner with you in this process to improve science curricular materials. Thank you for resubmitting the First Grade Sounds unit for further review. The reviewers appreciate the revisions that were made and that they were made clear by the font color. Targeted Disciplinary Core Ideas and Crosscutting Concepts are adequately addressed, and the integration of the three-dimensions of science learning is evident. In addition, the Conceptual Flow chart, the Learning Sequence Narrative, and the Front Matter of each lesson help to support unit sequencing. The materials also address a diverse population of students (e.g., students that may be hard of hearing or deaf).

The reviewers would like to emphasize that when developing and revising materials, please give considerable care to making the materials as universally accessible and applicable as possible. Pre-service educators may be using the materials. They might need considerable support from the materials to ensure that every one of their students is successful. Veteran educators may also be using the materials, and they will need different kinds of supports from the materials to ensure that every one of their students is successful. Educators and students may exist in urban, suburban, or rural settings. The materials will be most effective if they are consistently comprehensive, with the intent explicitly articulated.

The reviewers believe that it is critical that a safety note be added to the front matter of the unit or individual lessons. As stated in the previous review, there are safety concerns related to exposure to loud noises for certain periods of time. Please add a note recognizing this and directing educators to play the siren sound for only a few seconds at a time. Additionally, a note should be added to direct educators to warn their school colleagues that they will be using siren sound effects. Unexpectedly hearing a siren indoors, the sound carrying over from a nearby classroom or space, may be alarming for other staff members or students.

Addressing the potential anxiety of students with the added statement of "listen to their feelings" is likely to be inadequate. Some students may be mildly to severely disturbed by loud noises or have trauma related to sirens. Reviewers strongly advocate that guidance be provided in the materials to prompt the educator to watch for signs of discomfort or anxiety among all students. Direction to lower the volume or turn off the siren at the onset of a student's negative reaction, as well as to discontinue the use of the siren for the remainder of the unit, could be given.

Suggested Edits:

With the format in which the materials were made available to Achieve, the links were not accessible (e.g., the links to the tabletop siren and guitar videos), so these supplementary resources were unable to be reviewed.

It would be helpful to remove any reference to time-sensitive actions (e.g., Lesson 1.2, Session #1, Engage, #2, "today"). With most of the 5E components being predicted to last 35+ minutes, one individual component may be all an educator gets to in one day's worth of science instruction.

The reviewers suggest making edits to the lesson session "concepts," so as to make them more consistent and coherent in comparison to one another as well as compared to the intent of the individual session. For example, in Lesson 1.1, the questions are as follows:

- Session #2, Explore 1, "Plan and conduct investigations to provide evidence that vibrating matter causes sound."
- Session #2, Explain 1, "Construct an explanation to provide evidence that vibrating matter causes sound." It is not clear why the explanation is providing evidence.

- Session #3, Explore 2, “Conduct investigation that vibrations cause sound.” This could be edited to be the same as that used in Explore 1.
- Session #3, Explain #2 Part A, “Construct an explanation that vibrating matter can make sound.” Consider replacing the word “make” with “cause.”
- Session #4, Explain 2 Part B, “Construct an explanation that vibrating matter causes sound.”

In relation to minor formatting issues, in the materials made available to Achieve, all pages are numbered 10 and some pages are unnecessarily blank. In addition, Lesson 1.3 is titled “See Sounds,” but the footer of the document is titled “Can you feel sound?”

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

The reviewers found adequate evidence that learning is driven by students making sense of phenomena or designing solutions to a problem because the phenomenon (emergency siren) is connected to the learning, although it doesn't drive the learning as well as it could. Materials support students in returning to the phenomenon multiple times to add layers to an explanation of what causes sound, based on learning. However, materials do not support that students would be clear about how the learning they are doing will help them to better explain the phenomenon or design a solution to the given problem (emergency vehicle siren stops working).

Students return to the phenomenon multiple times to add layers of explanation based on learning:

- Lesson 1.1, Session #1, Engage #3: "Play the siren or a siren video. Ask students about when, where, and why they may have heard that siren, and what they think causes the siren's sound. Have them think of questions they might have about the sound and chart them. Let students know that they will be learning how sirens work and what they are used for."
- Lesson 1.1, Session #5, Elaborate #28: "Return to the anchor phenomenon by playing the siren or siren video again. Ask the students to predict what causes the sound of the siren using the data from their investigations."
- Lesson 1.2, Session #1, Engage #2: "Replay the siren and ask students what questions have been answered about the sound of the siren (what causes the sound), what questions remain, and what other questions they might now have. Explain that they will be designing an investigation to gather more evidence about how the siren works."
- Lesson 1.2, Session #1, Engage #5: "Show the siren or siren video again. Ask the students what the siren is used for (communicating an emergency). Ask the students whom the siren is communicating with (cars, people on the street). Ask the students 'What is the same about the

way the siren and the whistle communicate?'"

- Lesson 1.2, Session #2, Explore Part A #6: "Begin by blowing the whistle and playing the siren. Ask the students what caused each device to be able to communicate over a distance. Have a couple of students share out. (Both items were loud enough to be heard from a distance)."
- Lesson 1.2, Session #5, Evaluate: "Expected student's response: _____ vibrated in my device to cause the sound, which could be heard across the field. Ambulances have sirens because they have to communicate an emergency to people on the street or in other cars, and something must vibrate inside the siren to make the sound."
- Lesson 1.3, Session #3, Evaluate #28: "Bring the tabletop emergency siren that was used as the unit phenomena from lesson one. Provide an opportunity for students to feel the siren and the table near the siren, to see what observations they can make."
- Lesson 1.3, Session #3, Evaluate #29: "Ask students to think about the anchoring phenomenon: the sound made by Emergency Sirens."

The phenomenon (emergency siren) is only indirectly connected to student questions or prior experiences. Connections are assumed to connect with "typical" students and include little support for being intentionally connected to the experiences of all the students in the classroom. For example:

- Lesson 1.1, Session #1, Engage #3: "Ask the students about other sounds they have heard. Create a list of other sounds both at school and out in the community or in nature. This list should start to get students to think of sound as a larger concept that is a part of our lives, but often not focused on. Tell the students that you heard this interesting sound and you want to know if they can help you figure out what it is. Play the siren or a siren video. Ask students about when, where, and why they may have heard that siren, and what they think causes the siren's sound. Have them think of questions they might have about the sound and chart them. Let students know that they will be learning how sirens work and what they are used for."

The way that the materials support students to engage in the engineering design process results in students demonstrating a deeper understanding of the science DCI (PS4.A vibrating matter can make sound). However, while student understanding of the science DCI (PS4.A) can support the design process, the understanding is not necessary for the students to solve the problem (create a sound device to communicate over a long distance); students can create a device using trial and error. Related evidence includes:

- Lesson 1.2, Session #2, Explore Part A #10: "Pose the challenge to students again: How can we design and test a device that causes a loud sound using these materials? Have students return to their seats and independently think about how they could use the materials to solve this problem. In their notebook, have each student draw their design for their device."
- Lesson 1.2, Session #4, Explain #17: "After all the groups test their device, ask if all the groups met their goal, to 'design a device that causes a loud sound to communicate over a distance.' Then ask the groups to discuss how their device was the same and different from the other groups' devices. Encourage them to talk about cause and effect relationships. As in the previous lesson, ask the

students if they observed any patterns among all the devices. (Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, reinforce the notion that vibrating matter causes sound and this pattern is repeated in every device they designed and built."

- Lesson 1.2, Session #5, Evaluate #19: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations in their devices caused sound to be heard over a distance, and what they observed."

Suggestions for Improvement

To be rated as having extensive evidence, materials would need to be organized so that students figuring out a central phenomenon or designing the solution to the problem really drives the learning across the unit. Teaching and learning could be focused on supporting students to better make sense of the phenomenon or design a better solution to a problem. Evidence does not currently support that the materials position students to engage in investigation that accurately explains or helps them to figure out how a siren works. Specifically, Lesson 1.3, does not contribute to the driving question of how a siren works. Additionally, the Lesson 1.2 materials, as currently designed, would not explain or help students to figure out why sirens are so loud. To clarify, the reviewers are not advocating that Grade 1 students should investigate electronics and sound waves. However, it is suggested that the selected phenomenon and related driving question(s) could be more grade appropriate and accessible as related to student sense making.

The reviewers suggest that the materials provide an alternative anchor phenomenon to the selected emergency siren or provide greater guidance on how to appropriately and safely present the phenomenon. Currently, no alternative phenomenon is offered, so if an educator has concerns that sirens may cause anxiety for some students, or that the sound may be a safety issue for students, it would be helpful to have ideas for different phenomena in which to anchor the lessons instead. Additionally, if there is a possibility that students do not hear a siren during the outside schoolyard walk, alternate phenomena would be helpful. Consider ensuring that the materials encourage educators to more thoroughly and genuinely connect with student prior experiences or questions about the sounds they hear outside.

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

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The reviewers found adequate evidence that the materials give students opportunities to build understanding of grade-appropriate elements of the three dimensions because students are using and developing several elements of the claimed three dimensions and the opportunities to engage are grade-appropriate.

Science and Engineering Practices (SEPs): Adequate

The reviewers found adequate evidence that students have the opportunity to use or develop the SEPs in this unit.

Science and Engineering Practices (SEPs) claimed in the materials:

- Asking Questions and Defining Problems
    - *Ask questions based on observations to find more information about the natural and/or designed world* (claimed in Lessons 1.1–1.3 front matter)
        - Lesson 1.1, Session #1, Engage #3: "Tell the students that you heard this interesting sound and you want to know if they can help you figure out what it is. Play the siren and a siren video. If you have students who are hard of hearing or deaf, have them touch the siren as you play it. Ask students about when, where, and why they may have heard that siren, and what they think causes the siren's sound. Have them think of questions they might have about the sound and chart them."
        - Lesson 1.1, Session #1, Engage #4: "Draw a T-Chart on chart paper with *"What I Wonder"* on the left and *"What I Found Out"* on the right. Have them think about the different sounds they heard outside and the sound of the siren (if they didn't hear a siren outside)."
        - Lesson 1.1, Session #1, Engage #5, Teacher Note: "Initially students have a hard time with the concept (practice) of asking questions. You can provide modified levels of support to students depending on their language needs: Substantial prompting and support for emerging speakers using sentence frames such as 'Why is ?' or 'What does ?' and minimal support for expanding and bridging speakers, with sentence frames such as: 'What would happen if ?' or 'What cause ?' You can also use prompts and questions to elicit students asking questions: 'Which of these questions are you wondering about?', or 'Is your question ?' for emerging speakers, and "What questions do you have about ?" or 'What would be another question?' for expanding and bridging speakers or for students who are knowledgeable of the topic and need to be encouraged to go deeper."
        - Lesson 1.1, Session #5, Elaborate: "Revisit the T-Chart with the list of questions from steps #3 and #4 and discuss which questions have been answered. Record what they have found out under '*What I Found Out*.' Ask what other questions they might have and record these. Ask what they could do to find answers to their

other questions. If it hasn't come up, ask the question of why sirens are so loud. Explain that they will be answering this question in the next lesson."

- Lesson 1.2, Session #1, Engage #2: "Replay the siren and ask students what questions have been answered about the sound of the siren (what causes the sound), what questions remain on the T- Chart, and what other questions they might now have; record these on the T- Chart…"
- Lesson 1.2, Session #1, Engage #4: "Ask students to come up with questions they might have about the whistle, and how it is similar or different from what they observed in the previous lesson. Record their questions on the T-Chart."
- Lesson 1.3, Session #1, Explore Part A #5: "Ask the students what questions they have about what they just observed. Chart the questions from the group on the T-Chart (at least one student should ask Why did [what caused] the rice move on the speaker?)."

- *Ask and/or identify questions that can be answered by an investigation* (claimed in Lessons 1.1–1.3 front matter)
  - Lesson 1.1, Session #1, Engage #4: "Lead the class in a discussion that through asking questions scientists can begin to think of investigations they can plan to answer their questions. Encourage students to ask what they wonder about sound and record their questions under "*What I Wonder*." If no one brought it up, ask the students 'What causes sound?' and add it to the chart of questions. Have the class look back through the questions and see which ones would be something they could investigate in the classroom. For this first experience, choose the question, 'what causes sound?' and set that question as the focus of what students will be investigating. You can introduce the question by saying: We have developed a list of great questions to investigate."
  - Lesson 1.1, Session #2, Explore 1: "Ask the students what questions came up after the sense walk (step 4). Remind them that our question for today is "What causes sound?" Show students the materials they will have access to for their investigation today."
  - Lesson 1.1, Session #5, Elaborate #29: "Ask what other questions they might have and record these. Ask what they could do to find answers to their other questions. If it hasn't come up, ask the question of why sirens are so loud. Explain that they will be answering this question in the next lesson."
  - Lesson 1.2, Session #1, Engage #2: "...record these on the T-Chart and discuss how they think they could find answer these questions. Explain that today they will be designing an investigation to gather more evidence about how the siren works."
  - Lesson 1.3, Session #1, Explore Part A #6: "Go through the class questions together. Ask students to show thumbs up if they think the question can be answered by doing a science investigation. Ask the students to give thumbs down if they think the questions cannot be answered with a science investigation. Circle

the questions that the students identify as being able to be answered with a science investigation. This should narrow the list of possible questions to investigate. Help the students narrow down which question on the list they would like to investigate (and use teacher moves to get the class to): What caused the rice to move on the speaker?"

