# Sound Digital Sampler

## Sample Lesson

**Big Ideas**

**Unit Summary**

**Lesson 2: What Makes Sound?**

**Teacher Background Information**

**My Science Notebook**

**Mi Libreta de Apuntes de Ciencias**

**Assessments**

**Teacher Masters**

**Visual Pack**

**ExploraGear**

**I Wonder Circle**

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Science Companion

www.sciencecompanion.com
The Teacher Lesson Manual engages and guides teachers to implement hands-on science lessons with their students. Lesson by lesson, students develop strong process skills and in-depth understanding of specific concepts.

The book brings teachers up to speed for the science content through “Teacher Background Information” and in-context lesson notes. Teachers can feel comfortable with leading the class—whether they have a long history of teaching science or not.

Each Teacher Lesson Manual focuses on a set of Big Ideas for a science topic. Each lesson focuses on a Big Idea. Groups of lessons (called clusters) develop a Big Idea through a series of different experiences and discussions.

Lessons Follow a Consistent Sequence

- **Engage** – In this section of a lesson, the teacher introduces the topic. The goal is to briefly generate interest, activate prior knowledge, or link the day’s activities to what has come before.

- **Explore** – This is often (but not always) a hands-on exploration conducted in small groups. Students record their work in their Science Notebooks. Collaboration with peers is encouraged. Key materials are provided in the ExploraGear kit.

- **Reflect and Discuss** – In this important section, the teacher and students discuss what they observed, share ideas and data, and reflect on the day’s activities. This portion of the lesson brings the class back to the Big Idea.

You’ll find that while the lesson format is very consistent, students explore science content and the process of “doing science” in a large variety of ways.

You’ll also find that students LOVE the mix of active, hands-on, minds-on science.
Lessons at a Glance

Science Content: Big Ideas

The Sound Unit concentrates on the following “big ideas” about sound sources and production, as well as about changing sound and hearing sound. Along with the scientific Habits of Mind discussed on page 6, these concepts should be reinforced throughout the unit. The lessons in which each big idea is introduced or is a major focus are indicated in parentheses.

- Sounds are produced by sources all around us. You can describe sounds in a variety of ways. (Lesson 1)
- All sounds are made by vibrations. (Lesson 2)
- Sound travels through air and other materials. Sound travels through some materials better than others. (Lesson 3)
- Sound travels by causing vibrations in the air or in other materials. (Lessons 4–6)
- The shape and parts of the ear allow sound to travel through it so we can hear. (Lesson 6)
- All sounds are made by vibrations. Changing the vibrations changes the sounds. (Lessons 7 and 8)
- You can apply what you know about sound and vibration to design and build musical instruments that can change pitch and volume. (Lessons 9–12)
- Observation is a powerful tool for learning about something, and detailed and accurate descriptions help you communicate your observations. (Observing and Describing Skill Building Activity)
## Unit Summary

<table>
<thead>
<tr>
<th>Cluster 1: Sound Is Vibration (Lessons 1 and 2)</th>
<th>Cluster 2: Sound Travels (Lessons 3-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overview</strong></td>
<td>Children establish that sound can travel through air and other materials and test a variety of materials to determine how well sound travels through them. They use cup-and-string telephones and a “pepper dance” activity to explore how sound travels. Children also assume the roles of various parts of the ear and participate in an enactment of how sound travels through the ear.</td>
</tr>
</tbody>
</table>
| **Science Content** | • Sound originates from a source.  
• Sources around us produce sounds.  
• Sounds are made by vibrations.  
• A vibration is a regular back and forth motion. |
| **Science Center** | • Conduct variations of the “pepper dance” activity using glitter, rice, feathers, or other lightweight materials.  
• Continue to test and document differences in how well sound travels through various materials.  
• Experiment with spoon bells.  
• Discover ways to improve hearing. |
| **Family Links** | • Enlist families to help collect materials for the Sound Unit.  
• Ask for volunteers to visit the class to share musical instruments. |
| **Further Science Explorations** | • Observe the ripples created by a vibrating tuning fork placed in water. |
| **Cross-Curricular Extensions** | • Experiment to deduce that sound travels in all directions.  
• Construct soundproof boxes.  
• Visit stairwells and gymnasiums to explore echoes.  
• Investigate the concept of sound waves using dominoes or other materials.  
• Create “party lines” with cup-and-string telephones.  
• Discover that two ears are better than one.  
• Investigate the ears and hearing of various animals.  
• Simulate hearing impairment and discuss the causes. |

**Language Arts:** Write about the Sound Search. Categorize sound descriptors. Talk about onomatopoeias. Discuss the role of sound in communication. Read and write poems using rhymes and alliteration.  
**Art:** Explore TV and movie sound effects. Create sound effects. Capture vibrations on paper.  
**Music:** Explore the vibrations that produce sound in musical instruments.  

**Language Arts:** Write, draw, or tell the story of a sound that goes from one end of a cup-and-string telephone to the other.  
**Social Studies:** Discuss the history of how the telephone was invented as a model invention story.
<table>
<thead>
<tr>
<th>Cluster 3: Changing Sounds (Lessons 7 and 8)</th>
<th>Cluster 4: Making Instruments (Lessons 9-12)</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children explore pitch and volume, and learn ways to vary them. They develop an ear for pitch and the vocabulary to describe differences in pitch and volume. They consider the relationship between pitch and the rate of sound vibrations, and the relationship between volume and the size of sound vibrations.</td>
<td>Children design and build musical instruments, paying special attention to what will vibrate to produce the sound and how the pitch and volume will be varied. They test, evaluate, and refine their instruments as they build. To culminate the project, children present and explain their instruments to the class.</td>
<td></td>
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</tbody>
</table>
| • Pitch is a characteristic of sound that describes how high or low a sound is.  
• Volume is a characteristic of sound that describes how loud or soft a sound is.  
• Differences in vibrations (rate and size) produce differences in sound (pitch and volume). | • Musical instruments are based on creating vibrations that produce sound.  
• Musical instruments often include mechanisms that allow the pitch and volume to be changed.  
• String, percussion, and woodwinds are types of musical instruments.  
• Design, construction, evaluation, and revision are all elements of product development. |
| • Experiment with changing pitch and volume using a variety of instruments and materials.  
• Document interesting examples of high and low pitches and loud and soft volumes. | • Observe and experiment with simple handmade instruments.  
• Explore raw materials for instrument-making.  
• Continue to design, test, and build instruments. | Science Content |
| • Place a container of water on a stereo speaker and observe how the ripples in the water change as the volume of the stereo is adjusted.  
• Make instruments at home that can change pitch in various ways. | • Request additional materials the children need to complete their musical instruments. | Science Center |
| • Conduct additional activities to explore the relationship between pitch and rate of vibration.  
• Experiment with “paper ears” to improve sound perception.  
• Discuss the relationship between very loud sounds and ear damage. | • Study instruments (or photographs of them) from other cultures. Relate the materials used to the available regional resources. | Family Links |

