SOUNDS ALL AROUND: THE SCIENCE OF HOW SOUND WORKS TEACHING GUIDE

ABOUT THE BOOK

From a cat's purr to a thunderstorm's clap, from a friend's voice to a school bell's clang, sounds can lull us, entice us or call us to action. But how does sound happen? How do we hear it? What makes some sounds loud and some soft? Some high pitched and some low pitched? How do humans and animals use sound to communicate? Which sounds happen naturally, and which are created for a specific purpose? This charming picture book explores all of these questions in child-friendly language, offering readers a gentle introduction to how sound works that will encourage them to stop and listen.

ABOUT THE AUTHOR

Award-winning author Susan Hughes has written over thirty books --- both fiction and nonfiction --- for children of all ages. She is also a freelance editor and writing coach. Susan has always loved writing. When she was growing up she and several friends started a writing club. They would gather with their poems and stories and read them aloud to one another. Today, Susan lives in Toronto, Canada, in a house with a big red door. She does freelance editing (including critiques, commissioned writing, and story coaching. And of course, she loves writing her own stories --- from picture books, middle-grade novels and graphic novels to nonfiction and young adult novels!

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ABOUT THE ILLUSTRATOR

Born in New England, Ellen Rooney carries the east coast in her heart while making her home in western Canada. She lives in the Okanagan Valley of British Columbia with her husband and their dog. She loves to visit her big New England family, and the Atlantic Ocean, whenever she can.

Instagram: @ellenaroo

Pre-reading Activities

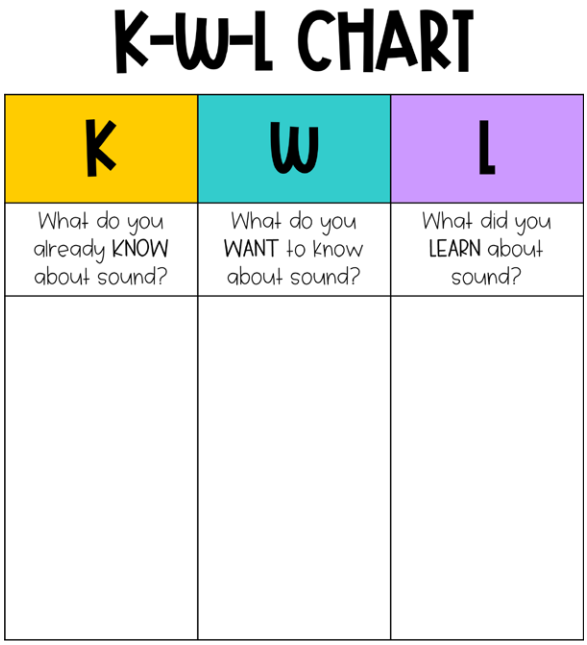
Picture Predictions

Starting at the beginning of the story, flip through the illustrations and show the students each page. Ask and discuss any of the following questions before reading:

"What do you notice about…"
"What does the illustration tell you about what might be happening?"
"What do you think might happen next? Why?"
"What might this story be about? Why?"

K-W-L Chart

A K-W-L chart is a great way to activate background knowledge and get a feel for what students already know about the topic. Create a chart with three columns (see sample below). Label each column K (what do you already KNOW about the topic?), W (what do you WANT to know about the topic?), L (what did you LEARN?). Complete K and W of the K-W-L chart before reading. After reading, revisit the chart and record what students learned as a result of reading.



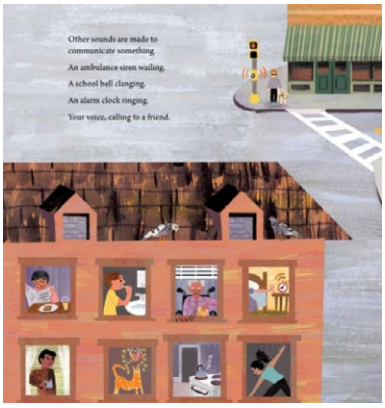
Sound Walk

Get students excited about sound by taking them on a sound walk! If weather allows, plan your walk for both inside and outside of school. Have students create a table in their journals titled: Sound Walk. There should be a spot for students to describe the sound they're hearing and whether that sound happens naturally or to communicate something (see sample below). Students will take their journals and pencils with them

on the walk to record what they hear. This will be a great exercise to study the different types of sound discussed in the book on pages 6 - 7 and 8 - 9.

