Lesson 3.4
Seeing Sound
Lesson Overview

Through reading the book *Seeing Sound*, students are introduced to different kinds of professionals—scientists, audiologists, doctors, and sound engineers—who visualize sound in their jobs. Students prepare to read by reviewing the ways in which they have visualized sound, and they read the first part of the book together in order to set a purpose for reading. Students read the book in pairs and record notes about why each kind of professional visualizes sound. In order to do this, students draw from the visual representations as well as from the text. Students then engage in a whole-class discussion during which they reflect on the patterns that are visible in the book’s visual representations. In this lesson, students learn about real-world applications of the science ideas they have been learning in this unit.

**Anchor Phenomenon:** Dolphins in Blue Bay National Park communicate with one another underwater and calves only respond to their mother’s call.

**Investigative Phenomenon:** Sounds can be high-pitched or low-pitched.

**Everyday Phenomenon:** Sounds can be loud or quiet.

Students learn:

- Many different kinds of professionals use visual representations of sound waves in their work.
- Visual representations such as graphs can show patterns that help people better understand sound.
- Men and women from all cultures and backgrounds choose careers as scientists and engineers.
- Creativity and imagination are important to science.
Setting a Purpose for Reading

Students review what they have learned about how sounds differ. Help the class set a purpose for reading.

Instructional Guide

1. Connect to the Investigation Question. Point out the Investigation Question on the board and read it aloud. Have students turn to a partner and discuss what they now know about how sounds can be different from one another.

2. Reflect on visualizing sound.

Question: What are some ways that we have been able to “see” sound even though it is actually impossible to see? [Using models, such as the spring toy model; analyzing images of waveforms; observing visual representations of waveforms and particles in the Sound Waves Sim.]

Question: How was this helpful in our investigations?

3. Connect to students’ role.

Question: Remember that we have been investigating how sounds are different in order to help us figure out how a dolphin calf can hear his mother’s call. As marine scientists, you have been using visual representations of sound—waveforms—to help you study how sounds can be different from one another. Now, you will read about how people in other kinds of jobs visualize sound.

4. Hold up a copy of Seeing Sound and introduce the book.

Question: The book is called Seeing Sound, and it describes four jobs in which it is useful to visualize sound.

5. Distribute books. Distribute one copy of Seeing Sound to each pair of students. Ask partners to read the table of contents (page 3) and have them identify the types of jobs they will read about. [Scientists, audiologists, doctors, and sound engineers.]

6. Read the “Working with Sound” section as a class. Have students take turns reading pages 4–5 aloud.
7. Discuss pages 4–5. Ask the following questions to help students make connections to what they have been doing in class.

- What similarities do you notice between what these professionals do in their jobs and your work as marine scientists?
  
  [They work with sound. They visualize sound and use waveforms, like we have been doing.]

- What do professionals who work with sound do that we have also been learning to do?
  
  [Visualize.]

- What do you notice about the visual representations of sound on page 5?

8. Set a purpose for reading.

You will read to find out how and why people visualize sound in their jobs. To do this, you will need to read the text as well as look at the visual representations in the book.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection

Some scientists use visual representations of sound in their work. Why do you think using visual representations helps them? This prompt (on page 58 in the Investigation Notebook) asks students to think about why it might be important for scientists to visualize sound in their work. This prepares students to read the book in this lesson.

Background

About the Book: Seeing Sound

Seeing Sound introduces students to professionals who use visual representations of sound in their jobs: scientists, audiologists, sound engineers, and doctors. The book provides examples that show the importance of visual representations of sound, such as waveforms, in various kinds of work. Students learn that scientists investigate sound for many reasons, including to study how animals communicate. A section about audiologists explains how these professionals administer hearing tests and make visual representations of the sounds that people can hear. Students find out that sound engineers can change the amplitude and wavelength of recorded sounds to make movies and music sound better to listeners. Finally, students may be surprised to learn that doctors can use sound to diagnose and heal patients. The book reinforces science content about the properties of sound waves, including wavelength, pitch, amplitude, and volume, and how these properties can be visually represented and even manipulated to change a sound. The book shows students that their knowledge about sound applies to the real world and gives them additional context for looking at waveforms.
Background

Student Thinking: Visualizing Sound
One of the important practices students are developing in this unit is visualization. Students will read about how sound can be represented visually. Reading this book at this point in the unit—after students have had multiple opportunities to visualize sound—allows them to solidify their understanding of how sounds can be different from one another. Incorporating these representations into their existing understanding of sound will help students refine their thinking.