**Language Arts**: Keep a “Sound Diary” for a day.  
**Mathematics**: Relate pitch to the size of instrument parts. Create a volume scale.  
**Art**: Make and decorate sound boxes.  
**Music**: Play a “Matching Pitches” game. Learn the musical scale to reinforce the range of pitches. Examine how pitch and volume are changed in musical instruments.  

**Language Arts**: Research an inventor.  
**Art**: Decorate handmade musical instruments.  
**Music**: Watch videos or listen to recordings of innovative musicians.  

**Cross-Curricular Extensions**
What Makes Sound?

Big Idea
All sounds are made by vibrations.

Overview
During a science talk, children explore their ideas about how sound is produced. They learn what a vibration is, and that all sounds are produced by vibrations. They generate a variety of sounds by making different materials vibrate.

Key Notes
- Consider teaching this lesson in two sessions. It works well to do the Engage activities (science talk and sensory observations) during the first session, and the exploration and synthesizing discussion during the second session. Another possibility for the exploration is to set up all of the vibration stations in one area of the room and rotate small groups of children through this area over the course of several days.
- For the exploration, be sure you have one plastic bottle for each child, labeled with the child’s name.
- For more information about the science content in this lesson, see the “Sound Is Vibration” section of the Teacher Background Information.
Lesson 2

**Lesson Goals**

1. Understand that vibration is a regular back and forth motion.
2. Identify that sounds are produced by vibrations.

**Standards and Benchmarks**

As children explore the connection between sound and vibration, they work toward an understanding of The Physical Setting Benchmark 4F (Motion) and Physical Science Standard B (Position and Motion of Objects): “Sound is produced by vibrating objects….”

**Assessment**

Take notes during the exploration and the synthesizing discussion, focusing on whether children understand that sounds are produced by vibrations. Alternatively, you might talk with children individually about their entries in the science notebook to assess their level of comprehension. Both options offer good opportunities to note children’s understanding of the first criterion on **Rubric 1**: All sounds are produced by vibrations. This criterion, along with the others listed on this assessment, will be revisited later in the unit as children experiment with changing vibrations and describe the resulting sounds.

**Teacher Note:** The concept that sounds are produced by vibrations is central to this unit, so note any lingering misconceptions and try to address them. Children who remain skeptical or confused can repeat the activities in this lesson with additional materials that illustrate the relationship between sound and vibration. (See the Science Center section on page 60 for suggestions.) The Further Science Exploration “Seeing Vibrations in Water,” and the Art and Music Extensions described at the end of this lesson also reinforce this important concept, as do many of the books that are listed in the Sound Science Library and Web Links section on pages 34-37.

**Rubric 1: Sound and Vibration**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description 1</th>
<th>Example 1</th>
<th>Description 2</th>
<th>Example 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sounds</td>
<td>A. Sound waves are produced by vibrations.</td>
<td>Example of a vibrating bell</td>
<td>B. Changing a volume increases the loudness of sound.</td>
<td>Example: A louder bell sounds louder.</td>
</tr>
<tr>
<td>2. Teacher Note</td>
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**Materials**

**MANAGEMENT NOTE:** It will work best to set up two stations for each kind of vibration, unless you have a very small class or plan to rotate children through the stations over the course of several sessions. If you only set up one of each station, you may need to put extra materials at the stations to accommodate larger groups of children.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ExploraGear</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roasting pans</td>
<td>1 per station</td>
<td>For spoon and pan “vibration station.”</td>
</tr>
<tr>
<td>Rubber bands, assorted sizes</td>
<td>3-5 per station</td>
<td>For rubber band “vibration station.”</td>
</tr>
<tr>
<td>Rulers</td>
<td>2 per station</td>
<td>For ruler “vibration station.”</td>
</tr>
<tr>
<td>Spoons</td>
<td>1 per station</td>
<td>For spoon and pan “vibration station.”</td>
</tr>
<tr>
<td><strong>Classroom Supplies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chart paper</td>
<td>1 sheet</td>
<td>To make a “Sound is Vibration” chart.</td>
</tr>
<tr>
<td>Meter stick or yardstick</td>
<td>1</td>
<td>For the sensory observations.</td>
</tr>
<tr>
<td>Plastic bottles</td>
<td>1 per child</td>
<td>For bottle “vibration station.” (The bottles should be labeled with children’s names.)</td>
</tr>
<tr>
<td>Safety goggles</td>
<td>Class set</td>
<td>To protect eyes while working with rubber bands.</td>
</tr>
</tbody>
</table>

**Curriculum Items**

- *Sound Science Notebook, page 4*
- Rubric 1: Sound and Vibration (optional)

*For the most current list of all ExploraGear materials, please visit our web site: www.sciencecompanion.com/exploragear*
**Preparation**

- Distribute materials to the following “vibration stations.”
  - Ruler station—2 rulers
  - Spoon and pan station—A spoon and a disposable roasting pan
  - Bottle station—1 plastic bottle per child (labeled with their name)
  - Rubber band station—3-5 rubber bands, assorted sizes

**Safety Note:** We recommend that children wear safety goggles at the rubber band station to protect their eyes.

- Draw and post a large version of the “Sound Is Vibration” chart (*Sound Science Notebook, page 4*) on a sheet of chart paper. Leave the “Source” column blank and leave space at the top to write a definition of the term *vibration*.