SOUND WALK

What sound do you hear?	Does it happen naturally or to communicate something?
Birds chirping	It happens naturally.
School bell ringing	It happens to communicate when lunch starts.



Outline of Activities

Lesson One: Whole Group Literacy | Exploring main idea and supporting details
Lesson Two: Individual Writing | Informational brochure writing
Lesson Three: Small Group STEAM | Design an instrument STEAM project
Lesson Four: Whole Group Science | See the sound science experiment
Lesson Five: Individual & Small Group Reflection | Putting it all together

The lessons in this guide can be differentiated for students in grades K - 5. They are

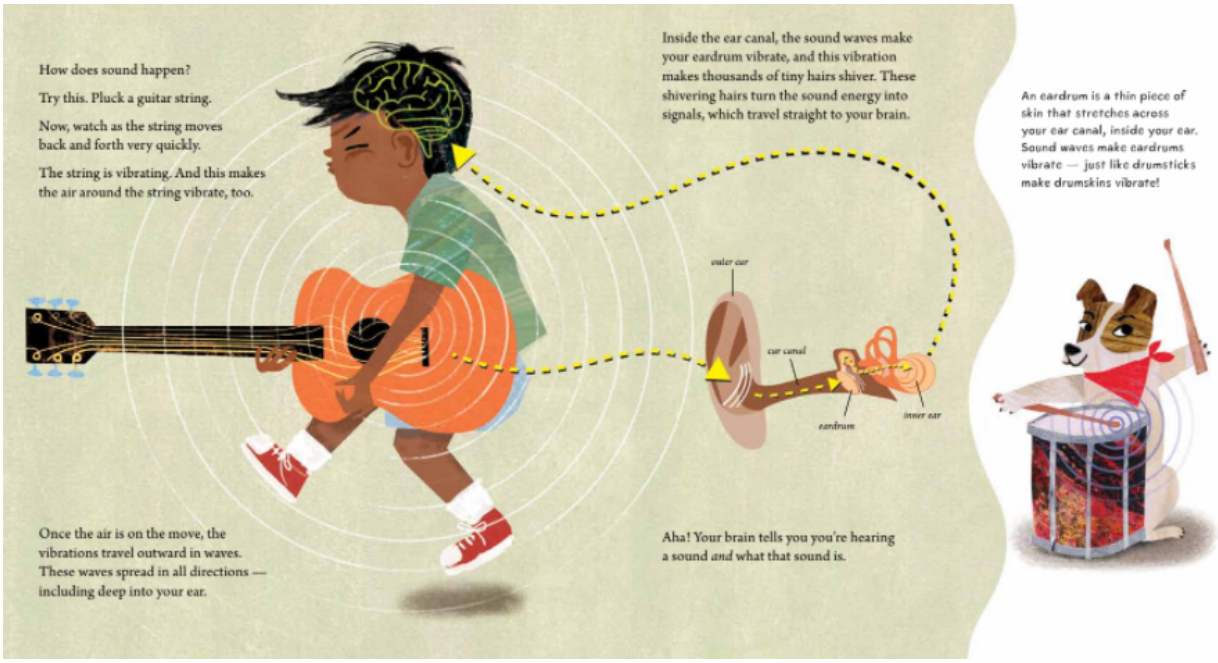
planned sequentially and work best completed over a series of days. Specifically, Lesson 2 should follow Lesson 1. The remaining lessons can be chosen one at a time at random.

Lesson One: Whole Group
Exploring main idea and supporting details
Target Grade Range: K - 5th Grade

Standards:
CCSS.ELA-LITERACY.RI.K.2
CCSS.ELA-LITERACY.RI.1.2
CCSS.ELA-LITERACY.RI.2.2
CCSS.ELA-LITERACY.RI.3.2
CCSS.ELA-LITERACY.RI.4.2
CCSS.ELA-LITERACY.RI.5.2

Materials:

- Sticky notes (optional)
- Highlighters
- Pencils
- Student copies of pages 10 - 11 from the story



Lesson:
Begin the lesson by asking students: "How does sound improve our lives?" Depending