- Planning and Carrying Out Investigations
  - *Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.* (claimed in Lesson 1.1 front matter)
    - The materials do not provide evidence that students are making use of grade appropriate measuring skills to compare.
    - Lesson 1.1, Session #1, Engage #4: "Transition the students to thinking about what things are similar or different about all the sounds that the class has heard or discussed. Have students share out with the class their ideas about sound.
    - Lesson 1.1, Session #2, Explore 1: "As the students explore, ask questions about what they see happening to cause a sound, and encourage students to use the sentence frame to explain the cause."
    - Lesson 1.1, Session #3, Explore 2 #15: "Ask the students what the question for our investigations was, 'What causes sound?' Ask the students what data we were collecting at each station: a drawing of what made sound and to determine what causes the sound. At each station students will need to draw the object and label what is making the sound in their notebook."
  - *Plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question.* (claimed in Lessons 1.1 and 1.3 front matter)
    - Lesson 1.1 Session #2, Explore 1 #6: "The teacher will lead the class in a think-aloud to collaboratively plan a science investigation. Explain that when we plan an investigation we want to focus our thinking on the following three areas (chart these as you complete step 6): • the question that we are trying to answer (What causes sound?), • the materials we are using (instruments: kalimba, spoon gong, shoe box guitar, door fiddle, tuning fork, fishing line instrument), • the data we are collecting and how we are collecting it (drawing each instrument, use of labels or writing could also be added)."
    - Lesson 1.1, Session #2, Explore 1: "Teacher Note: The purpose of collaboratively planning this investigation is to provide a progression in the use of this science and engineering practice (Plan and conduct investigations). During Lesson 3 students will be planning investigations with their groups and individually, so this lesson will lay the foundational work and create a chart to serve as a reference and support students during those lessons."
    - Lesson 1.1, Session #2, Explore 1 #7: "Make a chart of the materials being used. Ask students to talk to their partner about what data they might collect while using these materials."

        - Lesson 1.1, Session #2, Explore 1 #8: "Explain to students that they will be working in groups of 4 to conduct this investigation. Refer to the plan and ask students what data we are collecting as we visit each station. Clarify that at each station students will need draw the object and label what is making the sound in their notebook."
        - Lesson 1.1, Session #3, Explore 2 #15: "Explain to students that they will be working in groups of 4 to follow their investigation plan for the remaining 3 sound stations today."
        - Lesson 1.3 Session #1: Students work independently and then with peers to design an investigation (using drum and beans, toilet paper kazoo) to understand and explain why the rice moves on the speaker)
- Constructing Explanations and Designing Solutions
    - *Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomenon*. (Lessons 1.1 and 1.3)
        - Lesson 1.1, Session #2, Explain 1 #13: "Have students share with their elbow partner about their chosen station, verbally explaining what caused sound."
        - Lesson 1.1, Session #3, Explain 2 #21: "Have students share with their elbow partner about their chosen station, verbally explaining what caused a sound to be made, again using the frame about the cause of the sound they heard. ("If _____, then _____," or "When _____, then _____.")"
        - Lesson 1.3, Session #4, Extend/Elaborate #23: "Once all students have had a turn, have them turn to a partner and explain what happened and why. Students might use the sentence frame "The tuning fork caused the sprinkles to _____. I think this happened because _____. This is similar to the drum because _____."'
        - Lesson 1.3, Session #5, Evaluate #29: Students will write and/or draw a scientific explanation based on a provided set of questions. Students are also provided sentence stems to scaffold their work.

Disciplinary Core Ideas (DCIs): Extensive

The reviewers found extensive evidence that students have the opportunity to use or develop the DCIs and DCI elements claimed in this unit. The selected DCIs and elements are in service of students making sense of the cause of sound.

Disciplinary Core Idea(s) claimed in the materials:

- PS4.A: Wave Properties
    - *Sound can make matter vibrate and vibrating matter can make sound.* (Lessons 1.1, 1.2, and 1.3)
        - Lesson 1.1: "The large take-away at the end of the lesson is that vibrating matter causes sound."

- Lesson 1.1, Session #2, Explore 1: "Teacher Note: At all stations students should clearly see an object vibrating that is making the sound, although the word vibrate may not be familiar to or used by students. The use of the word vibrate/vibration is not an expectation at this time, just that they see the object moving back and forth to make sound."
- Lesson 1.1, Session #2, Explore 1: "With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and sound, ask questions specifically about how their drawing shows the cause of the sound they hear."
- Lesson 1.1, Session #4, Explain 2 Part B #26: "Ask students what kind of motions they observed (springing, stretching, wiggling, etc.). Show students that when you pluck (pull and let go) the rubber band it moves back and forth really fast. Tell students that this is called vibration. You can't always see vibration, but you can hear or feel it."
- Lesson 1.1, Session #5, Elaborate #27: "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships. (Optional scaffold: 'When___, then ___') The key understanding that we want to make sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships."
- Lesson 1.1, Session #5, Evaluate: "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations).Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"
- Lesson 1.2, Session #4, Explain #17: "After all the groups test their device...Through a guided discussion, reinforce the notion that vibrating matter causes sound and this pattern is repeated in every device they designed and built."
- Lesson 1.2, Session #5, Evaluate #19: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations

in their devices caused sound to be heard over a distance, and what they observed."

- Lesson 1.3, front matter: "This lesson builds on student's prior experience planning investigations and observing cause and effect relationships; students explore sound causing matter to vibrate, which completes the cause and effect relationship between sound and vibrations."
- Lesson 1.3, Session #2, Explore Part B #17: "Distribute a set of materials to each group. Students should conduct their investigation based on their plans. Remind them to collect their data in their notebooks. While groups are working, circulate around the room and listen to the conversations the groups are having. Specifically listen for how students are describing the movement of the beans and the wax paper and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur."
- Lesson 1.3, Session #3, Explain #18: "Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture for both the drum with beans and the toilet paper roll kazoo and ask students to label what is vibrating and what is causing the vibrations to happen. (The drum's sound caused the beans to vibrate. The student's voice caused the wax paper to vibrate.)"

- PS4.C: Information technology and Instrumentation
  - *People use a variety of devices to communicate over long distances.*
    - Lesson 1.2, Session #4, Explain #17: "After all the groups test their device, ask if all the groups met their goal, to 'design a device that causes a loud sound to communicate over a distance.' Then ask the groups to discuss how their device was the same and different from the other groups' devices. Encourage them to talk about cause and effect relationships. As in the previous lesson, ask the students if they observed any patterns among all the devices. (Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, reinforce the notion that vibrating matter causes sound and this pattern is repeated in every device they designed and built."
    - Lesson 1.2, Session #5, Evaluate #19: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations in their devices caused sound to be heard over a distance, and what they observed."
- ETS1.A Defining and Delimiting Engineering Practices
  - *A situation that people want to change or create can be approached as a problem to be solved through engineering.* (Lessons 1.2)
    - Lesson 1.2, Session #2, Explore Part A #7: "Set up the scenario by asking students: 'What would happen if the siren of the ambulance was not working?' Ask

students to discuss in their groups why this might be a problem. Discuss as a class and chart the group's responses.

- Lesson 1.2, Session #2, Explore Part A #8: "Summarize the problem: The siren is not working, so you need to help the medics so that they can drive safely through the streets to help someone who needs medical attention. Present the challenge: to design a device that makes a loud noise that they can use in their pretend ambulance to drive safely through the streets."

- *Asking questions, making observations, and gathering information are helpful in thinking about problems*. (Lesson 1.2)
  - Lesson 1.2, Session #4, Explain #15, 16: (15) "Bring the students together. Ask the students to describe the problem and the challenge that their devices are meeting."
- *Before beginning to design a solution, it is important to clearly understand the problem.* (Lessons 1.2)
  - Lesson 1.2, Session #2, Explore Part A #7–8: (7) "Set up the scenario by asking students: "What would happen if the siren of the ambulance was not working?" Ask students to discuss in their groups why this might be a problem. Discuss as a class and chart the group's responses…(8) "Summarize the problem: The siren is not working, so you need to help the medics so that they can drive safely through the streets to help someone who needs medical attention. Present the challenge: to design a device that makes a loud noise that they can use in their pretend ambulance to drive safely through the streets."
  - Lesson 1.2, Session #3, Explore Part B #11: "Bring the students together. Ask the students to describe the problem and the challenge outlined in the previous session."

Crosscutting Concepts (CCCs): ***Adequate***

The reviewers found adequate evidence that students have the opportunity to use or develop the targeted CCC element in this unit. The selected CCC element is in service of students making sense of and supporting their ideas about the cause of sound.

Crosscutting Concept(s) claimed in the materials:

- Cause and Effect
  - *Simple tests can be designed to gather evidence to support or refute student ideas about causes*. (Claimed in Lessons 1.2 and 1.3); *Events have causes that generate observable patterns.* (Claimed in Lessons 1.1 and 1.2)
    - Based on the Performance Expectation identified for this unit (1-PS4-1), the targeted CCC element is *Simple tests can be designed to gather evidence to support or refute student ideas about causes*. However, the evidence cited only

supports the element that *Students learn that events have causes that generate observable patterns*.

- Lesson 1.1, Session #5, Elaborate #27: "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships. (Optional scaffold: "When___, then ___") The key understanding that we want to make sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold: "A pattern I observed is ____" or "I think this is a pattern because ____.") Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships."
- Lesson 1.1, Session #5, Elaborate #28: "Return to the anchor phenomenon by playing the siren or siren video again. Ask the students to predict what causes the sound of the siren using the data from their investigations..."
- Lesson 1.1, Session #5, Evaluate: "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations). Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"
- Lesson 1.3, page 3: "This lesson builds on student's prior experience planning investigations and observing cause and effect relationships; students explore sound causing matter to vibrate, which completes the cause and effect relationship between sound and vibrations."
- Lesson 1.3, Session #2, Explore Part B #17: "Distribute a set of materials to each group. Students should conduct their investigation based on their plans. Remind them to collect their data in their notebooks. While groups are working, circulate around the room and listen to the conversations the groups are having. Specifically listen for how students are describing the movement of the beans and the wax paper and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur."
- Lesson 1.3, Session #3, Explain #18: "Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture for both the drum with beans and the toilet paper roll kazoo, and ask students to label what is vibrating and what is causing the vibrations to happen.

(The drum's sound caused the beans to vibrate. The student's voice caused the wax paper to vibrate.)"

- Lesson 1.3, Session # 5, Evaluate #29: "Ask students to write a scientific explanation of the questions: How do people use emergency sirens? Provide students with the sentence frame: The siren communicates an emergency to people because it is _____. My evidence for this from the sound investigation is _____."

Suggestions for Improvement

General

- For a unit to have a rating of Extensive , significant evidence must be present to support that students are not only being given opportunities to use all three dimensions, but there are also provisions made so that students can develop their understanding of and skill with all three dimensions.

SEPs

- Consider claiming other SEP elements that students are using in the unit, such as **Developing and Using Models**: *Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed world(s).*
- Related to the design of simple tests, consider providing additional resources, specifically student-facing resources, to support students in beginning to design tests.

DCIs

- ETS1.A was claimed in Lesson 1.2 only, and evidence exists for all three elements claimed. However, additional guidance would be needed to link the "class chart of responses based on the problem" to the "statement of the design challenge." For example, what responses might students generate for the class chart and how would a teacher successfully synthesize the ideas so that the design challenge is generated by the student ideas as opposed to the teacher? This would further support the element, "A situation that people want to change or create can be approached as a problem to be solved through engineering"

CCCs

- In order to have clearer evidence of student use of the Cause and Effect element *Simple tests can be designed to gather evidence to support or refute student ideas about causes,* it would be helpful if the teacher guidance were clear about how students could be asked to articulate the connection between the tests and their understanding of the cause of sound. In addition, students could be supported in using their collected data to clarify any existing misconceptions or refute the ~~inaccurate~~ thinking of peers.
- In Lesson 1.1 Session #5, Elaborate #27, the teacher is told to "Explain that identifying patterns helps us understand cause and effect relationships." This is building toward a middle school element of Patterns. It could instead be helpful to have the teacher start to build student understanding that *patterns in the natural and human designed world can be….used to describe phenomena and used as evidence.*

Sounds - Grade 1
EQuIP Rubric for Science Evaluation

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: Adequate

The reviewers found adequate evidence that student performances integrate elements of the three dimensions in service of figuring out phenomena or designing solutions to problems because there is evidence of intentional overlap of the integration of the three dimensions and making sense of a phenomenon. The materials present more than one event during which students are engaged in grade appropriate elements of three dimensions used together and the integration is in service of figuring out something about the phenomenon.

An example of three-dimensional learning in service of figuring out something about the phenomenon:

- Lesson 1.1, Session #5, Elaborate #27: (Claimed: Plan and conduct investigations and construct an explanation that vibrating matter can cause sound.)
    - "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships. (Optional scaffold: "When___, then ___") The key understanding that we want to make sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold: "A pattern I observed is ____" or "I think this is a pattern because ____.") Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships."
        - DCI- **PS4.A: Wave Properties**: *Sound can make matter vibrate and vibrating matter can make sound.*
        - SEP- **Constructing Explanations and Designing Solutions**: *Use information from observations (firsthand and from media) to construct an evidence-based account for natural phenomenon*.
        - CCC- **Cause and Effect**: *Students learn that events have causes that generate observable patterns.*

Examples of one- or two-dimensional learning in service of figuring out something about the phenomenon:

- Lesson 1.2, Session #5, Evaluate #22–23: (CLAIMED: Students will define a simple problem (non-working siren) and design a communication device that solves this problem through engineering.)
  - "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The____, causes ____.' or 'The effect of____ is ____.', or '____ causes ____.'). Discuss why scientists and engineers look for cause-and-effect relationships. Ask students how the cause- and-effect relationship helped them understand more about a phenomenon. Have students explain why ambulances have sirens and how they think the siren might cause the sound."
    - DCI- **PS4.A: Wave Properties**: *Sound can make matter vibrate and vibrating matter can make sound.*
      ETS1.A: *A situation that people want to change or create can be approached as a problem to be solved through engineering.*
    - It is unclear from this sentence frame how students should be accessing the claimed CCC (*simple tests can be designed to gather evidence to support or refute student ideas about causes*) and SEP (*define a simple problem that can be solved through the development of a new or improved object or tool*).

Suggestions for Improvement

- The intention for three-dimensional science instruction and learning can be interpreted by the reviewers. However, it is suggested that the language of and direction within the materials be explicit enough so that any teacher, novice or veteran, from any location can implement this intention with fidelity. Student models would further support interpretation of tasks, particularly their intention in demonstrating three-dimensional learning. For example, for the Lesson 1.2, Session #5, Evaluate #22–23 claimed three-dimensional performance, it would be helpful if sample student models were included, demonstrating how these dimensions are addressed.