- Look for additional vibrating materials to place in the Science Center. (See the Science Center section on page 60 for suggestions.)

- (Optional) Arrange for the music or band teacher, or other volunteers, to share musical instruments with the class and show how vibration produces sound on each instrument. This can be done any time after this lesson is taught. See the Music Extension on page 62 for more specific suggestions.

**Vocabulary**

- **sound** ................. Anything that can be heard by humans or other animals. Sounds are made by vibrations.

- **vibration** ............... A regular back and forth motion.
Teaching the Lesson

Engage

Science Talk
Start a science talk in which children discuss their theories about how sound is produced. Accept and encourage all ideas, without intervening to move the discussion toward any single conclusion. Listen to the children and note ideas and theories you’d like to revisit later in the lesson or unit.

Sensory Observations
Have the class help you complete the “Sound Is Vibration” chart for each of the sensory observations as you conduct them.

- Source—Sketch the source of the sound. (You may want to let a child do this.)
- Describe Sound—Jot down descriptive words. Take several suggestions to elicit a rich and thorough description.
- What Vibrated?—Write down what vibrated to produce the sound in each case. Reinforce that all sounds are produced by vibrations.
- How Did You Know?—Indicate which sense or senses identified the vibration. Emphasize the idea that, while some vibrations could be seen (the meter stick and the lips) and some vibrations could be felt even when they couldn’t be seen (humming), all of the vibrations could be heard.

Vibrating Meter Stick
1. Have children look and listen as you vibrate a meter stick. Hold one end of the meter stick on a table with the heel of your hand close to the edge of the table, and then pluck the free end of the meter stick with your other hand. It is easy to see the meter stick vibrating if you leave approximately 75 centimeters of it free.
2. Introduce the word *vibration* by talking with the children about what is happening to the meter stick. Write the word “vibration” and its definition at the top of the “Sound Is Vibration” chart.

**Teacher Note:** It may be helpful to talk with your class about what you see when you look at something that is vibrating—it looks like a blur because you can’t see each back and forth movement. Demonstrate a very slow vibration of the meter stick, your hand, or a piece of string to show the children the back and forth movements, then speed it up to show what it looks like at a higher speed.

3. Repeat the vibration as often as necessary as you encourage the class to talk about their observations.
   - Can they hear anything when the meter stick vibrates? Can they hear anything when the vibrations stop?
   - What do they think made the sound? (If someone says vibration, use it to lead into the next example. If no one mentions vibration, move on to the next example and revisit this question afterwards.)

**Teacher Note:** If some children say that the meter stick is making the sound, ask why the meter stick doesn’t make a sound when it is still. You might also ask children what they think is happening to the meter stick to make it produce the sound.

4. Fill in the first row of the posted chart with the children’s observations and ideas about the vibrating meter stick.

**Vibrating Lips**

1. Model vibrating your lips together to make a “horse lips” or “raspberry” sound; then have the children do it. Have them watch each other’s vibrating lips while touching their own.

2. Help children connect the sound they hear with the vibration of their lips by asking the following questions:
   - Is the sound coming from our voices? *(No.)*
   - What is making the sound? (If no one mentions vibration, tell them that the sound is made by the vibration of their lips.)

3. Remind the children what they observed about the vibrating meter stick to help them realize that vibrations produced both sounds. Help the children understand that a sound starts when something starts to vibrate and a sound stops when the vibrations stop.

4. Fill out the second row of the chart.
Humming
1. Tell the children to hum. Have them watch each other and touch their own throat and neck areas as they hum.
2. Help any children that can’t locate and feel the vibration in their throat or neck area (called the voice box, or larynx, inside the body). Point out that the sound stops when their larynx stops vibrating.
3. Confirm that, even though they couldn’t see it, a humming sound is made by a vibration, too.
4. Compare humming to the other examples as you fill out the third row of the chart.

Explore

MANAGEMENT NOTE: Establish and practice using a visual signal, such as flickering the lights or raising one hand and having the children do the same, to help you silence the class and get their attention for this activity and others throughout the unit.

Making Vibrations
1. Show children the vibration stations you set up.
2. Explain that at each station they need to figure out how to make a sound by making the materials vibrate. Tell them that each group needs to work together and take turns using the materials at the stations.

MANAGEMENT NOTE: Set clear expectations for how to use the materials before children begin experimenting.

SAFETY NOTE: Warn children that the rulers can snap if they are bent too much and that flying rubber bands can cause eye injuries. To minimize risk, set limits about how the rulers and rubber bands can be used, and provide safety goggles at the rubber band station. Also clarify that children should blow into their own bottles, and not others’, to minimize the spread of germs.
3. Quickly review with the class the “Sound Is Vibration” chart on page 4 of their science notebooks, and tell them to record their findings for each material before they move to the next station.

4. Divide the class into as many groups as you have vibration stations. Assign each group to a station to begin. Establish a rotation system so each group has a chance to work with each set of materials.

**Management Note:** The bottle is the most challenging of the materials to make work and figure out what is vibrating. You may want to stay near the bottle station to assist groups, if needed, as they rotate through it.

**Teacher Note:** Children may find different ways to produce sound using the bottle, such as blowing across the opening, which vibrates the air; tapping on it, which vibrates both the plastic and the air; and blowing into it with pursed lips, which vibrates both the lips and the air. Help children figure out what vibrates in each case.

5. Allow the groups ample time to explore each station. If time permits, encourage children who are ready for further exploration with questions such as the following:
   - Can you stop a vibration? How? What happens then?
   - Have you found any other way to make the material vibrate? Does the sound change?
   - Can you make different sounds with the same material? How?
   - Can you make sounds louder or softer? How?