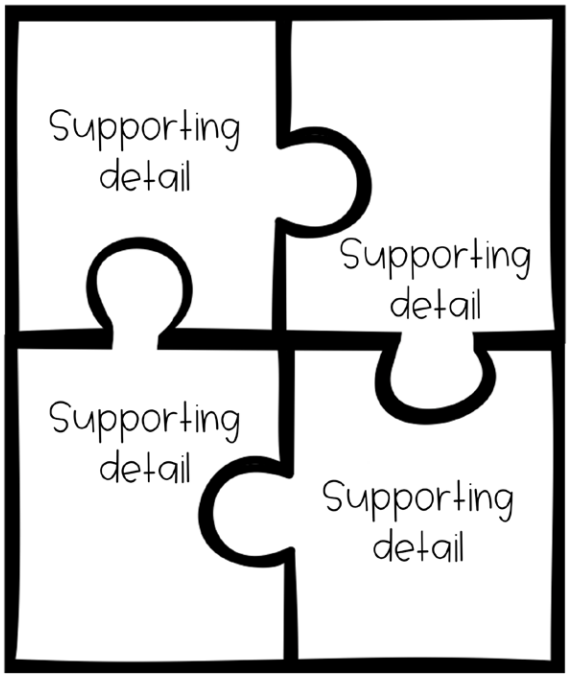
on the age of students, you can pass out sticky notes and have them record their thoughts and post them around the classroom. Invite students to walk around the classroom and read their classmates' thoughts before having a discussion with the whole group. If students are unable to record their thoughts or read their classmates' recordings of their thinking, you can simply jump right into the whole group discussion and record students' thoughts on the white-board.

Explain that today we'll learn all about SOUND by reading a story called Sounds all Around: The Science of How Sound Works. The author, Susan Hughes, and illustrator, Ellen Rooney, teach us about the different kinds of sounds and the science behind how sound works. Depending on the age of the students, you can approach reading the story in a number of ways. You can read the text aloud, call for student volunteers, "popcorn" read, or have students read independently. Consider the grade and skill level of your students when deciding how to read the story.

After reading, introduce the non-fiction reading comprehension strategy - main idea. Explain that when we find the main idea of a body of text, we discover what the story is ***mostly*** about or what the author hopes to have taught us after reading. The main idea must be supported by details from the story. These details are called supporting details.

Use a puzzle piece analogy to help students better grasp the relationship between main idea and supporting details. The main idea is the whole puzzle and the supporting details are the individual pieces. Just as you can't have a completed puzzle without all of its pieces, you can't have a main idea without supporting details (see image below). The supporting details aren't just random facts from the story; they connect directly to the main idea. Just as the puzzle pieces fit together, the supporting details should work together to support the main idea.

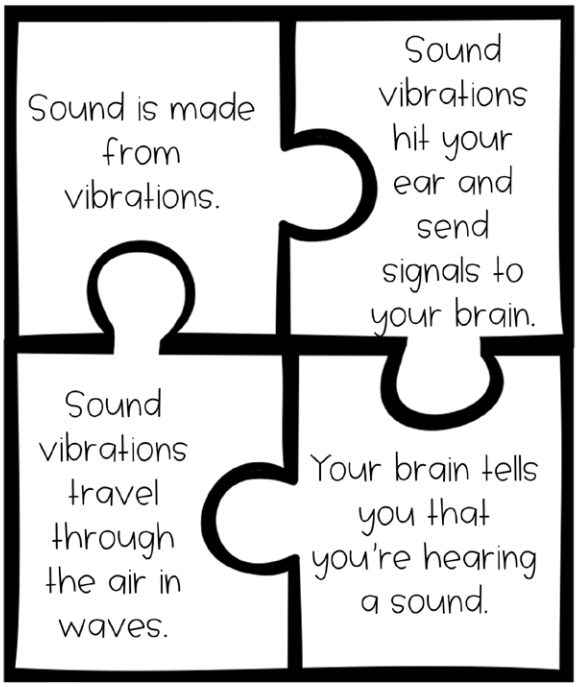
MAIN IDEA



A non-fiction text can have many main ideas from start to finish. Explain that today we'll be looking specifically at the main idea on pages 10-11 of Sounds all Around.

For older students, distribute paper copies of pages 10 -11 for students to read. Decide whether you will read the pages aloud or have students read independently. Remind students that the main idea is supported by details from the text. While reading, encourage students to use highlighters to find sentences that they think might be good details to support the main idea (these highlighted sentences will be referenced and written as supporting details later in the lesson). After re-reading and highlighting, discuss with students what they think the main idea and supporting details may be. Use anchor chart paper and markers or the white board to draw a large puzzle, like the one pictured below. Above the puzzle write the main idea of pages 10 -11 (How Sound Happens) and ask older students for supporting details to write in each puzzle piece. Encourage students to revisit the sentences they highlighted from the text.