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

The reviewers found adequate evidence that lessons fit together coherently to target a set of performance expectations. However, while an intended progression—a building of understanding from lesson to lesson—was evident, there were missed opportunities in how student questions are used throughout the unit, as well as how student explanation is connected to intended learning.

Questions are used throughout the unit to connect one lesson to the next. For example:

- Lesson 1.1, Session #1, Engage, #3, "Have them think of questions they might have about the sound and chart them. Let students know that they will be learning how sirens work…"
- Lesson 1.1, Session #1, Engage, #4, "Have students share out with the class their ideas about sound. Draw a T-Chart on chart paper with *'What I Wonder'* on the left and *'What I Found Out'* on the right. Have them think about the different sounds they heard outside and the sound of the siren (if they didn't hear a siren outside). Lead the class in a discussion that through asking questions scientists can begin to think of investigations they can plan to answer their questions. Encourage students to ask what they wonder about sound and record their questions under '*What I Wonder*.' If no one brought it up, ask the students 'What causes sound?' and add it to the chart of questions. Have the class look back through the questions and see which ones would be something they could investigate in the classroom. For this first experience, choose the question, 'what causes sound?' and set that question as the focus of what students will be investigating. You can introduce the question by saying: We have developed a list of great questions to investigate. Today we will start with a question that will help us solve the problem of a broken-down ambulance siren. This one right here... point to the T-Chart. *What causes sound?* How many of you are wondering the exact same thing?"
- Lesson 1.1, Session #2, Explore 1, #7, "Ask the students what questions came up after the sense walk (step 4). Remind them that our question for today is 'What causes sound?'"
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- Lesson 1.1, Session #5, Elaborate, #29, " Revisit the T-Chart with the list of questions from steps #3 and #4 and discuss which questions have been answered. Record what they have found out under '*What I Found Out*.' Ask what other questions they might have and record these. Ask what they could do to find answers to their other questions. If it hasn't come up, ask the question of why sirens are so loud. Explain that they will be answering this question in the next lesson."
- Lesson 1.2, Session #1, Engage, #2, "Replay the siren and ask students what questions have been answered about the sound of the siren (what causes the sound), what questions remain on the T-Chart, and what other questions they might now have; record these on the T- Chart and discuss how they think they could find answer these questions. Explain that today they will be designing an investigation to gather more evidence about how the siren works."
- Lesson 1.2, Session #1, Engage, #4, "Ask students to come up with questions they might have about the whistle, and how it is similar or different from what they observed in the previous lesson. Record their questions on the T-Chart."
- Lesson 1.2, Session #5, Elaborate, #23, "Revisit the T-Chart with the list of questions from steps #3 and #4 from lesson 1.1 and discuss which questions have been answered. Continue adding, revising, and connecting to their learning by recording what they found in this lesson out under '*What I Found Out*,' ask what other questions they might have, and recording these. Ask what they could do to find answers to their other questions."
- Lesson 1.3, Session #1, Engage, #1, "Ask students to answer the focus question from lesson 1, "What makes sound?" Have a few students share out their responses."

- Lesson 1.3, Session #1, Explore Part A, #5, "Ask the students what questions they have about what they just observed. Chart the questions from the group (at least one student should ask Why did (what caused) the rice move on the speaker)."
- Lesson 1.3, Session #1, Explore Part A, #6, "This should narrow the list of possible questions to investigate. Help the students narrow down which question on the list they would like to investigate (and use teacher moves to get the class to): What caused the rice to move on the speaker?"

There are multiple areas in the unit that provides guidance on students developing towards proficiency in the targeted performance expectations. For example:

- Lesson 1.1, "PE(s) lesson is building toward: 1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]"
- Lesson 1.1, Session #2, Explore 1, #9, "As they work, walk around the groups with a performance assessment checklist of students' names that includes columns for: asking questions and defining problems; planning and carrying out investigations; constructing explanations; cause and effect; PS4A. Make quick notes on how students are doing in all 3 dimensions. As the students explore, ask questions about what they see happening to cause a sound, and encourage students to use the sentence frame to explain the cause and effect relationship if they need this support."
- Lesson 1.2, "PS4.A: Wave Properties: Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1) Vibrating matter can make sound PS4.C: Information technology and instrumentation. People use a variety of devices to communicate over long distances (1-PS4-4)"
- Lesson 1.2, "PE(s) lesson is building toward: 1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.* [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drumbeats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]"
- Lesson 1.2, Session #3, Explore Part B, #14, "As they work, walk around the groups with a performance assessment checklist of students' names that includes columns for: asking questions and defining problems; planning and carrying out investigations; constructing explanations; cause and effect; PS4A; PS4C. Make quick notes on how students are doing in all 3 dimensions. As the students explore, ask questions about what they see happening to cause a sound, encourage students to use the sentence frame to explain the cause and effect relationship."
- Lesson 1.3, "DCI: PS4.A: Wave Properties Sound can make matter vibrate, and vibrating matter can make sound. (1-PS4-1) -sound can make matter vibrate"
- Lesson 1.3, Session #2, Explore Part B, #17, "Use a performance assessment checklist that includes columns for: planning and carrying out investigations; constructing explanations; cause and

effect; PS4A. Make quick notes on how students are doing in all 3 dimensions. As the students explore, ask questions about what they see happening to cause a sound, encourage students to use the sentence frame to explain the cause and effect relationship."

Suggestions for Improvement

For units to be rated as extensive, lessons in the unit should provide students with an opportunity to be left with unanswered questions that motivate the need to engage in the next lesson. Since all of the learning for answering the question "what causes sound?" occurs in lesson 1.1, the questions in the lessons 1.2 and 1.3 only provide students with the opportunity to support their answer that they formed in lesson 1.1. The questions that are used throughout the unit to connect one lesson to the next should be more significantly generated from student thinking. This will require further guidance within the unit materials to help educators foster young learners as "question askers" and to strategically craft driving questions from student input. This is in contrast to the current directions like, "If no one brought it up, ask the students 'What causes sound?' and add it to the chart of questions" (Lesson 1.1)

The reviewers also suggest that further guidance be provided to educators within the materials for not only eliciting student questions, but also leveraging them to drive concurrent lesson sessions. There are structures and direction for educators in the materials that provide students with the opportunities to ask questions, but how can educators support students in asking more relevant or testable questions? In what ways can the materials provide guidance that help the educator to support students in developing as question askers?

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

The reviewers found adequate evidence that links are made across the science domains when appropriate because the phenomenon (cause of sound, emergency siren sound) only requires knowledge from one domain (physical sciences) to explain it at a developmentally-appropriate level, and the materials focus on that domain.

Examples of making sense of the phenomenon with only the target DCI: **PS4.A: Wave Properties:** *Sound can make matter vibrate, and vibrating matter can make sound*:

- Lesson 1.1, Session #2, Explore 1: "Teacher Note: At all stations students should clearly see an object vibrating that is making the sound, although the word vibrate may not be familiar to or used by students."
- Lesson 1.1, Session #4, Explain 2 Part B #26: "Ask students what kind of motions they observed (springing, stretching, wiggling, etc.). Show students that when you pluck (pull and let go) the rubber band it moves back and forth really fast. Tell students that this is called vibration. You can't always see vibration, but you can hear or feel it."
- Lesson 1.1, Session #5, Elaborate #27: "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships. (Optional scaffold: 'When___, then ___') The key understanding that we want to make sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships."
- Lesson 1.1, Session #5, Evaluate: "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations). Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"
- Lesson 1.2, Session #4, Explain #17: "After all the groups test their device...Through a guided discussion, reinforce the notion that vibrating matter causes sound and this pattern is repeated in every device they designed and built."
- Lesson 1.3, Session #2, Explore Part B #17: "Specifically listen for how students are describing the movement of the beans and the wax paper and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur."
- Lesson 1.3, Session #3, Explain #18: "Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture for both the drum with beans and the toilet paper roll kazoo and ask students to label what is vibrating and what is causing the vibrations to happen. (The drum's sound caused the beans to vibrate. The student's voice caused the wax paper to vibrate.)"

Suggestions for Improvement

- Materials that earn an extensive rating in this category appropriately and effectively address more than one science domain in service of students' understanding of the phenomenon. Consider incorporating Life Science references (e.g., 1-LS1-2.) to animals that use vibrations to communicate (e.g., crickets). This may potentially help to further connect to what students hear

in the schoolyard. Alternatively, consider choosing a different phenomenon that would require the understanding and application of multiple science domains. The ETS component (ETS1.A) and related elements selected are not necessary to understand the anchor phenomenon (cause of sound, emergency siren sound), so it was not considered as a second science domain by reviewers.

- Consider supporting students to make explicit connections between science domains using crosscutting concepts.

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

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 grade-appropriate English Language Arts connections have been purposefully integrated into the materials. Students are provided with multiple opportunities to discuss and write their observations and understandings throughout the unit, however there is no evidence that students used any informational text to conduct shared research.

The front matter of the unit, "Sounds: Grade 1" includes the resource 'Science Talk Structures, Strategies, and Checklists."

In the front matter of each lesson, Common Core State Standards for English Language Arts are claimed:

- Lesson 1.1:
  - CCSS.ELA-LITERACY.W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
  - CCSS ELA-LITERACY. SL.1.1. Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
  - CCSS ELA-LITERACY. SL.1.6. Produce complete sentences when appropriate to task and situation.
- Lesson 1.2:
  - CCSS.ELA-LITERACY.SL.1.1.B Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
  - CCSS.ELA- LITERACY.SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
  - CCSS.ELA- LITERACY.W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.

  - CCSS.ELA-Literacy.W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
  - CCSS. ELA-LITERACY. RI.1.10. With prompting and support, read informational texts appropriately complex for grade 1. However, there is no evidence in the materials to support that students read informational text within this lesson.
- Lesson 1.3:
  - SL.1.1.B Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
  - SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
  - W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
  - W.1.8 With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
- Lesson 1.1, Session #2, Explore 1 #7: "...Ask students to talk to their partner about what data they might collect while using these materials. Have students share out as a whole group and chart the data to be collected."
- Lesson 1.1, Session #4, Explain 2 Part B #25: "Bring the class back together and have each group take turns presenting their assigned station. Start each group presentation by having them use the actual object to demonstrate what caused the sound to be made. Then have them present their model. Model and work together with students to create a graphic organizer on the whiteboard to record examples from the stations. Co-construct cause-and-effect statements that students can practice stating orally."
- Lesson 1.1, Session #5, Evaluate #30–31: "Pose the question: What causes the guitar's sound? Have students respond to this question in their notebook."
- Lesson 1.1, Session #5, Evaluate, Teacher Note: "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations).Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"
- Lesson 1.2, Session #3, Explore Part B #12: "Send students back to their groups. Have each student share their designs from step 8 in their group. Each group needs to decide on one design to construct."
- Lesson 1.2, Session #4, Explain #15: "Bring the students together. Ask the students to describe the problem and the challenge that their devices are meeting. Have students think-pair-share how to design a simple test to find out if their devices are effective – that they can be heard (communicate) over a distance. Take a few ideas and acknowledge them."
- Lesson 1.2, Session #4, Explain #17: "After all the groups test their device, ask if all the groups met their goal, to 'design a device that causes a loud sound to communicate over a distance.' Then ask the groups to discuss how their device was the same and different from the other groups' devices.

Encourage them to talk about cause and effect relationships. As in the previous lesson, ask the students if they observed any patterns among all the devices."

- Lesson 1.2, Session #5, Evaluate #20: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations in their devices caused sound to be heard over a distance, and what they observed. Have students discuss how they think they could make their devices even louder."
- Lesson 1.2, Session #5, Evaluate #21: "Have each student draw and label the parts of the device their group made in their notebook. Review the conventions of drawing and labeling models, (e.g., using arrows to show movement, labeling with lines). In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show ___ another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others."
- Lesson 1.2, Session #5, Evaluate #22: "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The____, causes ____.' or 'The effect of____ is ____.', or '____ causes ____.')."
- Lesson 1.3, Session #1, Explore Part A #12: "Distribute a set of materials to each group. Have students stand, push in their chairs and stand behind their chairs. While standing behind their chairs have the students talk to their group and verbalize a plan to answer this question, which includes what data they will be collecting. Give the groups about 5–10 minutes to talk through the plan. As groups are talking, be listening for a group or two that are discussing a plan that will help them answer the investigation question."
- Lesson 1.3, Session #3, Explain #18: "Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture for both the drum with beans and the toilet paper roll kazoo, and ask students to label what is vibrating and what is causing the vibrations to happen. (The drum's sound caused the beans to vibrate. The student's voice caused the wax paper to vibrate.)"
- There is no evidence to demonstrate that the materials support Common Core State Standards for Mathematics

Suggestions for Improvement

- In order to earn an extensive rating, grade-appropriate mathematics connections could be purposefully incorporated into lessons with teacher support to help students make these connections. Consider building in connections to grade-appropriate mathematics practices and standards. The NGSS document suggests the following possible connections to 1-PS4-4:
    - MP.5 Use appropriate tools strategically.
    - 1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.

  - 1.MD.A.2 Express the length of an object as a whole number of length units, by layering multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.
- In response to the standard, CCSS.ELA-LITERACY.RI.1.10. *with prompting and support, read informational texts appropriately complex for grade 1*, students could be provided with texts that would develop understanding and explanations of the scientific concept of sound. In order to achieve an extensive rating, the reading materials would need to go beyond textbooks and include news articles, journal articles, infographics, websites of scientific entities. This standard is claimed in Lesson 1.2 but would be clearer if it were moved to the front matter of Lesson 1.3 based on the evidence of suggested texts in Lesson 1.3 #31.
- In addition, there could be an appropriate and purposeful opportunity to incorporate social studies standards through the historical development of the siren (why was there a need for it?; how was it used?; what were its' limitations?).