**Teacher Note:** Many children will experiment with pitch and volume during this activity. Avoid lengthy discussions or details about these variables during this lesson, but watch and listen so you can build on the children’s ideas and questions in Lessons 7 and 8, “Exploring Pitch” and “Exploring Volume.”

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**Language Arts Connection**

Encourage children to use the sound word bank you started in Lesson 1. Add words the children suggest during this lesson.
Reflect and Discuss

Synthesizing
Revisit the science talk from the beginning of the lesson. Ask children again how they think sound is produced, reminding them to think about what they observed and learned in this lesson. During the discussion, emphasize the following ideas:

• If they hear a sound, there must have been a vibration, because all sounds are made by vibrations, even if they can’t see or feel them.

• Many things can vibrate and produce sound.

Teacher Notes: It’s common for children to cling to their original theories. Try to counter this, if necessary, by drawing on the evidence provided by the activities and the experiences the children have in each lesson. Also explain to the children that they are doing what scientists do all the time—revising their theories to take into account new evidence from observations and experiments.

Some children may mention examples of sounds that can’t be heard by humans, such as dog whistles or special sonar to repel mice. You can explain that some vibrations make sounds that humans can’t hear, but don’t spend a lot of time on this concept.

Ongoing Learning

Science Center

• Put out the rubber bands, rulers, bottles, roasting pan, and spoon for further exploration. Put out safety goggles for children to wear while experimenting with rubber bands.

• Add, and encourage children to add, other materials for making vibrations and sound, such as rope, flexible tubing, fishing line, bungee cords, homemade or commercial drums, a musical triangle, chimes, and other musical instruments.

• Encourage children to play “Guess the Vibration.” Children use various materials to make different sounds and try to figure out what is vibrating in each case.

• Put out a tuning fork and bowl of water for experimentation. (See the “Seeing Vibrations in Water” extension in this lesson.)

Maintenance
When new vibrating materials are added to the Science Center, take a few minutes to share and discuss them with the class.
Extending the Lesson

Further Science Exploration

Seeing Vibrations in Water

Vibrate a tuning fork (provided in the ExploraGear). Allow children to feel and hear the vibration. Ask whether they feel the metal vibrating and if they can see it. Put the vibrating metal end in a bowl of water or against the side of a paper or plastic cup filled with water. Look for ripples on the water surface. Ask the children what they think made the ripples. *(The vibration of the tuning fork made the ripples.)* Talk about how this is one way to “see” vibrations that would otherwise be very difficult to see. Put the tuning fork and water in the Science Center for further experimentation.

**Teacher Note:** Test this experiment using various types of bowls or cups to see which produces the most visible ripples on the water.

**Management Note:** It may work best to do this with small groups so that everyone has a chance to feel the tuning fork vibrate and see the water ripple.

Art Extension

Children can “see” vibration in a different way by dipping a paintbrush in paint and vibrating it back and forth over a large sheet of paper. The results are interesting and beautiful, especially if repeated with different colors for different sizes and speeds of vibration.
Music Extension

**MANAGEMENT NOTE:** Ask a music teacher, band director, or other volunteers to bring in instruments and help with the Music Extension. This extension can be done all at once if you have access to a collection of instruments, or it can be spread over the course of the unit.

Have the class analyze and compare what vibrates to produce sound in a variety of musical instruments. You can create a “Sound Is Vibration” chart like the one used in this lesson. Fill out the chart for each instrument as it is discussed.

**TEACHER NOTE:** Wind and brass instruments produce sound when a reed, the musician’s lips, or a turbulent airflow vibrates a column of air. This is more subtle and difficult to visualize than the way strings or various membranes, such as drumheads, vibrate and produce sound in other instruments.

Planning Ahead

**For Lesson 3**

Preview the materials list and setup for Lesson 3 so you can collect what you need in advance.
Most children have been exposed to sound their entire lives. Some sounds, like the voice of a parent singing a familiar lullaby, or the coo of a mourning dove, are pleasant. Other sounds, like fingers scratching along a chalkboard, the loud crack of thunder, or an ambulance siren, can be frightening or unpleasant. From the time they are babies, children learn to make sense of the sounds in their world. They learn to distinguish which sounds they need to pay attention to (teachers, family members, their pets, or signals from their surroundings) and the sounds they can ignore.

In this unit, children study the sounds in their environment. They listen closely for sounds, determine the sources of the sounds, and practice describing the sounds they hear. The children learn how sounds are produced and how sounds travel through the air and other materials. They learn how to change the pitch and volume of sounds, and then apply what they have learned about sound by designing, building, and demonstrating musical instruments.

Sound Is Vibration

The children begin this unit by acting as “sound detectives.” As such, they are asked to find sounds and then listen carefully for “clues” about the sounds. What are the sources of the sounds? Are the sounds pleasant or unpleasant? What are their reactions to the sounds? How would they describe the sounds?

People describe the sounds in their environment in a variety of ways. Musicians often describe the sounds they make according to their volume, pitch, and timbre (pronounced “tamber”). In this unit, children learn the meaning of pitch and volume and experiment with different ways to create and control sound.

The children also learn that sounds are produced by vibrations. A vibration is a regular back and forth motion. Some sound-producing vibrations are easy to see. For example, if you pluck the lowest-pitched string on a guitar, it’s possible to see the string moving back and forth very quickly. After you first pluck the string, the amplitude, or size, of the vibration is at its greatest. The amplitude is the distance between the string at rest and the string when it is farthest from its resting point.
As the vibration continues, its **frequency** (the number of vibrations per second, measured in hertz) stays constant until the amplitude gradually decreases to zero. This is when the string stops vibrating and the sound stops. You can also stop the sound of the plucked string by using your hand to discontinue the vibration. When the vibration stops, the sound stops. On many stringed instruments, it is possible to see the plucked string vibrate and note that the sound stops when the vibration stops.