Instructional Suggestion

Diverse Learners: Using Realia
It may be helpful to give students a few cues for accessing their prior knowledge. To help students think about what they know about how people use sound, hold up a pair of headphones and ask, “What jobs can you think of where people might use these?” Using realia in this way can be helpful for English learners as well as students who benefit from visual reminders to recall prior experiences.
Partner Reading

Students read *Seeing Sound* and record why people visualize sound in different jobs.

### Instructional Guide

1. **Project notebook.** Ask students to turn to page 60, Why People Visualize Sound, in their notebooks. Read the directions aloud. Keep this notebook page projected for the remainder of Activity 2.

2. **Model reading and recording ideas.**
   - Have students take turns reading aloud pages 6–8 of *Seeing Sound*.
   - Have students examine the photographs on pages 7–8. Ask pairs to look at the visual representations of sound in the photographs.
   - Point out the first row of the table on projected notebook page 60. Let students know that you’ll now record notes about why scientists visualize sound.
   - Ask a few students to summarize some reasons why scientists visualize sound, according to the book. Record these in the second column of the table.

3. **Prompt pairs to read the rest of the book and record responses in their notebooks.** Remind students that as they read, they should complete the table on page 60 in their notebooks.

### Teacher Support

#### Rationale

**Literacy Note: Partner Reading**

At this point in the unit, students have engaged in reading with a partner several times. Partner Reading allows students to apply and practice the reading strategies they’re learning, keeps them focused on the task at hand, and encourages students to assist each other with reading. Giving students multiple opportunities to practice working together to read and discuss science texts effectively supports comprehension. In this lesson, you may want to prompt partners to pause after reading each section of the book and discuss how each kind of professional visualizes sound. Partners...
should talk to each other about what they just read and then record notes in their notebooks. Remind students that even though they might have the same or similar responses, both partners should contribute to deciding what information to record.

**Background**

**Literacy Note: About the Visual Representations in Seeing Sound**

Reading *Seeing Sound* allows students to think about both the visual representations and the text in order to learn about how people visualize sound. There is a variety of visual representations of sound in the book—waveforms, graphs, spectrograph images, and more. Students are not expected to be able to interpret all of these visual representations in a detailed way. The purpose of providing these visual representations is to show a variety of ways that sound can be represented visually.

**Rationale**

**Pedagogical Goals: Understanding the Nature of Science**

One goal set forth by the Next Generation Science Standards (NGSS) is for students to understand the nature of science as a discipline and how scientific knowledge develops over time. The NGSS calls out eight understandings about the nature of science that are woven throughout the Amplify Science curriculum. This unit gives students an opportunity to experience that Science Is a Human Endeavor. First, in this activity, students read the book *Seeing Sound* with a partner and think about four professions in which scientists visualize sound. As students read, they record different reasons why the scientists in the book visualize sound in their professions. Finally, students reflect upon and discuss how scientists use a variety of visualizations to understand characteristics of sound waveforms and solve complex problems. Collectively, this text illustrates how scientists from diverse backgrounds use their imagination and think creatively in order to work with, understand, and manipulate sound in their work.

**Possible Responses**

**Investigation Notebook**

*Why People Visualize Sound* (page 60)

**Examples for second column of the table:**

- Row 1: to study how animals communicate, to understand the different properties of sound
- Row 2: to help people who are deaf or hard of hearing, to make sense of hearing tests, to help people see the difference between sounds
- Row 3: to treat disease
- Row 4: to make recorded sounds sound better, to change sounds and make new sounds
Why People Visualize Sound

1. As you read Seeing Sound, record some of the reasons why people visualize sound in their jobs.
2. Remember to look carefully at the visual representations in the book as well as reading the text.