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 Authenticity: Adequate

The reviewers found adequate evidence that the materials engage students in authentic and meaningful scenarios that reflect the real world because students experience the sound phenomenon firsthand, and the sound of a siren is one that many students have had prior experience with. However, while students have a common experience and motivation to ask questions before engaging in the learning, it is unclear how educators are guided to return to and connect students' questions to the targeted learning throughout the unit.

The dialogue represented below illustrates students' initial engagement with the phenomenon:

- Lesson 1.1, Session #1, Engage, #3, "Ask the students about other sounds they have heard. Ask the students if they heard any animals sounds and if they can identify what animal was making the sound. Have the students share with a partner why they think animals make sounds (to communicate, such as birds and crickets). Create a list of other sounds both at school and out in the community or in nature. This list should start to get students to think of sound as a larger concept that is a part of our lives and nature, but often not focused on."
- Lesson 1.1, Session #1, Engage, #3, "Tell the students that you heard this interesting sound and you want to know if they can help you figure out what it is. Play the siren and a siren video. If you have students who are hard of hearing or deaf, have them touch the siren as you play it. Ask students about when, where, and why they may have heard that siren, and what they think causes the siren's sound. Have them think of questions they might have about the sound and chart them."
- Lesson 1.1, Session #1, Engage, #3, "Let students know that they will be learning how sirens work and what they are used for. (Be aware that some students might display feelings of anxiety as

they listen to a siren. If this is the case, provide an opportunity for students to express their feelings, and then explain that we will be learning how an ambulance siren works)."

- Lesson 1.1, Session #1, Engage, #3, "Let students know that their challenge will be to design a device that makes a loud noise that they can use in a pretend ambulance to drive safely through the streets if their siren is not working, and for this we first need to learn about more sound."
- Lesson 1.1, Session #1, Engage, #4, "Transition the students to thinking about what things are similar or different about all the sounds that the class has heard or discussed. Have students share out with the class their ideas about sound. Draw a T-Chart on chart paper with *"What I Wonder"* on the left and *"What I Found Out"* on the right. Have them think about the different sounds they heard outside and the sound of the siren (if they didn't hear a siren outside). Lead the class in a discussion that through asking questions scientists can begin to think of investigations they can plan to answer their questions. Encourage students to ask what they wonder about sound and record their questions under "*What I Wonder*." If no one brought it up, ask the students "What causes sound?" and add it to the chart of questions. Have the class look back through the questions and see which ones would be something they could investigate in the classroom. For this first experience, choose the question, "what causes sound?" and set that question as the focus of what students will be investigating. You can introduce the question by saying: We have developed a list of great questions to investigate. Today we will start with a question that will help us solve the problem of a broken-down ambulance siren. This one right here... point to the T-Chart. What causes sound? How many of you are wondering the exact same thing? In a few minutes we are going to use our sense of sight (seeing), feeling (touch) and hearing to investigate the answer to that question."

Suggestions for Improvement

- To be rated as Extensive, the materials would need to provide support to teachers or students for connecting students' questions to the targeted learning; student questions, prior experiences, and diverse backgrounds related to the phenomenon and problem could be used to drive the lessons and the sense-making or problem-solving. It is suggested that the materials include samples of expected student questions (i.e., sample driving question board) and include guidance for teachers regarding how these questions can be organized and capitalized upon to drive the learning sequence of the unit.
- While the students may hear a siren outside and are guaranteed to hear a siren played indoors, the problem they are presented with—creating a replacement for the broken siren of a pretend ambulance—might not seem relevant and authentic to the student. Consider questions and student responses that may capitalize on personal experiences, such as: What sounds did we hear on our walk that are used to communicate a message? Has there ever been a time that you needed to be louder to get someone's attention, or be heard (e.g., getting a family member's attention at dinner, or a friend's attention on the playground, a teacher trying to get the attention of a class of students)?

- Given the statement, "Be aware that some students might display feelings of anxiety as they listen to a siren", consider providing an alternative experience for those students who may not be able to productively engage with this phenomenon.

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

The reviewers found adequate evidence that the materials provide students with multiple opportunities to share their ideas and thinking within individual, small group, and whole group formats in both oral and written form. However, there is limited evidence to show that students have the opportunity to receive and apply feedback after Lesson 1.1.

Opportunities for students to express, clarify, justify, interpret, and represent their ideas include:

- Lesson 1.1, Session #1, Engage #2: "Then ask for students to share out specific observations made, and record those on the chart under the corresponding sense used."
- Lesson 1.1, Session #1, Engage #4: "...Have students share out with the class what ideas they are thinking about sound..."
- Lesson 1.1, Session #1, Engage #5: "Have students share with their elbow partner what they think they know about what causes sound, even if they are not sure. Have students share with the class and chart their ideas."
- Lesson 1.1, Session #2, Explain 1 #13: "Have students share with their elbow partner about their chosen station, verbally explaining what caused sound."
- Lesson 1.1, Session #2, Explain 1 #14: "...Through using sticky- notes, or some other removable paper, provide feedback to students about the quality of the data they are collecting. Through asking questions about their drawings or writing, you can often help students think more deeply about their data. With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and sound, ask questions specifically about how their drawing shows the cause of the sound they hear."
- Lesson 1.1, Session #2, Explain 1: "Teacher Note: When providing feedback to students in their notebook, the purpose is to help students deepen their thinking and not to penalize students. In that line of thought, feedback should be provided in a format that helps students revise or add to their notebook, not feel like they are wrong. Often through asking questions, teachers can help students think about their notebook in a different perspective. Feedback is best shared with students through writing questions on a sticky note or other removable paper, not writing directly on the student notebook."
- Lesson 1.1, Session #3, Explain 2, Part A #22: "At this point, it would be another good place for the teacher to review the other half of the student's notebooks and to look the data that has been

collected. Through using sticky- notes, or some other removable paper, provide feedback to students about the quality of the data they are collecting. Through asking questions about their drawings or writing, you can often help students think more deeply about their data. With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and sound, ask questions specifically about how their drawing shows the cause of the sound they hear or feel."

- Lesson 1.1, Session #3, Explain 2, Part A: "Teacher Note: When providing feedback to students in their notebook, the purpose is to help students deepen their thinking, not to penalize students. In that line of thought, feedback should be provided in a format that helps students revise or add to their notebook, not feel like they are wrong. Often through asking questions, teachers can help students think about their notebook in a different perspective. Feedback is best shared with students through writing questions on a sticky note or other removable paper, not writing directly on the student notebook. Questions and comments can include: Use the science words in your answer. Can you tell me why you think that? Label what is making the sound in your drawings. Pre- select common feedback from a few notebooks to share at the beginning of the next lesson."
- Lesson 1.1, Session #4, Explain 2 Part B #23: "Ask students to look back in their notebooks and find the teacher feedback from the last session(s). Walk around helping them read the feedback if needed and then share the few common feedback comments you selected."
- Lesson 1.1, Session #4, Explain 2 Part B #24: "Ask students to look back in their notebooks and find the question we were investigating in the last session, "What causes sound?" Have students revisit each station by reviewing the data they collected. Have students review the feedback the teacher has provided and add to or revise their notebook entries as they feel necessary."
- Lesson 1.1, Session #5, Elaborate #28: "...Revisit the list of questions from steps #3 and #4 and discuss which questions have been answered and what other questions they might have. Record these..."
- Lesson 1.2, Session #3, Explore Part B #12: "Send students back to their groups. Have each student share their designs from step 8 in their group. Each group needs to decide on one design to construct. As they reach consensus, check in with each group to see their plans for the device they will be building and give feedback as needed."
- Lesson 1.2, Session #4, Explain "15: "Have students think-pair-share how to design a simple test to find out if their devices are effective"
- Lesson 1.2, Session #4, Explain "17: "...Then ask the groups to discuss how their device was the same and different from the other groups' devices..."
- Lesson 1.2, Session #5, Evaluate #20: "...In pairs, have students practice asking each other questions about their models..."
- Lesson 1.2, Session #5, Evaluate #21: "Have students explain in writing what caused their device to be able to communicate across a distance"
- Lesson 1.2, Session #5, Evaluate #23: "Have students explain why ambulances have sirens and how they think the siren might cause the sound. Revisit the T-Chart with the list of questions from steps #3 and #4 from Lesson 1.1 and discuss which questions have been answered. Continue

adding, revising, and connecting to their learning by recording what they found in this lesson out under '*What I Found Out*,' ask what other questions they might have, and recording these. Ask what they could do to find answers to their other questions."

- Lesson 1.3, Session #1, Engage #1: "Ask students to answer the focus question from lesson 1, 'What makes sound?' Have a few students share out their responses."
- Lesson 1.3, Session #1, Engage #11: "Have the students independently think about how they could use the objects…"
- Lesson 1.3, Session #3, Explain #19: "Ask students what test they designed to gather information on what might cause the rice to move on the speaker. Have each group present their drawings and explain what they observed in their investigation. Ask students what is the cause of the rice moving on the speaker. Ask how they know this. Give students time to provide feed-back to each other as they present their models."
- Lesson 1.3, Session #4, Extend/Elaborate #23: "Have them turn to a partner and explain what they can do with the tuning fork, the bowl, and the sprinkles, then share ideas as a class."
- Lesson 1.3, Session #4, Extend/Elaborate #24: "Identify a couple of students who would be able to provide their explanation orally to the class. Have students compare what they hear from their classmates to what they wrote for their explanations."

Suggestions for Improvement

- This criterion is about students negotiating new understandings by clarifying their own ideas and comparing to their peers' ideas and ideas encountered in the learning experience(s). For this to be successful, there have to be grade-appropriate ways for students to make their thinking explicit, as well as opportunities for feedback loops (from the teacher or peers as appropriate) to help them to improve their understanding. To earn an Extensive rating, the materials would need to include consistent opportunities for students to apply the feedback directly to their work, as well as guidance to educators on how to productively facilitate feedback loops among Grade 1 learners. Consider describing what it would look like for a student to use the feedback to deepen their learning or to construct new learning.
- Additionally, the evidence for this criterion may be strengthened by enhancing the guidance for educators regarding how to elicit student ideas when expression or vocabulary is limited; how can an educator support a student in articulating thinking?

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: Adequate

The reviewers found adequate evidence that the materials identify and build on students' prior learning in all three dimensions. The materials do a thorough job of explaining the learning progression from lesson to lesson within this unit, and the materials identify prior learning relative to the three dimensions.

The Learning Sequence Narrative and front matter of each lesson provides a progression of three-dimensional learning within the unit. For example:

- The "Sounds: Grade 1" front matter includes:
    - Unit Overview
    - Learning Sequence Narrative, "The Learning Sequence Narrative briefly describes what students do in each lesson and links the learning between the lessons as a conceptual storyline."
    - Conceptual Flow diagram
- Lesson 1.1, front matter, NGSS, SEP: Asking Questions and Defining Problems: "Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions. Ask questions based on observations to find more information about the natural and/or designed world(s). Ask and/or identify questions that can be answered by an investigation." However, no statement is given regarding expectations for prior student learning.
- Lesson 1.2, front matter, NGSS, SEP: Planning and Carrying Out Investigation: "...Students are expected to come in with experience in conducting investigations, with guidance, on the effects of pushes and pulls from Kindergarten. They are also expected to have had experience with ETS1.A, defining engineering problems as they worked to change the speed and direction of an object with a pull or a push. This learning sequence will provide students with the opportunity to plan their investigations with less guidance."
- Lesson 1.2, front matter, NGSS, SEP: Constructing Explanations and Designing Solutions: "...Students will have little experience with constructing explanations in Kindergarten; they do come in with some experience designing solutions when they build structures to reduce the warming effect of sunlight on an area, which this lesson sequence will build on by having students design solutions to a problem with a non-functioning siren."
- Lesson 1.2, front matter, NGSS, CCC: "...Students come in with much experience with cause and effect from Kindergarten. They have used this crosscutting concept to better understand the effect of pushes and pulls on moving objects and the effect of sunlight on Earth's surface. This lesson sequence will give students more practice with cause and effect as they use this crosscutting concept to understand how vibration causes sound. They will also be expected to have experience with patterns as they studied weather patterns over time in Kindergarten."
- The front matter of each lesson includes a "Storyline Link" statement:
    - Lesson 1.1, page 3, "This is the first lesson out of a sequence of three. The lesson begins by connecting to the fact that kids hear sounds every day by going on a sense walk and generating a list of things observed, specifically focusing on sounds heard. The anchoring phenomenon, the sound made by Emergency Sirens, is introduced in this lesson as one of the sounds that we hear or have heard before…"

  - Lesson 1.2, page 3, "In the previous lesson students identified that they hear many different sounds. Then they planned and carried out an investigation to try to figure out what causes sound. They used a variety of different instruments to find that vibrating material causes sound, and observed patterns…"
  - Lesson 1.3, page 2–3, "This is the third lesson in the learning sequence. In the previous lessons students explored the idea that vibrations cause sound…"
- No evidence was found about the expected progression of the Physical Science (Lessons 1.1 and 1.2) discipline. While the individual core ideas (4.A, 4.C) would not have been addressed in Kindergarten, the Physical Science discipline would have been.
- No evidence was found about expected progression of the ETS (Lesson 1.2) discipline. Instruction toward ETS1.A would likely have been experienced in Kindergarten.

Suggestions for Improvement

- Consider moving the statement from Lesson 1.1, NGSS front matter "They are also expected to have had experience with ETS1.A, defining engineering problems as they worked to change the speed and direction of an object with a push or pull" to Lesson 1.2 under ETS1.A in the front matter.
- The reviewers suggest adding a statement about progression under the SEP: Asking Questions and Defining Problems in front matter of Lesson 1.1. How might students have engaged in this practice in Kindergarten?
- As the reviewers stated in the first review, "For elements in which students are expected to have no prior knowledge, it would be helpful to mention this explicitly to teachers so they know they will have to support all students from scratch." We again suggest adding a simple statement recognizing that while the Physical Science discipline is part of Kindergarten standards, the core ideas are first being introduced in First Grade. Therefore, students are not expected to enter the unit with prior knowledge related to the targeted core ideas.