Another easily observed vibration is the shaking of loudspeakers in a home stereo system. If you take the cover off one of the speakers and turn up the volume on the stereo, you can see the speaker vibrate back and forth as the sound is produced. The louder the sound, the greater the amplitude of vibration, and the easier (but more painful) it is to observe the vibrations.

In most cases, the phenomenon of vibrations producing sound is difficult, and often impossible, to observe visually. For example, if you beat the head of a drum, you might be able to see the drumhead move, but it would be difficult to see the vibrations that cause the movement. It is even more difficult to observe sound-producing vibrations in a wind instrument. If, for example, you blow across the top of a glass bottle or blow into a flute, it is impossible to see or feel the vibrating air that produces the sound inside the bottle or flute. The vibrations that produce most of the noises we hear every day can’t be seen. For example, if you tap on a tabletop, it is easy to hear the sound, but impossible to see the vibrations that produce the sound.

This unit offers the children many hands-on experiences with vibrating objects that produce sound. At first they experiment with objects that are obviously vibrating. Later, they work with objects that cause vibrations that cannot be seen, but can be detected by our other senses, especially touch. Through this progression, children can experience the connection between sound and vibration in concrete ways before having to recognize the more typical phenomenon of sound-producing objects that cause vibrations that cannot be easily seen or felt.
The Science Notebook is a student’s ongoing record of his or her work as a scientist. Each Science Companion module for grades 1-6 has a Student Science Notebook tailored for that module.

Student Science Notebooks are age-appropriate. Notebooks for younger grades contain minimal text and opportunities to draw instead of write, so all students can participate and shine as scientists. For older grades, Student Science Notebooks utilize students’ developing skills: they contain procedures for students to follow, and provide support for controlling variables as students develop their own experiments—all leading to increased independence.

All the Student Science Notebooks develop literacy and support mathematics skills. Students apply these disciplines in the highly motivating process of doing science.
Hello, Scientist,

All scientists like to study things carefully. They like to think and ask questions. They try things out and then see what happens. They use their senses to observe things. They describe their observations with pictures and words.

Scientists use science notebooks to write and draw their ideas and their observations about the things they study.

This is your science notebook. You will write and draw some of your ideas and your observations here.

Enjoy it!
Sound Is Vibration

Fill in the chart with information about the sounds and vibrations you made.

<table>
<thead>
<tr>
<th>Source</th>
<th>Describe Sound</th>
<th>What Vibrated</th>
<th>How Did You Know?</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image 1" /></td>
<td>[Description of Source]</td>
<td>[Description of What Vibrated]</td>
<td>See</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image 2" /></td>
<td>[Description of Source]</td>
<td>[Description of What Vibrated]</td>
<td>See, Feel, Hear</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image 3" /></td>
<td>[Description of Source]</td>
<td>[Description of What Vibrated]</td>
<td>See, Feel, Hear</td>
</tr>
<tr>
<td><img src="image4.png" alt="Image 4" /></td>
<td>[Description of Source]</td>
<td>[Description of What Vibrated]</td>
<td>See, Feel, Hear</td>
</tr>
</tbody>
</table>
Hola Científico,

A todos los científicos les gusta estudiar las cosas cuidadosamente. Les gusta pensar y hacer preguntas. Les gusta experimentar y observar lo que sucede. Usan sus sentidos para observar cosas. Describen sus observaciones con dibujos y palabras.

Los científicos usan libretas para anotar y dibujar sus ideas y observaciones de las cosas que experimentan.

Ésta es tu libreta de ciencias. Aquí vas a escribir y a dibujar algunas de tus ideas y observaciones.

¡Disfrútala!

Hola Científico
**El Sonido es Vibración**

Comleta la gráfica con información sobre los sonidos y vibraciones que hiciste.

<table>
<thead>
<tr>
<th>Origen</th>
<th>Describe el Sonido</th>
<th>¿Qué Vibró?</th>
<th>¿Cómo Sabías?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Siento</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Escucho</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Siento</td>
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<td></td>
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<td>Escucho</td>
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<td></td>
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<td>Observo</td>
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<tr>
<td></td>
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<td></td>
<td>Siento</td>
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<td></td>
<td></td>
<td></td>
<td>Escucho</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observo</td>
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<td></td>
<td></td>
<td></td>
<td>Siento</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Escucho</td>
</tr>
</tbody>
</table>

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**Fecha:** ____________________________
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Science Companion supplies a variety of tools to assess children “in-the-act” of doing science, as well as evaluate their understanding and proficiency as they finish clusters of lessons.

**In the Teacher Lesson Manual:**

- Big Ideas and lesson goals are clearly outlined on each lesson’s Quick Look pages.
- Assessment Options in each lesson suggest where pre-assessment and formative assessment can occur in the context of a lesson.

**In the Assessment Book:**

- **Rubrics** are supplied to score understanding of science content. The criteria in each rubric are derived from a module’s Big Ideas and lesson goals.
- **Opportunities Overviews** show where each criteria can be evaluated during pre-assessment, formative assessment and summative assessment.
- **Checklists and Self-Assessments** list criteria that are related to science process skills.
- **Performance Tasks** are used for summative assessment to evaluate students’ understanding of Big Ideas and lesson goals. The Assessment Book supplies evaluation guidelines and blank masters for each Performance Task.
- **Quick Checks**—another summative assessment tool—employ a multiple-choice format.

**The Science Notebook Teacher Guide:**

A final assessment tool is the Science Notebook Teacher Guide. This teacher edition of the Student Science Notebook is annotated to help teachers know what to expect in from children in their Student Science Notebooks.
# Rubric 1: Sound and Vibration

Rubrics return to the Big Ideas and show how to evaluate student progress.