HOW SOUND HAPPENS



For younger students, re-read pages 10 -11 aloud to students. Highlight important facts from those pages that will lead them to discover the main idea of those pages (i.e. how sound works). Use anchor chart paper and markers or the white board to draw a large puzzle, like the one pictured above. Above the puzzle write the main idea of pages 10 -11 (How Sound Happens) and ask younger students for supporting details to write in each puzzle piece. Encourage students to revisit the sentences you highlighted from the text. Ask students: "What do these facts have in common? What is the main idea?" Show how the details work together to support the larger main idea.

End the lesson for all students by explaining that thinking about the main idea better helps us understand what a story or piece of text is about.

Lesson Two: Individual Work
Informational brochure writing
Target Grade Range: K - 5th Grade

Standards:

CCSS.ELA-LITERACY.W.K.2
CCSS.ELA-LITERACY.W.1.2
CCSS.ELA-LITERACY.W.2.2
CCSS.ELA-LITERACY.W.3.2
CCSS.ELA-LITERACY.W.4.2
CCSS.ELA-LITERACY.W.5.2

Materials:

- Online "guess the sound" video
- White copy paper / cardstock
- Pencils
- Art supplies (crayons or colored pencils)

Lesson:
Begin the lesson with a fun "guess the sound" game. Ahead of time, locate a "guess the sounds" video online (using the search words "guess the sounds video"). Play it for the students, and have them guess what they think each sound is. Remind students how sound works.

Ask students to flip to pages 10-11 in Sounds All Around. Review what students learned during the last lesson about the science behind sound. Explain that students will use the main idea and supporting details discussed in the previous lesson to create an informational piece of writing. Depending on the grade and ability level, students will create an informational brochure about how sound and ears work, including a diagram like the one shown in the story. Younger students can simply write a short, informational paragraph or draw a simple picture showing what they learned. Decide whether those students creating a brochure will use white copy paper/cardstock folded in thirds or a digital template.

Lesson Three: Group Work

Design an instrument STEAM project

Target Grade Range: K - 5th Grade

Standards:

NGSS: K-2-ETS1-2.

NGSS: 3-5-ETS1-1.

NGSS: 3-5-ETS1-2.

Materials:

- Poster Board
- Pencils
- Lined paper
- Art supplies (crayons, colored pencils, or markers)
- Optional art supplies (pipe cleaners, rubber bands, Kleenex boxes, paperclips, tape, staples, playdough, etc.)

Lesson:

Begin the lesson with a discussion of music. Ask the following questions to get students thinking:

"What is your favorite style of music? Why?"
"What kind of instruments do you hear in that style of music?"
"What kind of instruments are your favorite? Why?"
"Can voices act as instruments? What makes you think that?"

Record students' thinking on the white board. Explain that instruments create sounds that work together to make the music we all know and love. In this creative STEAM project, students will design a new instrument and describe what it sounds like.

Small groups of students (3 - 4 per group) will work collaboratively to design a new instrument. First, they'll use scratch paper to create blueprints for the new design. Then, the group will use lined paper to describe the instrument (its name, what it looks like, the sound it makes, etc). Finally, students will work together to draw and decorate their new instrument using crayons, colored pencils, or markers. Younger students can simply draw an instrument and verbally share the descriptions (its name, what it looks like, the sound it makes etc). Older students can actually build an instrument with supplies around the classroom (i.e. pipe cleaners, rubberbands, Kleenex boxes, paperclips, tape, staples, playdough, etc).

Allow 30 - 45 minutes for students to work in their small groups. Set 15 - 20 minutes aside at the end of the lesson for groups to share their new design.

Lesson Four: Whole Group
See the sound science experiment
Target Grade Range: K - 5th Grade