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: Inadequate

The reviewers found inadequate evidence that the materials use scientifically accurate and grade appropriate scientific information because there are multiple instances within this unit in which prompts and activities may likely cause students to formulate incorrect or incomplete conceptions.

In Lessons 1.1 and 1.2, during times when the educator is prompting students to generate questions, the following two statements are included in the material, "…why sirens are so loud. Explain that they will be answering this question in the next lesson" (Lesson 1.1) and "Explain that today they will be designing an investigation to gather more evidence about how the siren works" (Lesson 1.2)." Evidence does not

support that students are engaged in investigations and/or discussion that will explain or support them in figuring out why sirens are loud or how sirens actually work. These are generalized statements—related to far more complex concepts—that may lead to student misconceptions.

Even with the addition of the word "pretend," the design challenge remains misleading to students because it communicates that students will be creating a device out of simple materials that will be appropriately loud enough to replace an actual or pretend ambulance siren:

- Lesson 1.2, Session #2, Explore Part A, #8, "Summarize the problem: The siren is not working, so you need to help the medics so that they can drive safely through the streets to help someone who needs medical attention. Present the challenge: to design a device that makes a loud noise that they can use in their pretend ambulance to drive safely through the streets."

The rice will definitely move if on a plate that is directly placed on a speaker. This will not be an accurate demonstration of sound causing material to vibrate, as the physical vibrations of the speaker will transfer directly to the plate, which will move the rice. The plate and the rice should not be directly touching the speaker. In most speakers, the vibrations are not only caused by sound, and therefore might lead to misconceptions.

- Lesson 1.3, Session #1, Engage, #3–4, "Put a paper plate on the speaker and add rice to the plate...Begin to play music through the speaker."

Placing a vibrating tuning fork very close to, but not touching the bowl or plastic wrap may not result in the sprinkles moving. In this case, this would not an appropriate demonstration of sound causing matter to vibrate. If the tuning fork touches the bowl, plastic wrap, or sprinkles it would no longer be the sound causing disturbances, it would be the vibration of the tuning fork material itself:

- Lesson 1.3, Session #4, Extend/Elaborate, #23, "Tell the students that they will be gathering more evidence to explain what caused the rice to move on the speaker. Show the students how to tap the tuning fork on the side of the table. Have them turn to a partner and explain what they can do with the tuning fork, the bowl, and the sprinkles, then share ideas as a class. (Make sure that students know not to touch the sprinkles with the tuning fork). Ask the students to pay close attention to what the effect of the tuning fork is. Now distribute the materials to each group (tuning fork, bowl with plastic wrap on a tray, and sprinkles). Add a few sprinkles at the center of the plastic covering the bowl and instruct the students to have each member of their group take a turn with the tuning fork. Once all students have had a turn, have them turn to a partner and explain what happened and why."

However, humming or making loud, low noises near (not blowing or breathing on!) the sprinkles or plastic wrap and watching for movement can effectively demonstrate the desired results.

- Lesson 1.3, Session #4, Extend/Elaborate, #23, "You can also have students observe what happens to the sprinkles if they hum close to the plastic wrap."

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While it is recognized that the materials intend a progression, or release of responsibility for students to practice collaboratively planning and conducting investigations, the reviewers are still unable to find enough evidence to negate the potential for inadequate, inappropriate, or misdirected design during Lesson 1.3:

- Lesson 1.3, Session #1, Explore, Part A #12: "Using the drum to make the sprinkles jump without touching the bowl."
- Lesson 1.3, Session #1, Explore, Part A #13: "If no group has thought about not touching the bowl while playing the drum, ask them to predict what would happen to the sprinkles if they played the drum close to but not touching the bowl. Have students share with a partner, then as a whole group."
- Lesson 1.3, Session #1, Explore, Part A, does not provide a successful investigation design for educators to reference. The materials do state that the bowl and the drum should not be touching, but it is valuable to provide educators with guidance so that they can accurately clear up misconceptions after students groups have explored their own designs.
- Lesson 1.3, Session #4, Extend/Elaborate #23, "Show the students how to tap the tuning fork on the side of the table. Have them turn to a partner and explain what they can do with the tuning fork, the bowl, and the sprinkles, then share ideas as a class. (Make sure that students know not to touch the sprinkles with the tuning fork). Ask the students to pay attention to what the effect of the tuning fork is. Now distribute the materials to each group (tuning fork, bowl with plastic wrap on a tray, and sprinkles)...and instruct students to have each member of their group take a turn with the tuning fork." The class and/or student groups did not have an opportunity to come to consensus and record an investigation design plan. The partner to whom the student turns to initially share ideas may not be in the student groups. The student groups are not given time to discuss a plan, nor direction for recording data (could be written, or drawn).

<u>Suggestions for Improvement</u>

- Consider revising the wording of the teacher prompts about "why sirens are so loud" or "how sirens work," or revising the chosen siren phenomenon. For example, Lesson 1.3 could be shifted to the beginning of the unit, making the speaker and rice, or maybe even the school's intercom the unit's anchor phenomenon.
- As the materials are written, they continue to be unrealistic in communicating that students will be creating a device out of simple materials that will be appropriately loud enough to replace an actual or pretend ambulance siren. Shifting language to explain that the class is limited by the available materials, but can still create loud devices (louder than those instruments investigated in Lesson 1.2) that can communicate over a distance (e.g., schoolyard field, classroom) would be very helpful. Students' devices may be similar (louder than an average item or sound), but not the same as a siren. The reviewers suggest considering revising the problem, or at least the Lesson 1.2, Session #2, Explore Part A #8 summary of the problem.

- Consider removing or modifying the statement in Lesson 1.2, Session #4, Explain, #19, "State that while their devices were different, they all were effective and solved the problem" to take into account the reality that students' devices will not be loud enough to solve the given problem.
- Reviewers strongly advocate that the plate of rice not be directly placed on the speaker. Instead, please consider directing educators to place a large, empty, upside down coffee can over, but not touching the speaker. The rice can be poured on the can's bottom, which is face up.

- The reviewers strongly suggest replacing the sprinkles with salt, as the salt particles will be lighter and more sensitive to small vibrations.
- The reviewers also suggest not using the tuning fork, and sticking instead with voice. The lower the tone, the more successful the investigation will be, so a tuning fork held near the plastic wrap may not yield results because of its very high pitch. A low-pitched humming, or "hey" beside and below the height of the plastic wrap was successful for reviewers. However, a note would have to be added with this revision reminding educators to remind students not to blow or breathe on the sprinkles.
- The reviewers suggest that developers consider providing for teachers exemplar investigation plans for the drum or tuning fork with sprinkles in Lesson 1.3 that will successfully demonstrate sound causing material to vibrate. While there is guidance for teachers to look for student group models and have those groups present to the class, a teacher that is unaware of the ideal investigation plan would not know what to look for.
- Consider adding guidance to the materials to ensure that the educator using the materials will be on the lookout for appropriate investigation design, and misconceptions. In addition, guidance could be added to the materials to support the educator in addressing misconceptions that may have been born from inaccurate investigation design.
- The reviewers suggest that the statement in Lesson 1.3, Session #4, Extend/Elaborate, #23, "Once everyone has shared, have students go to their notebook and record their observation of what happened" should be moved after step #25, the teacher demonstration. The opportunity for students to talk about their ideas with pairs in step #23 is valuable, but it would be more useful if a final written conclusion/explanation from individual students occurs only after the educator has had the opportunity to clear up misconceptions.

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: Adequate

The reviewers found adequate evidence that the materials provide guidance for teachers to support differentiated instruction. Evidence supports that the materials support a variety of students. However, the unit does not provide any student materials, only a step-by-step narrative to guide educator instructional delivery. There are no provided picture supports, student notebook templates, graphic organizers, etc. In addition, very limited evidence is present to guide educators in eliciting multiple modalities of expression from students.

Student Support Strategies: Suggested strategies for students who have not met the targeted expectations:

- "Centers—Set up a center at which students can continue to explore making vibrations and hearing/feeling sound. Pair students so that a student who understands the concept well works with another student who needs some help. This also helps those students who have a deeper understanding of the concepts as they refine their thinking through teaching."
- "Small Group Reteach—Set up a modified investigation in which students can work with the concept of vibrations producing sound. Select a few students who need extra support and question them as they explore the instruments."
- "One-on-One Conferences—Use silent reading time or other times when students work independently to conference with small groups or individual students."
- "Key Points—Have students describe the important points that should have been included in their model. List each of those key points on the board. After the discussion is completed and all of the important ideas are listed, number them. Have students then go back to their original work and number each of the key points that they included in their own model."
- "Scaffolds for Cause and Effect—
    - When <cause>, I notice <effect>.
    - If I want <effect>, I need to <cause>.
    - I wonder what the effect would be if _____.
    - I think _____ is causing _____."

- Suggested strategies for students who have met the targeted expectations:
    - "Self-Direction Opportunities—Present the activities in a more open-ended fashion so students can deepen their understanding of the relationship between vibrations and sound. This can include exploring changes in volume (soft-loud) or pitch (high-low). They can solve problems in novel ways, formulate their own questions, and plan investigations within the constraints of the classroom and available materials."
    - "Grouping—Advanced students are better served when paired up or in small groups; occasionally group them in same level groups."
    - "Crosscutting Concepts—While all students can and should interact with the crosscutting concepts, in this case cause and effect, have advanced students use other crosscutting concepts to think about and make sense of the phenomenon of sound. This could include what patterns they see or how the structure of an instrument produces different sounds (structure and function)."
    - "Deeper Levels of Challenge— Encourage students to continually expand on their thinking through the creation of more complex models, explanations, and arguments from evidence. Have them answer questions such as Why do you think that happened? or What would happen if?"

Other differentiation strategies are also included, such as:

- The front matter of each lesson references English Language Development (ELD) standards.
- Lesson 1.1, Session #1, Engage #1 Teacher Note: "If you have students who are hard of hearing or deaf, pair them with a student who can share what they are hearing through drawings."
- Lesson 1.1, Session #1, Engage Teacher Note: "Initially students have a hard time with the concept (practice) of asking questions. You can provide modified levels of support to students depending on their language needs: Substantial prompting and support for emerging speakers using sentence frames such as 'Why is ____?' or 'What does ____?' and minimal support for expanding and bridging speakers, with sentence frames such as: 'What would happen if ____?' or 'What cause ____?'"
- Lesson 1.1, Session #2, Explore 1 #10 , Teacher Note: "For hard of hearing or deaf students, have them touch the vibrating object, and explain that the vibrating object is producing sound, which they can feel, though not hear."
- Session 1.1, Session #5, Elaborate #28: "Optional scaffolds for cause and effect can be found on page 14 of the Narrative – these sentence frames can be made into a chart to display in the classroom."
- Session 1.1, Session #5, Elaborate #28: "Optional scaffold: 'A pattern I observed is ___' or 'I think this is a pattern because___.'"
- Lesson 1.1, Session #5, Evaluate Teacher Note: "Provide differentiated support to students based on their needs, such as: 'The guitar string _____and made _____.' or 'The ___ caused the ____'...Set up a center with some of the materials where students can continue to explore their

ideas and refine their thinking. You might try to pair students so that a student who understands the concept well works with another student who needs some help."

- Lesson 1.2, Session #1, Engage #3: "If you have students who are hard of hearing or deaf, have them touch the whistle as you blow it and let them know that the whistle is making a sound."
- Lesson 1.2, Session #1, Engage #4: "If you have students who are hard of hearing or deaf, make sure that hearing students share that there is a sound and that is louder or softer depending on how you blow the whistle."
- Lesson 1.2, Session #1, Engage #4: "Optional scaffolds on page 14 of the Narrative or point to a cause and effect chart if displayed."
- Lesson 1.2, Session #4, Explain #18: "(Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, reinforce the notion that vibrating matter causes sound and this pattern is repeated in every device they designed and built."
- Lesson 1.2, Session #5, Evaluate #22: "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The____, causes ____.' or 'The effect of____ is ____.', or '____ causes ____.')."
- Lesson 1.2, Session #5, Evaluate, Teacher Note: "For students who are still struggling with the concepts, or for those students who are able to demonstrate an advance understanding of the concepts at this time (see SEP, DCI, and CCC Instructional Rubric on page 12 and 13 of the Narrative), you can refer to the Student Support Strategies on page 14 of the Narrative."
- Lesson 1.3, Session #1, Engage #4: "If you have students who are hard of hearing or deaf, let them know when the speaker is on (ideally you would use a speaker that has a small light that turns on when the speaker is on, and a scale of lights as it gets louder)."

<u>Suggestions for Improvement</u>

- In several instances, students are asked to work collaboratively or independently to create investigation plans or record ideas regarding an explanation. The reviewers recommend that both blank templates (e.g., blackline masters for templates that students can cut out and glue into their science notebooks) and exemplar student work samples be added to the unit materials.
- Consider adding guidance for educators to support students in expressing their thinking through multiple options (e.g., independent writing, Cloze prompts for writing, labeled drawings, and verbal explanation dictated to educator)
- The reviewers do not think it necessary to leave out the FOSS Next Step (and Self-Assessment) Strategies, unless the developers do not have permissions to use this resource as part of the CA NGSS Early Implementation Initiative.
- First graders may not know how to create a numbered list and may need additional support in several components of designing investigations. Consider providing guidance for educators or student-facing materials that can support learners in designing investigations.
- All of the statements in the materials intended to prompt educators to support students that are hard of hearing or deaf can also support hearing students that are having difficulty making sense

of the phenomenon and using the three dimensions. Consider adding a note that the "touch" option can be for all students.

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

The reviewers found adequate evidence that the materials support teachers in facilitating coherent student learning experiences over time because the materials provide a structure for eliciting student questions throughout the materials.

The evidence supports that materials present efforts to connect lessons and promote learning linked to the three dimensions.