<table>
<thead>
<tr>
<th></th>
<th>Criterion A (Lessons 2, 9 12)</th>
<th>Criteria B and C (Lessons 8 12)</th>
<th>Criteria B and D (Lessons 7, and 9 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All sounds are produced by vibrations.</strong></td>
<td><strong>Changing a vibration changes the volume of the sound that is produced.</strong></td>
<td><strong>Changing a vibration changes the pitch of the sound that is produced.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4 - Exceeds Expectations</strong></td>
<td>Understands at a secure level (see box below) and contemplates how this applies to new or unfamiliar examples.</td>
<td>Understands at a secure level (see box below) and recognizes that bigger vibrations produce louder sounds and smaller vibrations produce softer sounds.</td>
<td>Understands at a secure level (see box below) and recognizes that faster vibration rates produce higher pitched sounds and slower vibration rates produce lower pitched sounds.</td>
</tr>
<tr>
<td><strong>3 - Secure (Meets Expectations)</strong></td>
<td>Understands that all sound is produced by vibrations.</td>
<td>Recognizes differences in volume and understands that changing a vibration changes the volume of the sound that is produced.</td>
<td>Recognizes differences in pitch and understands that changing a vibration changes the pitch of the sound that is produced.</td>
</tr>
<tr>
<td><strong>2 - Developing (Approaches Expectations)</strong></td>
<td>Recognizes that sound is produced by vibrations but may be confused by, or skeptical of, vibrations that cannot be seen.</td>
<td>Recognizes that volume can be changed and can identify differences in volume, but does not relate changes in volume to changes in vibrations.</td>
<td>Recognizes that pitch can be changed and can identify differences in pitch, but does not relate changes in pitch to changes in vibrations.</td>
</tr>
<tr>
<td><strong>1 - Beginning</strong></td>
<td>Does not recognize that all sound is produced by vibrations.</td>
<td>Does not understand that volume can be changed.</td>
<td>Does not understand that pitch can be changed.</td>
</tr>
</tbody>
</table>

All sounds are produced by vibrations.

Changing a vibration changes the volume of the sound that is produced.

Changing a vibration changes the pitch of the sound that is produced.
Opportunities Overview: Sound and Vibration

This table highlights opportunities to assess the criteria on Rubric 1: Sound and Vibration. It does not include every assessment opportunity; feel free to select or devise other ways to assess various criteria.

<table>
<thead>
<tr>
<th>Criterion A (Lessons 2, 7-12)</th>
<th>Criteria B and C (Lessons 8-12)</th>
<th>Criteria B and D (Lessons 7 and 9-12)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre and Formative Opportunities</strong></td>
<td><strong>Performance Tasks</strong></td>
<td><strong>Performance Tasks</strong></td>
</tr>
<tr>
<td>Lesson 2:</td>
<td>Lesson 8:</td>
<td>Lesson 7:</td>
</tr>
<tr>
<td>- Science notebook page 4</td>
<td>- Sensory observation</td>
<td>- Sensory observation</td>
</tr>
<tr>
<td>- Synthesizing discussion</td>
<td>- Exploration</td>
<td>- Exploration</td>
</tr>
<tr>
<td><strong>Lesson 7:</strong></td>
<td><strong>Lessons 9-12:</strong></td>
<td><strong>Lessons 9-12:</strong></td>
</tr>
<tr>
<td>- Science notebook pages 11-14</td>
<td>- Science notebook page 19</td>
<td>- Science notebook page 18</td>
</tr>
<tr>
<td><strong>Lesson 8:</strong></td>
<td><strong>Lesson 12:</strong></td>
<td><strong>Lesson 12:</strong></td>
</tr>
<tr>
<td>- Exploration</td>
<td>- Exploration</td>
<td>- Exploration</td>
</tr>
<tr>
<td><strong>Lessons 9-12:</strong></td>
<td><strong>Lessons 9-12:</strong></td>
<td><strong>Lessons 9-12:</strong></td>
</tr>
<tr>
<td>- Science notebook page 17</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lesson 12:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Exploration</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sound is Vibration and Changing Sounds Clusters</strong></td>
<td><strong>Changing Sounds and Making Instruments Clusters</strong></td>
<td><strong>Changing Sounds and Making Instruments Clusters</strong></td>
</tr>
<tr>
<td>Describing Sound, page 26</td>
<td>“Make That Sound” game, page 29</td>
<td>“Make That Sound” game, page 29</td>
</tr>
<tr>
<td>“Make That Sound” game, page 29</td>
<td>Making Instruments project, page 30</td>
<td>Making Instruments project, page 30</td>
</tr>
<tr>
<td><strong>Quick Check Items</strong></td>
<td><strong>Quick Check Items</strong></td>
<td><strong>Quick Check Items</strong></td>
</tr>
<tr>
<td><strong>Sound is Vibration Cluster</strong></td>
<td><strong>Changing Sounds Cluster</strong></td>
<td><strong>Changing Sounds Cluster</strong></td>
</tr>
<tr>
<td>Page 32: items 2, 3</td>
<td>Pages 35-36: items 3-5</td>
<td>Pages 35-36: items 1, 2, 5</td>
</tr>
</tbody>
</table>

Opportunities Overviews show where ongoing and summative assessment can occur for each criteria.
Checklist: Describing Sound
Teacher Assessment
(Lessons 1-8)

Determine whether the following skills are evident in the child’s descriptions of various sounds. You might want to assign one point for each criterion that the child demonstrates. You can add specific observations or comments in the space below each criterion.

Name                                    Date

Criteria:

A. Includes the source of the sound.

B. Includes accurate terminology to describe volume.

C. Includes accurate terminology to describe pitch.

D. Includes additional descriptors.
Checklist: Observing and Describing
Teacher Assessment
(All lessons)

Determine whether the following skills are evident as the child makes observations and descriptions. You might want to assign one point for each criterion that the child demonstrates. You can add specific observations or comments in the space below each criterion.

Name  Date

Criteria:

A. Observations, descriptions and drawings are accurate; they reflect actual properties or events.

B. Observations, descriptions, and drawings incorporate details.

C. Uses multiple perspectives and senses when making observations.
Self-Assessment: Observing and Describing

Think about your observations, descriptions and scientific drawings. Answer the following questions.