<table>
<thead>
<tr>
<th>Job</th>
<th>Why they visualize sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientists</td>
<td></td>
</tr>
<tr>
<td>Audiologists</td>
<td></td>
</tr>
<tr>
<td>Doctors</td>
<td></td>
</tr>
<tr>
<td>Sound engineers</td>
<td></td>
</tr>
</tbody>
</table>
Setting a Purpose for Reading

Students review what they have learned about how sounds differ. Help the class set a purpose for reading.

Instructional Guide

1. **Connect to the Investigation Question.** Point out the Investigation Question on the board and read it aloud. Have students turn to a partner and discuss what they now know about how sounds can be different from one another.

2. **Reflect on visualizing sound.**

   ¿Cuáles son algunas maneras en las que hemos podido “ver” el sonido, aunque es realmente imposible verlo? [Usando modelos, como el modelo del juguete de resorte; analizando imágenes de formas de onda; observando representaciones visuales de formas de onda y partículas en la Simulación Ondas de sonido].

   ¿De qué manera fue útil esto en nuestras investigaciones?

3. **Connect to students’ role.**

   Recuerden que hemos estado investigando cómo son diferentes los sonidos para ayudarnos a averiguar cómo una cría de delfín puede oír el llamado de su madre. Como científicos marinos, han estado usando representaciones visuales del sonido (formas de onda) para ayudarles a estudiar cómo pueden ser diferentes unos de otros los sonidos. Ahora, leerán sobre cómo visualiza el sonido la gente en otros tipos de trabajos.

4. **Hold up a copy of Seeing Sound and introduce the book.**

   El libro se llama Viendo el sonido, y describe cuatro trabajos en los cuales es útil visualizar el sonido.

5. **Distribute books.** Distribute one copy of Seeing Sound to each pair of students. Ask partners to read the table of contents (page 3) and have them identify the types of jobs they will read about. [Scientists, audiologists, doctors, and sound engineers.]

6. **Read the “Working with Sound” section as a class.** Have students take turns reading pages 4–5 aloud.
7. Discuss pages 4–5. Ask the following questions to help students make connections to what they have been doing in class.

¿Qué semejanzas notan entre lo que estos profesionales hacen en sus trabajos y su trabajo como científicos marinos?
[Trabajan con el sonido. Visualizan el sonido y usan formas de onda, como hemos estado haciendo nosotros].

¿Qué hacen los profesionales que trabajan con el sonido que nosotros también hemos estado aprendiendo a hacer?
[Visualizar].

¿Qué notan sobre las representaciones visuales del sonido en la página 5?

8. Set a purpose for reading.

Leerán para averiguar cómo y por qué la gente visualiza el sonido en sus trabajos. Para hacer esto, necesitarán leer el texto así como mirar las representaciones visuales en el libro.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection
Some scientists use visual representations of sound in their work. Why do you think using visual representations helps them? This prompt (on page 58 in the Investigation Notebook) asks students to think about why it might be important for scientists to visualize sound in their work. This prepares students to read the book in this lesson.

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**Rationale**

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Why People Visualize Sound (page 60)

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Por qué las personas visualizan el sonido

1. Mientras lees *Viendo el sonido*, apunta algunas de las razones por las cuales las personas visualizan el sonido en su trabajo.
2. Recuerda mirar con atención las representaciones visuales del libro, así como leer el texto.

<table>
<thead>
<tr>
<th>Trabajo</th>
<th>Por qué visualizan el sonido</th>
</tr>
</thead>
<tbody>
<tr>
<td>Científicos/as</td>
<td></td>
</tr>
<tr>
<td>Audiólogos/as</td>
<td></td>
</tr>
<tr>
<td>Médicos/as</td>
<td></td>
</tr>
<tr>
<td>Ingenieros/as de sonido</td>
<td></td>
</tr>
</tbody>
</table>