- Lesson 1.1, Session #1, Engage #4: "Have students share out with the class their ideas about sound. Draw a T-Chart on chart paper with 'What I Wonder' on the left and 'What I Found Out' on the right...Encourage students to ask what they wonder about sound and record their questions under 'What I Wonder'...You can introduce the question by saying: We have developed a list of great questions to investigate. Today we will start with a question that will help us solve the problem of a broken-down ambulance siren. This one right here... point to the T-Chart. What causes sound? How many of you are wondering the exact same thing? In a few minutes we are going to use our sense of sight (seeing), feeling (touch) and hearing to investigate the answer to that question."
- Lesson 1.1, Session #5, Elaborate #29: "Revisit the T-Chart with the list of questions from steps #3 and #4 and discuss which questions have been answered. Record what they have found out under "What I Found Out." Ask what other questions they might have and record these. Ask what they could do to find answers to their other questions."
- Lesson 1.2, Session #1, Engage #2: "...what questions remain on the T-Chart, and what other questions they might now have; record these on the T-Chart and discuss how they think they could find answer these questions."
- Lesson 1.2, Session #1, Engage #4: "Ask students to come up with questions they might have about the whistle, and how it is similar or different from what they observed in the previous lesson. Record their questions on the T-Chart."

- Lesson 1.3, Session #1, Explore Part A #5: "Ask the students what questions they have about what they just observed. Chart the questions from the group on the T-Chart."
- Lesson 1.3, Session #5, Evaluate #30: "Revisit the T-Chart with the list of questions from steps #3 and #4 from Lesson 1.1 and discuss which questions have been answered. Continue adding, revising, and connecting to their learning by recording what they found in this lesson out under 'What I Found Out,' Ask what they could do to find answers to their other questions. Depending on classroom constraints, available materials, and in line with established learning goals, have students plan investigations to answer their other questions."

Suggestions for Improvement

- For materials to be rated as Extensive in this criterion, all students would need to be engaged with a phenomenon or problem that is meaningful and relevant, that has intentional access points and supports for all students; and that can be explained or solved through the application of targeted grade-appropriate SEPs, CCCs, and DCIs as the central component of learning. Consider adding strategies for educators to support students in making the connection between the function of a siren and the concept that sounds makes matter vibrate, helping students understand why they need to engage in the learning of Lesson 1.3 in order to figure out how a siren works.
- The reviewers recognize that at the first-grade level it can be difficult to fully allow student questions to drive the direction of instructional materials. However, the reviewers suggest considering how the materials might encourage and support educators in helping students to develop their question asking skills or guide educators in crafting a question from student words. This is in contrast to prompting educators to simply give students the desired question (e.g., "What causes sound?"). For example, educators could take a list of student questions and wordsmith a new driving question that points the instruction in the desired direction. A list of sample student questions, or an image of actual charted questions from Grade 1 students would serve to support this effort.

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: Adequate

The reviewers found adequate evidence that the materials support teachers in helping students engage in the practices as needed and gradually adjust supports over time because throughout the course of the unit, the expectation for student application of some of the Science and Engineering Practices progresses from small group instruction to independent application.

Sounds - Grade 1
EQuIP Rubric for Science Evaluation

The evidence in the lesson progression below demonstrates the transfer from student application of some of the Science and Engineering Practices within a small-group setting to independent questioning, data analysis, and investigation design:

- The front matter of the unit, "Sounds, Grade 1" includes a resource titled "Science Talk Structures, Strategies, and Checklists," "Small group discussion can serve as a scaffold for English Learners or others less inclined to speak in a large group."
- Lesson 1.1, Session #1, Engage #4: "Lead the class in a discussion that through asking questions scientists can begin to think of investigations they can plan to answer their questions."
- Lesson 1.1, Session #1, Engage: "Teacher Note: Initially students have a hard time with the concept (practice) of asking questions. You can provide modified levels of support to students depending on their language needs: Substantial prompting and support for emerging speakers using sentence frames such as 'Why is ____?' or 'What does ____?' and minimal support for expanding and bridging speakers, with sentence frames such as: 'What would happen if ____?' or 'What cause ____?' You can also use prompts and questions to elicit students asking questions: 'Which of these questions are you wondering about?', or 'Is your question ____?' for emerging speakers, and 'What questions do you have about ____?' or 'What would be another question?' for expanding and bridging speakers."
- Lesson 1.1, Session #2, Explore 1 #6: "The teacher will lead the class in a think-aloud to collaboratively plan a science Investigation. Ask students to identify the phenomenon and purpose of the investigation. Explain that when we plan an investigation we want to focus our thinking on the following three areas (chart these as you complete step 6)..."
- Lesson 1.1, Session #2, Explore 1: "Teacher Note: The purpose of collaboratively planning this investigation is to provide a progression in the use of this science and engineering practice (Plan and conduct investigations). During Lesson 3 students will be planning investigations with their groups and individually, so this lesson will lay the foundational work and create a chart to serve as a reference and support students during those lessons."
- Lesson 1.1, Session #4, Explain 2 Part B #25: "Assign each group one sound station (preferably each group would have a different station). On a provided piece of chart paper or large whiteboard, have each group create a drawing of their given object, using labels and color to show what caused a sound to be made. Introduce the conventions of a scientific model (shows change or movement by using arrows, labels for the parts, clearly drawn, etc.). Have groups add the sentence frame that has been consistently referred to and used during this lesson to their chart explaining the cause of the sound that their instrument made. ('When _____ then_____.')"
- Lesson 1.1, Session #4, Explain 2 Part B #26: "Then have them present their model. Model and work together with students to create a graphic organizer on the whiteboard to record examples from the stations. Co-construct cause-and-effect statements that students can practice stating orally."
- Lesson 1.1, Session #5, Elaborate, Teacher Note: "Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations). Provide differentiated support to students based on

their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"

- Lesson 1.3, Session #1, Explore Part A #6: "Go through the class questions together. Ask students to show thumbs up if they think the question can be answered by doing a science investigation. Ask the students to give thumbs down if they think the questions cannot be answered with a science investigation. Circle the questions that the students identify as being able to be answered with a science investigation. This should narrow the list of possible questions to investigate. Help the students narrow down which question on the list they would like to investigate (and use teacher moves to get the class to): What caused the rice to move on the speaker?"
- Lesson 1.3, Session #1, Explore Part A #8: "For each idea (claim) that students shared, ask them to think about how they might test those ideas. Have a few students share their tests. Ask what kind of evidence the test might give the class. Have a few students share. Let students know that we will be using two tests to gather evidence for our question: What caused the rice to move on the speaker?"
- Lesson 1.3, Session #1, Explore Part A #9: "Refer students to the investigation-planning chart used in the first lesson (step 5). Ask them to read the 3 areas necessary to plan an investigation: • the question that we are trying to answer • materials we are using • the data we are collecting and how we are collecting it"
- Lesson 1.3, Session #1, Explore Part A #11: "Have the students independently think about how they could use the objects introduced in step 10 (drum, bowl with plastic wrap over it, sprinkles or salt) to answer the question 'What caused the rice to move on the speaker?'"
- Lesson 1.3, Session #1, Explore Part A #12: "While standing behind their chairs have the students talk to their group and verbalize a plan to answer this question, which includes what data they will be collecting. Give the groups about 5–10 minutes to talk through the plan. As groups are talking, be listening for a group or two that are discussing a plan that will help them answer the investigation question."
- Lesson 1.3, Session #1, Explore Part A #13: "Using the preselected groups you identified during their work time in step 9, have a couple of groups share out their verbal plan. As groups are sharing out, record a few key points for class reference. Some examples that might help scaffold the planning process for students are…"
- Lesson 1.3, Session #1, Explore Part A #14: "Have each group get back together to finalize their investigation plans orally."
- Lesson 1.3, Session #1, Explore Part A #15: "Have students work individually to write their plan in their notebook."
- Lesson 1.3, Session #1, Explore Part A Teacher Note: "The purpose of having the students work on their plan individually is that it provides an opportunity for the teacher to see how each student is doing in their ability to plan investigations. While students are being scaffolded through the group conversations and the resulting key points on the board in step 10, the plan the students actually write up in their notebook will provide evidence for each student's development in this SEP."

Suggestions for Improvement

- In order to be rated as Extensive, the instructional materials would need to provide specific guidance to create learning experiences targeting students with diverse needs and abilities so they can make progress over time toward common learning goals of engaging in the practices and making sense of phenomena and developing solutions to problems. Students who are exceeding the expectations could begin to engage in practices from the next grade band level, such as:
    - Identifying the role of variables (what do you think would happen if the string was longer/shorter, or the drum was larger/smaller)
    - Planning and conducting an investigation collaboratively to produce data using controlled variables (compare and measure the sound from different instruments at a set distance)
    - Constructing an explanation of why sound is louder when there are more things making the sound and vice versa
- It would be helpful if supports were provided for all students to engage in the SEPs in ways that not only integrate the other two dimensions, but also explicitly build an understanding and proficiency in the SEPs over time through a variety of student approaches over the course of the unit.
- Consider supporting students to build their independent capacity to develop and use models to demonstrate their understanding of sound as well as the causes and effects of sounds

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

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

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 within each lesson, students are prompted to respond to tasks that elicit three-dimensional performances.

Examples of opportunities for students to demonstrate three-dimensional performances include:

- Lesson 1.1, Session #2, Explore 1 #8–9: Students engage in conducting an investigation; they are asked to determine "what data we are collecting as we visit each station." Students are provided a "sentence frame to help students frame their thinking, "If _____, then _____." "As the students explore, ask questions about what they see happening to cause a sound, and encourage students to use the sentence frame to explain the cause and effect relationship if they need support."
- Lesson 1.1, Session #4, Explain 2 Part B #25: "Assign each group one sound station (preferably each group would have a different station). On a provided piece of chart paper or large whiteboard, have each group create a drawing of their given object, using labels and color to show what caused a sound to be made. Introduce the conventions of a scientific model (shows change or movement by using arrows, labels for the parts, clearly drawn, etc.). Have groups add the sentence frame that has been consistently referred to and used during this lesson to their chart explaining the cause of the sound that their instrument made. ('When _____ then_____.')"
- Lesson 1.1, Session #4, Explain 2 Part B #26: "Bring the class back together and have each group take turns presenting their assigned station. Start each group presentation by having them use the actual object to demonstrate what caused the sound to be made. Then have them present their model. Model and work together with students to create a graphic organizer on the whiteboard to record examples from the stations. Co-construct cause-and-effect statements that students can practice stating orally."
- Lesson 1.1, Session #5, Elaborate #28: "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share

their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships...The key understanding that we want to make sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold: 'A pattern I observed is ____' or 'I think this is a pattern because ____.') Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships." In this instance, no artifact is being produced so the educator may not be able to assess the understanding of all students.

- Lesson 1.1, Session #5, Evaluate #32: "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations)."
- Lesson 1.2, Session #2, Explore Part A #10: "Pose the challenge to students again: How can we design and test a device that causes a loud sound using these materials? Have students return to their seats and independently think about how they could use the materials to complete this task. In their notebook, have each student draw their design for their device."
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- Lesson 1.2, Session #5, Evaluate #21: "In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show ___ another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others." In this instance, no artifact is being produced so the educator may not be able to assess the understanding of all students.
- Lesson 1.2, Session #5, Evaluate #22: "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The____, causes ____.' or 'The effect of____ is ____.', or '____ causes ____.'). Discuss why scientists and engineers look for cause-and-effect relationships. Ask students how the cause- and-effect relationship helped them understand more about a phenomenon." While this content produces an artifact from all students, it is not three-dimensional.
- Lesson 1.3, Session #2, Explore Part B #17: "Distribute a set of materials to each group. Students should conduct their investigation based on their plans. Remind them to collect their data in their notebooks. While groups are working, circulate around the room and listen to the conversations the groups are having. Specifically listen for how students are describing the movement of the sprinkles and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur."
- Lesson 1.3, Session #3, Explain #18: "Provide each group with a large piece of paper (chart paper or construction paper) or whiteboard. Have each group draw up a picture of the drum, bowl, and sprinkles, and ask students to label what is vibrating and what is causing the vibrations to happen. (The drum's sound caused the sprinkles to vibrate.)"

- Lesson 1.3, Session # 5, Evaluate #29: "Ask students to think about the anchoring phenomenon: the sound made by Emergency Sirens. Ask students to discuss with a partner the answers to the questions: What causes the siren to make sound? And What does the siren sound do?" In this instance, students would not necessarily produce an artifact.
- Lesson 1.3, Session #5, Evaluate #29: "Ask students to write and/or draw a scientific explanation of the questions. Provide students with the sentence stem, if needed: I think sirens; My evidence for this is; The sound."

Suggestions for Improvement

- Any instance in which all students are asked to use grade appropriate elements of the three dimensions of the NGSS to produce an artifact that demonstrates what they have figured out about a phenomenon or problem can count as evidence for this criterion. Examples of evidence above in purple text represent instances where student artifacts were not necessarily three-dimensional or where not all students would produce artifacts. For example, unit material such as Lesson 1.1, Session #5, Elaborate, #28 and Lesson 1.2, Session #5, Evaluate, #21 are not considered supporting evidence for this criterion because no artifact is being produced so the educator may not be able to assess the understanding of all students. The reviewers recognize that the developers may not have intended the content above in purple font to be opportunities for three-dimensional assessments. However, it is suggested that these areas be revisited to enhance them to be three-dimensional or provide guidance for processes that would allow an educator to collect data about all students.
- Consider which student products provide opportunities to measure individual student application; within a class discussion this may not be measurable.

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

Rating for Criterion III.B. Formative: Adequate

The reviewers found adequate evidence that the materials embed formative assessment processes throughout that evaluate student learning and inform instruction because the unit was rich in opportunities to elicit student thinking. Over the course of the materials, the variety of assessments should provide the teacher and student feedback about the degree to which the intended learning has been accomplished by all students. The materials frequently direct the educator to "ask students..." However, the materials do not include consistent guidance regarding how to interpret student performance and how to use this information to suggest next steps for instruction based on expected student responses.