1. Do you make careful observations?
   - Always
   - Sometimes
   - Seldom

2. How much detail do you include in your observations, drawings or descriptions?
   - A lot of detail
   - Some detail
   - Very little detail

   Give some examples of when you included details in your observations:

3. Do you use more than one sense when you make observations?
   - Always
   - Sometimes
   - Seldom

   Give some examples of when you used different senses in your observations:
**Describing Sound**

*Sound is Vibration Cluster (Lessons 1 and 2)*

Choose a sound that you know well, such as your doorbell, a family member’s voice, or a musical instrument that you play.

What do you think vibrates to make the sound?

Describe the sound. Include the source of the sound and lots of details in your description.

**Teacher Note:**

Use this assessment after Lesson 2.

**Evaluation Guidelines:**

When evaluating children’s answers, consider the following:

- Do children understand the term “source”?
- Do children understand the types of things that can vibrate to produce a sound?
- How much detail do they include in their descriptions of sound? (Children may use descriptors related to pitch and volume, but those will be formally introduced in Lessons 7 and 8.)
Sound is Vibration Cluster

Quick Check Items

**TEACHER NOTE:** The following questions relate to the Sound is Vibration cluster. Use them after teaching the entire cluster, or select the applicable questions immediately following each lesson. You can also compile Quick Check items into an end of unit assessment.

1. (Lesson 1) The thing that makes a sound is called the of the sound.
   a. sense
   b. hearing
   c. source
   d. ending

2. (Lesson 2) Sounds are made by .
   a. vibrations
   b. air
   c. nothing

3. (Lesson 2) Draw lines to match the sound with the material that vibrates to make the sound.

<table>
<thead>
<tr>
<th>SOUND</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guitar</td>
<td>Dry rice or beans</td>
</tr>
<tr>
<td>Baby rattle</td>
<td>Metal</td>
</tr>
<tr>
<td>Cymbal</td>
<td>String</td>
</tr>
</tbody>
</table>
ExploraGear® Items

The ExploraGear® provides all of the hard-to-find, hands-on materials needed to effectively implement a Science Companion module. This kit of non-consumable and consumable items is your go-to place for the tools needed to teach inquiry science. The authors of Science Companion carefully developed the curriculum so that the ExploraGear® items are not overwhelming and unfamiliar, but filled with the most essential, high quality items needed to engage students in a rich, interactive, inquiry science experience.
Science Companion uses the “I Wonder” Circle to help students reflect on how they (and other scientists!) do science.

**I Wonder:** notice, ask questions, state problems

**I Think:** consider, gather information, predict

**I Try:** experiment, model, test ideas, repeat

**I Observe:** watch, examine, measure

**I Record:** record data, organize, describe, classify, graph, draw

**I Discover:** look for patterns, interpret, reflect, conclude, communicate discoveries
For the Teacher

Teaching and Assessment

Teacher Lesson Manual
Assessment Book
Student Notebook Teacher Guide

Reference Materials
- Teacher Reference Materials
- Lesson 0

Teacher Masters

Visual Aids
- Transparencies and Posters
- I Wonder Circle® Poster in English & Spanish

Great Classroom Support

What’s in Science Companion?

- Human Body in Motion
  - Teacher Lesson Manual
  - Assessment Book
  - Student Notebook Teacher Guide

- Amazing Cells
  - "I Wonder" Circle® Poster

- Doing Science
- Reference Materials

www.sciencecompanion.com
I Discover...

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For the Student:

Classroom Supplies

Student Science Notebook
English & Spanish

Great Curriculum Support

Student Reference Book
(Levels 4-6)

Exploragear® Kit

Trade Books
(Levels K-3)

Curriculum now available in print and digital!

www.sciencecompanion.com
Collecting and Examining Life
From collecting animal tracks to dissecting flowers, children deepen their understanding of what makes something alive as well as exploring the similarities and differences among living things.

Rainbows, Color, and Light
Through experiments with prisms, mirrors, bubbles, water, sunlight, and flashlights, children bring rainbow effects into their classroom and onto the playground. They also mix colors to observe that colored light produces different results than mixing pigmented paints, dough, or water.

Solids, Liquids, and Gases
While deciding what makes a solid a solid, watching water disappear from an open cup, or comparing various liquids, children find the value in asking questions and probing the world around them for meaningful answers.

Early Science Explorations
From making a collage of the leaves and seeds they find to constructing a lever from rocks and wood, children are introduced to the wonders of science and scientific exploration. Contains 7 studies in one book: Growing and Changing; Class Pet; Collections from Nature; Constructions; Dirt, Sand and Water; Sky and Weather; and My Body.

Weather
One day students learn to use a thermometer to record temperature, another day they measure rainfall or investigate the nature of ice. Throughout the year, students use their senses as well as scientific tools to discover that weather is a dynamic part of nature.

Magnets
From testing what sort of everyday objects are attracted to magnets to comparing the strength of different magnets, children deepen their observation skills while learning about the nature of magnets.

Rocks
One day children examine fossils, another day they might test minerals. As children collect, examine, describe, and experiment with rocks, minerals and fossils, they hone their observation skills and begin to unravel the puzzle of what rocks are and how they are formed.

Soils
From closely observing soil components and their properties to discovering the importance of earthworms, children use their senses of sight, smell, and touch to explore the wonders of soil.
Habitats
From going on a nature walk to dissecting owl pellets, children are asked to think about how organisms (plants, animals, fungi, and microscopic living things) survive in the places they live, and how they interact with other living things.

Electrical Circuits
Whether exploring static charges, figuring out how to get a light bulb to light, or testing the conductivity of everyday objects, students experience firsthand the excitement of electricity and scientific discovery.

Nature’s Recyclers
By watching composting worms create soil, to modeling the nutrient cycle, students have the opportunity to investigate the organisms that carry out the process of decomposition and recycle nutrients in an ecosystem.

Earth’s Changing Surface
From building river models that explore erosion and deposition to touring the school grounds looking for evidence of the earth’s changing surface, students use hands-on investigations to discover the dynamic nature of the earth’s surface.