Sounds - Grade 1
EQuIP Rubric for Science Evaluation

The following evidence is specified in the materials as being Formative Assessment:

- Lesson 1.1, Session #5, Evaluate #32: "Teacher Note: For formative assessment, collect the notebooks at the end of the session and review students' answers to the question: What causes the guitar's sound?" "Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations). Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"

The following evidence has not been specified as formative assessment in the materials, but could be interpreted as such with revisions:

- Lesson 1.1, Session #1, Engage #1: "Ask students how we use our senses to make scientific observations. (If making scientific observation has not been introduced, spend a few minutes having a class discussion regarding how we use our senses to observe the world.)"
- Lesson 1.1, Session #1, Engage, page 4 #1: "Stop at least four different locations and ask students to record their observations in their notebooks using drawings and words."
- Lesson 1.1, Session #1, Engage #5: "Have students share with their elbow partner what they think they know about what causes sound, even if they are not sure. Have students share with the class and chart their ideas. Use this activity as a pre-assessment of students' prior knowledge about sounds and what causes them."
- Lesson 1.1, Session #2, Explore 1 #6: "The teacher will lead the class in a think-aloud to collaboratively plan a science Investigation. Ask students to identify the phenomenon and purpose of the investigation."
- Lesson 1.1, Session #2, Explore 1 #9: "Set a timer for 10 minutes and instruct the students to begin by trying to make a sound and then figuring out what causes the sound. Provide a sentence frame to help students frame their thinking, "If _____, then _____." During this time the teacher should circulate around the stations. As they work, walk around the groups with a performance assessment checklist of students' names that includes columns for: asking questions and defining problems; planning and carrying out investigations; constructing explanations; cause and effect; PS4A. Make quick notes on how students are doing in all 3 dimensions." [The rubric in the narrative is referenced as a means to determine the students' level of understanding of the DCI, CCC, and SEP at this time.] "As the students explore, ask questions about what they see happening to cause a sound, and encourage students to use the sentence frame to explain the cause and effect relationship if they need this support."
- Lesson 1.1, Session #2, Explain 1 #14: "At this point, it would be a good place for the teacher to review at least half of the students' notebooks and to look at the data that has been collected. Through using sticky- notes, or some other removable paper, provide feedback to students about the quality of the data they are collecting. Through asking questions about their drawings or writing, you can often help students think more deeply about their data. With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and

sound, ask questions specifically about how their drawing shows the cause of the sound they hear or feel."

- Lesson 1.1, Session #2, Explain 1: "...Often through asking questions, teachers can help students think about their notebook in a different perspective. Feedback is best shared with students through writing questions on a sticky note or other removable paper, not writing directly on the student notebook."
- Lesson 1.1, Session #3, Explore 2 #16: "Set a timer for 10 minutes and instruct the students to begin by trying to make a sound and then figuring out what causes the sound. During this time circulate around the stations. As the students explore, ask questions about what they see or feel happening to cause a sound. Direct student's attention to the frame that was used yesterday about the cause of the sound they hear or feel. ('If _____, then _____,' or 'When _____, then _____.') At all stations, students should clearly see or feel an object vibrating causing the sound, although the word vibrate may not be familiar to or used by students. The use of the word vibrate/vibration is not an expectation at this time, just that they see the object moving back and forth causing sound."
- Lesson 1.2, Session #5, Evaluate #21: "Have each student draw and label the parts of the revised device their group made in their notebook. Review the conventions of drawing and labeling models, (e.g., using arrows to show movement, labeling with lines). In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show ___ another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others."
- Lesson 1.1, Session #4, Explain 2 Part B #25: "Assign each group one sound station (preferably each group would have a different station). On a provided piece of chart paper or large whiteboard, have each group create a drawing of their given object, using labels and color to show what caused a sound to be made. Introduce the conventions of a scientific model (shows change or movement by using arrows, labels for the parts, clearly drawn, etc.). Have groups add the sentence frame that has been consistently referred to and used during this lesson to their chart explaining the cause of the sound that their instrument made. ('When _____ then_____.')"
- Lesson 1.1, Session #4, Explain 2 Part B #26: "Bring the class back together and have each group take turns presenting their assigned station. Start each group presentation by having them use the actual object to demonstrate what caused the sound to be made. Then have them present their model. Model and work together with students to create a graphic organizer on the whiteboard to record examples from the stations. Co-construct cause-and-effect statements that students can practice stating orally."
- Lesson 1.1, Session #5, Elaborate #28: "Once all the groups have presented, ask the students the question from the beginning of the lesson sequence: "What causes sound?" Have students share their opinion (claims) about the relationship between vibrations and sound. Encourage them to talk about cause and effect relationships. Ask them how the investigations help them understand the cause of sound." (Optional scaffolds noted.) "The key understanding that we want to make

sure the students have come to is that vibrating matter can make sound. At this point, it is appropriate to begin to ask the students to further develop their use of the crosscutting concept cause and effect. Ask the students if there were any patterns they observed among all the stations. (Optional scaffold noted.) Through a guided discussion, it should begin to become evident that vibrating matter causes sound and this pattern is repeated in every sound station they visited. Explain that identifying patterns helps us understand cause and effect relationships."

- Lesson 1.2, Session #1, Engage, page 4 #1: "Seat students at the carpet in a circle. Ask students to turn to a partner and answer the question from lesson #1, "What causes sound?" Have a couple of students share out their answers. Ask students how they know and have a couple share their answers."
- Lesson 1.2, Session #2, Explore Part A, page 5 #6: "Begin by blowing the whistle and playing the siren. Ask the students what caused each device to be able to communicate over a distance. Have a couple of students share out. (Both items were loud enough to be heard from a distance)"
- Lesson 1.2, Session #2, Explore Part A, page 5 #7: "Set up the scenario by asking students: "What would happen if the siren of the ambulance was not working?" Ask students to discuss in their groups why this might be a problem. Discuss as a class and chart the group's responses."
- Lesson 1.3, Session #2, Explore Part B #17: "Distribute a set of materials to each group. Students should conduct their investigation based on their plans. Remind them to collect their data in their notebooks. While groups are working, circulate around the room and listen to the conversations the groups are having. Specifically listen for how students are describing the movement of the sprinkles and notice if anyone is using the word vibrate. Students should specifically be discussing what causes the movement to occur. Look at the data (drawing and writing) students are collecting in their notebook, noticing the patterns among the students' observations. Use a performance assessment checklist that includes columns for: planning and carrying out investigations; constructing explanations; cause and effect; PS4A. Make quick notes on how students are doing in all 3 dimensions. (Later use the rubric on page 12 and 13 of the Narrative to determine the students' level of understanding of DCI, CCC, and SEP). As the students explore, ask questions about what they see happening to cause a sound, encourage students to use the sentence frame to explain the cause and effect relationship."
- Lesson 1.3, Session #3, Explain #18: "Teacher Note: As the groups work, circulate around looking at each group's drawing. Be sure to look for their labels and their explanation of the sound causing vibration. If there still seems to be some confusion for a group, look for another group who could share their model to help. These group models will serve as a consensus model which gives another opportunity for students to further think about what they observed about the cause and effect relationship between sound and vibration."

Suggestions for Improvement

- While there are opportunities for individual students, as well as student groups, to record thinking in their notebooks in the form of drawing or writing, the most frequent form of formative assessment is eliciting verbal responses. It would be helpful to provide guidance for how, along

with charting, the teacher or students could be taking record of these conversations. It would be even more helpful to add language to the materials about how educators could use these verbal contributions to make instructional decisions.

- Additionally, it is suggested that the materials provide more supports or alternatives for all students when asked to make verbal contributions. Suggesting wait time, or the use of Think-Pair-Share each time the materials direct the educator to elicit student verbal responses may help. Additionally, the materials could provide educators with alternatives to offer students, like recording thinking in writing on sticky notes, or getting up to demonstrate (show) thinking with physical materials.
- Consider increasing the prevalence of materials that guide educators in shifting instruction in response to student contributions. The materials would ideally be explicit so as to guide an educator as they reflect to answer the questions, "What does this tell me and what do I do next?"
- The reviewers suggest that the materials provide expected student responses for most verbal and written prompts, as well as guidance on pedagogical moves for when students do not provide the expected response.

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

The reviewers found inadequate evidence that the materials include aligned rubrics and scoring guidelines that help the teacher interpret student performance for all three dimensions because clear guidance is not provided for teachers to interpret student progress in relation to both the instructional materials as well as the targeted dimensions. Although a rubric is provided, there is no narrative to support the appropriate use of the rubric.

While the provided rubric includes all three dimensions, the materials do not show clear evidence that an educator would be adequately supported in interpreting student performance and progress, as well as appropriately planning for next steps.

- The provided rubric in the Introductory Narrative includes a row for SEPs, DCIs, and CCCs
- Lesson 1.1, Session #2, Explore 1 #9: "...As they work, walk around the groups with a performance assessment checklist of students' names that includes columns for: asking questions and defining problems; planning and carrying out investigations; constructing explanations; cause and effect; PS4A. Make quick notes on how students are doing in all 3 dimensions." A generic checklist is not adequate evidence for scoring guidance within specific lessons and/or units.
- Lesson 1.1, Session #2, Explore 1 #9: "Later use the rubric on page 12 and 13 of the Narrative to determine the student's level of understanding of DCI, CCC, and SEP at this point in time; you will do this again in Lessons 1.2 and 1.3."

- Lesson 1.1, Session #2, Explore 1, #9 Teacher Note: "As you assess students' performance with the SEPs using the checklist you can refer to the SEP, DCI, and CCC Instructional Rubric on page 12 and 13 of the Narrative to identify the level of students with respect to the 3 practices targeted."
- Lesson 1.1, Session #5, Elaborate, #32, Teacher Note: "Use the 3-dimensional rubric on pages 12 and 13 of the Narrative to assess students understanding."
- Lesson 1.2, Session #3, Explore Part B #14: "Give each group time to construct their device. As they work, walk around the groups with a performance assessment checklist of students' names that includes columns for: asking questions and defining problems; planning and carrying out investigations; constructing explanations; cause and effect; PS4A; PS4C. Make quick notes on how students are doing in all 3 dimensions."
- Lesson 1.2, Session #3, Explore Part B #14: "Later use the rubric on page 12 and 13 of the Narrative to determine the student's level of understanding of DCI, CCC, and SEP."
- Lesson 1.3, Session #2, Explore Part B #17: "...Use a performance assessment checklist that includes columns for: planning and carrying out investigations; constructing explanations; cause and effect; PS4A. Make quick notes on how students are doing in all 3 dimensions."
- Lesson 1.3, Session #2, Explore Part B #17: "Later use the rubric on page 12 and 13 of the Narrative to determine the student's level of understanding of DCI, CCC, and SEP."
- While a rubric is provided, there is no narrative to support the appropriate use of the rubric.
- The materials do not include student work exemplars.

<u>Suggestions for Improvement</u>

- It would be helpful if scoring rubrics provided the connection between the assessment, the targeted three-dimensional learning goals (i.e., NGSS three dimensions), and the learning experiences students have previously had. They would ideally target all dimensions being assessed and would provide guidance for how to interpret student performance along all three dimensions as well as their integration and sense-making. Scoring guidance could support teachers, students, and possibly parents in monitoring student progress toward their ultimate learning goals.
- Consider referencing NGSS Appendix F: Science and Engineering Practices to more closely align the rubric language with the K–2 grade band expectations.
- The reviewers suggest that an example of the "performance assessment checklist" referenced in Lesson 1.1, Session #2, Explore 1, #9 be provided. Additionally, the checklist categories could be more helpful if they included more than just "Asking Questions" etc. The checklist could instead include the specific elements of SEPs, CCCs, and DCIs targeted in that lesson.
- It is suggested that the front matter of the unit include a narrative to support the accurate and appropriate use of any provided rubrics.
- The scoring guidance within the lessons is currently very general. Instead of reusing the phrase, "later use the rubric on page 12 and 13 of the Narrative to determine the student's level of understanding of DCI, CCC, and SEP," consider providing guidance that is more specific to each individual task.

- The materials would be significantly enhanced by including student work exemplars.
- The developers may also consider including an example of a rubric that can be shared and used with students.

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

The reviewers found adequate evidence that the materials assess student proficiency using accessible and unbiased methods, vocabulary, representations, and examples. Overall, students are supported in conveying their thinking through multiple formats (e.g., notebooks, writing, drawing, labeling, as well as partner, small, and whole group discourse).

Evidence related to this criterion includes:

- Appropriate Text/Vocabulary: Vocabulary (science and non-science) is grade level-appropriate and the amount of text in tasks/items is grade appropriate. For example:
    - Lesson 1.1, Session #2, Explore 1 #10: "Teacher Note: At all stations students should clearly see an object vibrating that is making the sound, although the word vibrate may not be familiar to or used by students. The use of the word vibrate/vibration is not an expectation at this time, just that they see the object moving back and forth to make sound"
    - Lesson 1.1, Session #4, Explain 2 Part B, page 10 #27: "Ask students what kind of motions they observed (springing, stretching, wiggling, etc.). Show students that when you pluck (pull and let go) the rubber band it moves back and forth really fast. Tell students that this is called vibration. You can't always see vibration, but you can hear or feel it."
- Culturally Neutral: Representations or scenarios are culturally neutral or support teachers to be aware of the limitations of the scenario for reaching all students and provide potential scaffolds to make sure that students have the background they need to be successful with the task. For example:
    - Lesson 1.1, Session #1, Engage #3: "Ask the students about other sounds they have heard. Ask the students if they heard any animals' sounds and if they can identify what animal was making the sound. Have the students share with a partner why they think animals make sounds (to communicate, such as birds and crickets). Create a list of other sounds both at school and out in the community or in nature. This list should start to get students to think of sound as a larger concept that is a part of our lives and nature, but often not focused on. Tell the students that you heard this interesting sound and you want to know if they can help you figure out what it is. Play the siren and a siren video. If you have students who are hard of hearing or deaf, have them touch the siren as you play it. Ask

students about when, where, and why they may have heard that siren, and what they think causes the siren's sound. Have them think of questions they might have about the sound and chart them. Let students know that they will be learning how sirens work and what they are used for. (Be aware that some students might display feelings of anxiety as they listen to a siren. If this is the case, provide an opportunity for students to express their feelings, and then explain that we will be learning how an ambulance siren works). Let students know that their challenge will be to design a device that makes a loud noise that they can use in a pretend ambulance to drive safely through the streets if their siren is not working, and for this we first need to learn about more sound."

- Multiple modalities: Tasks/items provide a variety of ways for students to convey their answers (e.g., talking about their learning; creating visual representations, writing short and more complex answers, etc.). For example:
    - Lesson 1.1, Session #2, Explore 1 #8: "Explain to students that they will be working in groups of 4 to conduct this investigation. Refer to the plan and ask students what data we are collecting as we visit each station. Clarify that at each station students will need to draw the object and label what is making the sound in their notebook."
    - Lesson 1.1, Session #4, Explain 2 Part B #25: "Assign each group one sound station (preferably each group would have a different station). On a provided piece of chart paper or large whiteboard, have each group create a drawing of their given object, using labels and color to show what caused a sound to be made. Introduce the conventions of a scientific model (shows change or movement by using arrows, labels for the parts, clearly drawn, etc.). Have groups add the sentence frame that has been consistently referred to and used during this lesson to their chart explaining the cause of the sound that their instrument made. ('When _____ then_____.')"
    - Lesson 1.1, Session #4, Explain 2 Part B, page 10 #26: "Bring the class back together and have each group take turns presenting their assigned station. Start each group presentation by having them use the actual object to demonstrate what caused the sound to be made. Then have them present their model. Model and work together with students to create a graphic organizer on the whiteboard to record examples from the stations. Co-construct cause-and-effect statements that students can practice stating orally."
    - Lesson 1.1., Session #5, Evaluate: "Teacher Note: For Formative Assessment, collect the notebooks at the end of the session and review students' answers to the question: What causes the guitar's sound? Expected student response: Students describe in words or drawings their observations that provide evidence for that claim (e.g., the guitar string vibrated and caused sound, or the sound is caused by vibrations). Provide differentiated support to students based on their needs, such as: 'The guitar string _____ and made _____.' or 'The _____ caused the ____.'"
    - Lesson 1.2, Session #2, Explore Part A #10: "Pose the challenge to students again: How can we design and test a device that causes a loud sound using these materials? Let students know that they will be making the loudest sound they can with the materials

they have, but that this sound would never be as loud as a real ambulance siren. Have students return to their seats and independently think about how they could use the materials to complete this task. In their notebook, have each student draw their design for their device."

- Lesson 1.2, Session #5, Evaluate #21: "Have each student draw and label the parts of the revised device their group came up with in their notebook. Review the conventions of drawing and labeling models, (e.g., using arrows to show movement, labeling with lines). In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show ___ another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others."
- Lesson 1.3, Session #1, Engage #4: "Begin to play music through the speaker." [Support for hard of hearing or deaf student is noted.] "Have students closely observe what is happening. After students have observed for a few minutes, have them record their observations in their notebook using drawings and words. Ask students to use the following stem: I saw _____ when the speaker began to play music."
- Lesson 1.3, Session #1, Explore Part A #15: "Have students work individually to write their plan in their notebook."

Suggestions for Improvement

- This criterion focuses on whether or not the tasks or items for measuring student learning are sensitive to the variety of students in the nation's classrooms. Essentially, for materials to be rated as Adequate, the materials have to use developmentally appropriate text, provide tasks that do not assume all students know culturally-specific knowledge, and use a variety of modalities to collect information from students. To be rated as Extensive, the materials would leverage students' funds of knowledge within assessment opportunities.
- Consider including a series of potential student responses, including the ideal response, to show educators a spectrum of student understanding.

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

The reviewers found adequate evidence that the materials include pre-, formative, summative, and self-assessment measures that assess three-dimensional learning because assessments are in each of the individual lessons and the assessment progression (how each element of the three dimensions is assessed over time) is briefly described in the front matter narrative. However, there is limited evidence to about

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how each task will measure student learning and provide teachers with feedback to inform connected instruction throughout the unit.

The evidence below largely describes the integrated opportunities for assessment. However, adding further guidance is suggested to address why the assessments are occurring at these points within the unit and specifically what the teacher should be doing with the data collected. Any time that student artifacts are being produced by *all* students in the classroom can be considered a measurement of student learning. Within the materials, moments during which educators are prompted to "Ask students…" might be mistaken as opportunities for assessment. For example, in Lesson 1.3, Session #5, #29, the first two questions that students are asked to discuss with a partner are not considered as viable measures of student learning within an assessment system of the unit, as the educator would not hear from every student. However, the written or drawn student explanation could serve as assessment evidence.

- Front matter of the unit, "Sounds, Grade 1," Learning Sequence Narrative: "This is the first lesson out of a sequence of four. The lesson begins by connecting to the fact that kids hear sounds all day every day by going on a sense walk and generating a list of things observed, specifically focusing on sounds heard. The anchoring phenomenon, the sound made by Emergency Sirens, is introduced in this lesson as one of the sounds that we hear or have heard before. Students are encouraged to ask questions, and to determine which ones can be investigated. Students will need support with the practice of asking questions, especially ones that can be investigated, as they usually do not have experience with this concept. Teachers can provide modified levels of support to students depending on their experience and language needs. The focus is on "What causes sound." As the lesson progresses, students are challenged to use materials at given stations to make sound and figure out what the cause of that sound is. During this time, the teacher will model how to plan and carry out an investigation. The large take-away at the end of the lesson is that vibrating matter makes sound. This idea is built up during the next lesson, where students are challenged to construct devices that make loud sounds as a form of communication."
- Front matter of the unit, "Sounds, Grade 1," Learning Sequence Narrative: "This lesson further develops this concept by having students apply their incipient knowledge about what causes sound to solve a challenge and create a device to communicate over a distance. The next lesson will have students investigate how sound causes vibrations."
- Lesson 1.1, Session #1, Engage #5: "Have students share with their elbow partner what they think they know about what causes sound, even if they are not sure. Have students share with the class and chart their ideas. Use this activity as a pre-assessment of students' prior knowledge about sounds and what causes them."
- Lesson 1.2, Session #5, Evaluate #20: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations in their devices caused sound to be heard over a distance, and what they observed. Have students discuss how they think they could make their devices even louder. (If time permits, have the groups re-design their devices and test them again)."

- Lesson 1.2, Session #5, Evaluate #21: "Have each student draw and label the parts of the revised device their group came up with in their notebook. Review the conventions of drawing and labeling models, (e.g., using arrows to show movement, labeling with lines)."
- Lesson 1.2, Session #5, Evaluate #21: "In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others."
- Lesson 1.2, Session #5, Evaluate #22: "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The , causes .' or 'The effect of is .', or 'causes .')."
- Lesson 1.2, Session #5, Evaluate #22: "Discuss why scientists and engineers look for cause-and-effect relationships. Ask students how the cause- and-effect relationship helped them understand more about a phenomenon."
- Lesson 1.2, Session #5, Evaluate #23: "Have students explain why ambulances have sirens and how they think the siren might cause the sound."
- Lesson 1.3, Session #5, Evaluate #29: "Ask students to discuss with a partner the answers to the questions: What causes the siren to make sound? and What does the siren sound do?"
- Lesson 1.3, Session #5, Evaluate #29: "Ask students to write and/or draw a scientific explanation of the questions. Provide students with the sentence stem, if needed: I think sirens___. My evidence for this is____. The sound___."
- There is limited evidence of grade-appropriate self-assessment.
- There is limited evidence of opportunities for students to reflect on feedback and use the feedback to revise and construct learning.

Suggestions for Improvement

- Over the course of the materials, the variety of assessments would ideally provide the teacher and student feedback about the degree to which the intended learning was accomplished. It is recommended that to the materials is added a clear map (text or visual) that clarifies the assessment progression (how each element of the three dimensions is assessed over time). A more thorough description or visual of how the individual assessment prompts and pieces are connected coherently would be valuable for educators. The Conceptual Flow map within the front matter includes a color arrow in the key for "Assessments," but reviewers did not see specific evidence of individual assessments and their connections within the flow chart.
- Within the materials, moments during which educators are prompted to "Ask students…" might be mistaken as opportunities for assessment. Consider revising materials to be more explicit during any prompt that starts with "Have students explain…" Materials could describe how students will explain, in what format, and to whom. Consider which of these moments will be part of the assessment system and which moments are simply to inspire discourse.
- It is not required that every assessment be three dimensional. However, over the course of the materials, the variety of assessments would ideally provide the teacher with student feedback

about the degree to which the intended three-dimensional learning has been accomplished. In order to be rated as Extensive, materials would need to include assessments that are consistently designed to 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. Additionally, most or all tasks and items would need to be multi-dimensional, there would need to be significant tasks, and the measurement of the three dimensions would proportionally match up with the learning goals.

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

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. However, opportunities to provide feedback are largely limited to Lesson 1.1 and there are limited opportunities for students to reflect upon and apply the feedback provided.

The following examples illustrate opportunities for feedback to be applied to student performance of practices:

- Lesson 1.1, Session #1, Engage #5: "Use this activity as a pre-assessment of students' prior knowledge about sounds and what causes them."
- Lesson 1.1, Session #2, Explain 1 #14: "...Through using sticky- notes, or some other removable paper, provide feedback to students about the quality of the data they are collecting. Through asking questions about their drawings or writing, you can often help students think more deeply about their data. With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and sound, ask questions specifically about how their drawing shows the cause of the sound they hear."
- Lesson 1.1, Session #2, Explain 1: "Teacher Note: When providing feedback to students in their notebook, the purpose is to help students deepen their thinking and not to penalize students. In that line of thought, feedback should be provided in a format that helps students revise or add to their notebook, not feel like they are wrong. Often through asking questions, teachers can help students think about their notebook in a different perspective. Feedback is best shared with students through writing questions on a sticky note or other removable paper, not writing directly on the student notebook."
- Lesson 1.1, Session #3, Explain 2 Part A #22: "At this point, it would be another good place for the teacher to review the other half of the student's notebooks and to look the data that has been collected. Through using sticky-notes, or some other removable paper, provide feedback to students about the quality of the data they are collecting. Through asking questions about their

drawings or writing, you can often help students think more deeply about their data. With the focus of this investigation being on developing the cause and effect relationship between vibrating matter and sound, ask questions specifically about how their drawing shows the cause of the sound they hear or feel."

- Lesson 1.1, Session #3, Explain 2 Part A: "Teacher Note: When providing feedback to students in their notebook, the purpose is to help students deepen their thinking, not to penalize students. In that line of thought, feedback should be provided in a format that helps students revise or add to their notebook, not feel like they are wrong. Often through asking questions, teachers can help students think about their notebook in a different perspective. Feedback is best shared with students through writing questions on a sticky note or other removable paper, not writing directly on the student notebook. Questions and comments can include: Use the science words in your answer. Can you tell me why you think that? Label what is making the sound in your drawings. Pre- select common feedback from a few notebooks to share at the beginning of the next lesson."
- Lesson 1.1, Session #4, Explain 2 Part B #23: "Ask students to look back in their notebooks and find the teacher feedback from the last session(s). Walk around helping them read the feedback if needed and then share the few common feedback comments you selected."
- Lesson 1.1, Session #5, Elaborate #28: "...Revisit the list of questions from steps #3 and #4 and discuss which questions have been answered and what other questions they might have. Record these..."
- Lesson 1.1, Session #5, Evaluate #31–32: "Pose the question: What causes the guitar's sound? Have the students respond to this question in their notebook."
- Lesson 1.2, Session #3, Explore Part B #12: "Send students back to their groups. Have each student share their designs from step 8 in their group. Each group needs to decide on one design to construct. As they reach consensus, check in with each group to see their plans for the device they will be building and give feedback as needed."
- Lesson 1.2, Session #5, Evaluate #20: "Ask the students to describe what they did in the last session. Have them explain the simple test they carried out (taking their devices outside and testing them one at a time) to gather evidence that vibrations in their devices caused sound to be heard over a distance, and what they observed. Have students discuss how they think they could make their devices even louder. (If time permits, have the groups re-design their devices and test them again)."
- Lesson 1.2, Session #5, Evaluate #21: "Have each student draw and label the parts of the revised device their group came up with in their notebook. Review the conventions of drawing and labeling models, (e.g., using arrows to show movement, labeling with lines)."
- Lesson 1.2, Session #5, Evaluate #21: "In pairs, have students practice asking each other questions about their models using these prompts: What does your model explain? What does this part show? How could you show another way? Have students discuss how their drawings (models) help them understand how their devices work and also help them communicate this to others."

- Lesson 1.2, Session #5, Evaluate #22: "Have students explain in writing what caused their device to be able to communicate across a distance. (Optional scaffold: 'The , causes .' or 'The effect of is .', or 'causes .')."
- Lesson 1.2, Session #5, Evaluate #22: "Discuss why scientists and engineers look for cause-and-effect relationships. Ask students how the cause- and-effect relationship helped them understand more about a phenomenon."
- Lesson 1.2, Session #5, Evaluate #23: "Have students explain why ambulances have sirens and how they think the siren might cause the sound."
- In Lesson 1.2, there is no evidence to show that students are given the opportunity to process and apply feedback.
- Lesson 1.3, Session #5, Evaluate #29: "Ask students to discuss with a partner the answers to the questions: What causes the siren to make sound? and What does the siren sound do?"
- Lesson 1.3, Session #5, Evaluate #29: "Ask students to write and/or draw a scientific explanation of the questions. Provide students with the sentence stem, if needed: I think sirens___. My evidence for this is____. The sound___"
- In Lesson 1.3, there is no evidence to show that students are given the opportunity to process and apply feedback.

Suggestions for Improvement

To be rated as Extensive, materials would need to provide multiple, interconnected opportunities over time; for key, claimed learning in the unit there would be multiple, linked student performances that provide students with several opportunities to demonstrate understanding. Additionally, students would have opportunities to utilize multi-modal feedback across a series of performances to demonstrate new thinking based on peer and teacher feedback and personal reflection.

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): 2
Category III: Monitoring NGSS Student Progress Score (0, 1, 2, 3): 2
Total Score: 6

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Overall Score (E, E/I, R, N): E/I

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)*