Human Body in Motion
By modeling how muscles move bones, testing reflexes, and measuring the effects of exercise on breathing and heart rate, students begin to appreciate the interactions between body parts and recognize the importance of protecting them by making healthy choices.

Force and Motion
By demonstrating and explaining ways that forces cause actions and reactions, as well as gaining a deeper understanding of basic forces such as friction and gravity, students discover the many ways that forces affect the motion of objects around them.

Science Skill Builders
With 21 lessons spanning the breadth and depth of science skills, students develop a core understanding of using tools in science, scientific testing, observation skills, and the importance of analysis and conclusions.

Light
Whether watching light “bend” a pencil in water or building a periscope, the combination of hands-on, multi-sensory learning enables children to understand what light is, how it behaves, and why it makes sight possible.

Our Solar System
One day children chart the moon’s cycles, another day they might make a scale model of our solar system. By observing the world around them, they address questions such as “Why are there seasons?” and “Why does the moon appear to change shape?”

Watery Earth
Whether following a drop of water through the water cycle, measuring their own water usage, or exploring how filters clean dirty water, students are encouraged to use what they learn to have a positive impact on water resources.

Matter
With challenges like exploring what they can learn about an unknown substance called “Whatzit,” students experience the excitement of scientific discovery and gain an appreciation of the scientific method used by professional scientists.

Energy
Whether testing the efficiency of light bulbs, exploring heat conduction, or designing an imaginary invention demonstrating the transfer of energy, students discover that energy is at the root of all change occurring in the world around them.

Design Projects
Animal Homes, Human Tools, Simple Machines, Moving Systems, Electrical Circuits, Human Systems. The design project series was developed to support compatible modules by allowing students to design and/or build animal homes, tools, machines, and designs of their own creation. Taking between 4-6 sessions, the projects strengthen skills and ideas about choosing materials, using tools, working with the limitations of materials, solving problems, and overall project design.
## Unique Features...

<table>
<thead>
<tr>
<th>Program Features</th>
<th>FOSS</th>
<th>Science Companion</th>
<th>STC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepares students to do inquiry-based science</td>
<td>✓</td>
<td>Lesson O introduces students to the scientific method through the “I Wonder” Circle</td>
<td></td>
</tr>
<tr>
<td>Hardback, colorful, content-rich student reference materials for upper elementary students</td>
<td>✓</td>
<td>Student Reference Books</td>
<td></td>
</tr>
<tr>
<td>Bound student science notebooks to foster student literacy and reading skills</td>
<td>✓</td>
<td>The original Student Science Notebooks</td>
<td></td>
</tr>
<tr>
<td>Parallels in instructional design to <em>Everyday Mathematics</em>®</td>
<td>✓</td>
<td>Developed by the creators of <em>Everyday Mathematics</em>®</td>
<td></td>
</tr>
<tr>
<td>Variety of assessment strategies</td>
<td>✓</td>
<td>Teacher-friendly formative and summative assessment strategies</td>
<td>✓</td>
</tr>
<tr>
<td>A variety of pilot options to fit the interests and needs of districts</td>
<td>✓</td>
<td>Several no-cost pilot options, including an innovative online pilot program</td>
<td></td>
</tr>
<tr>
<td>Correlations to local and state science standards</td>
<td>✓</td>
<td>Correlated to state standards with customized local standard correlations available upon request</td>
<td></td>
</tr>
<tr>
<td>Teacher must gather minimal teacher supplied items</td>
<td>✓</td>
<td>ExploraGear and Supplemental Classroom Supplies available</td>
<td>✓</td>
</tr>
<tr>
<td>Early Childhood activity-based modules available</td>
<td>✓</td>
<td>Modules developed specifically for PreK-K available</td>
<td>(K Only)</td>
</tr>
<tr>
<td>Unique content offered to meet standards</td>
<td>✓</td>
<td>Light and Rainbows, Color, and Light modules available</td>
<td></td>
</tr>
<tr>
<td>Children develop science habits of mind in addition to content knowledge</td>
<td>✓</td>
<td>“I Wonder” Circle integrates modules as tool for student reflection</td>
<td></td>
</tr>
<tr>
<td>Engaging activities nourish children’s curiosity</td>
<td>✓</td>
<td>Engaging, hands-on activities focused on Big Ideas</td>
<td>✓</td>
</tr>
<tr>
<td>Supports teachers in reaching Big Ideas</td>
<td>✓</td>
<td>Reflective Discussions help children integrate their experience and build science knowledge</td>
<td></td>
</tr>
<tr>
<td>Full curriculum available digitally</td>
<td>✓</td>
<td>Hyperlinked teacher materials (iTLM’s) &amp; digital student materials build affordable access</td>
<td></td>
</tr>
</tbody>
</table>

[www.sciencecompanion.com](http://www.sciencecompanion.com)
We know that both time and financial resources are limited for school districts these days.
So, we are delighted to introduce an exciting new digital opportunity for you to try Science Companion materials at no cost, at a scale that is easily manageable. And it’s high tech, too!

Come to our Online Pilot Website and find:

• Sample lessons from eight of our modules.
• Conversation and support from content and teaching experts.
• Free digital teacher materials and student resources.
• Directions on how to order ‘lending library’ for kit materials.
• A pilot that will give you a rich taste of inquiry science but requires no more than a handful of classroom sessions.

“I think this is an awesome resource for doing science.”

Field Test Teacher

There are a limited number of online pilots available, so contact us now to find out how you can explore Science Companion at your pace, for free.

(And, of course, we have traditional pilots available too. Just ask!)
Professional Development
Succeed with Science Companion

Inquiry-based learning in science is exciting, effective, and evocative. It also can be challenging. We can help you take the mystery out of inquiry!

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A half-day session introducing the methodology, pedagogy, and best practices of Science Companion.

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Building from specific modules your district is using, a hands-on exploration of how to best implement Science Companion in your classrooms.

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 Teachers and administrators in districts using Science Companion.

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