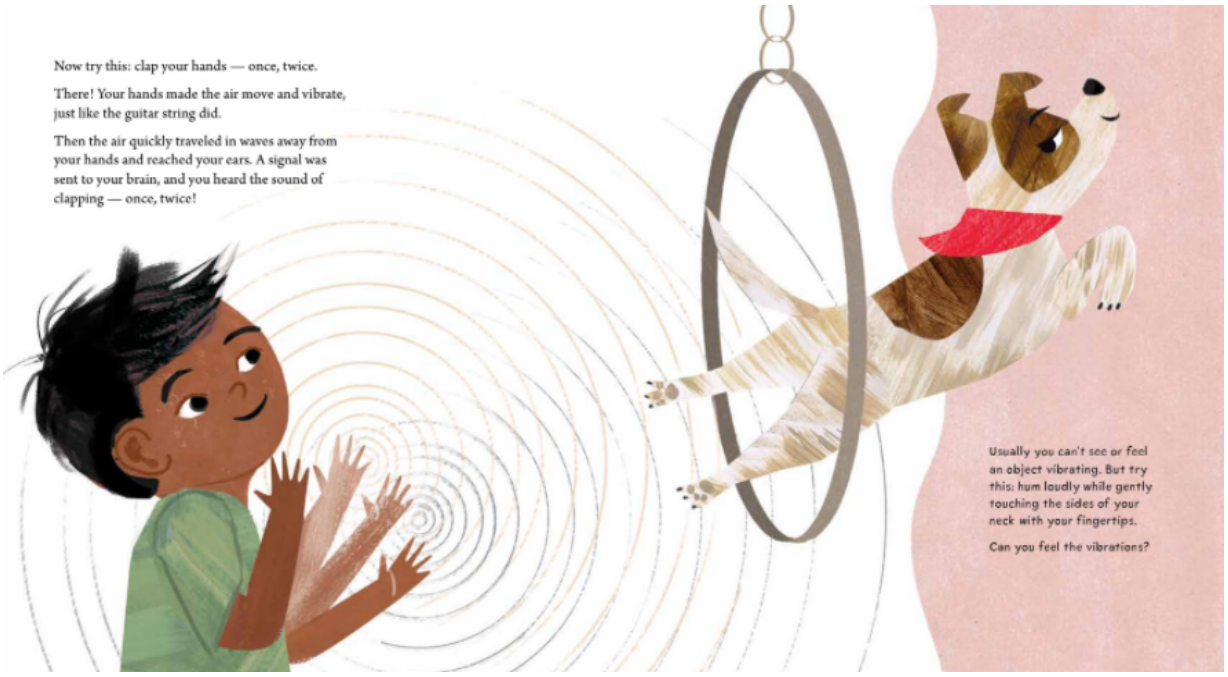
Standards:
NGSS: 1-PS4-1.
NGSS: 1-PS4-4.
NGSS: 4-PS4-1.
NGSS: 4-PS4-3.

Materials:

- Plastic cups
- Scissors
- Plastic wrap
- Rubber bands
- Table salt

- Speakers (cell phone, headphones, etc)
- Pencils

Lesson:
Begin the lesson by referring back to and rereading pages 10 -11. Then, place 3 - 4 rubber bands around your fingers. With the opposite hand, use your fingers to strum the bands. Ask students to watch closely and observe what happens. Ask: "What do you notice about the rubber bands?" and "Why do you think that's happening?"

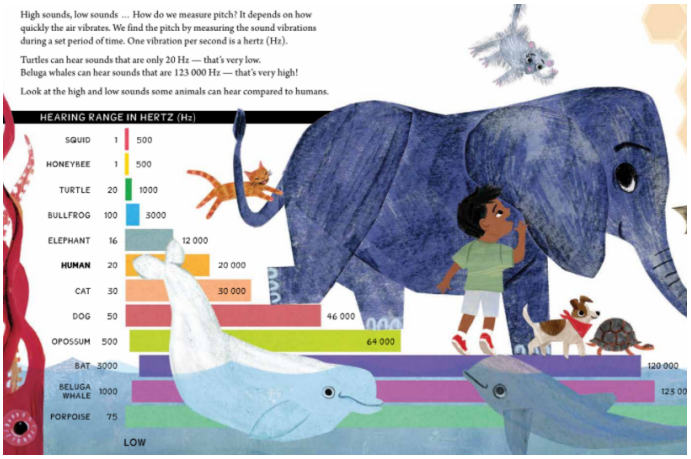


That's right! The rubber bands are vibrating. The movement makes the air around them vibrate too. The moving air travels into our ears as sound waves. Reread the text and sidebar on pages 12-13. Explain that students will be making a model ear drum. With this project, students will be able to observe the salt crystals moving. The movement shows the air traveling away from the source of the sound in waves

<u>Complete the following steps to conduct the experiment:</u>
Note: The teacher will prepare and conduct the experiment while students observe. Older students may be able to complete certain aspects of the experiment including but not limited to: holding the salt, holding the cup over the speaker, and playing different types of music at different volumes. Use your discretion.

Step 1: Gather the supplies (1 plastic cup, plastic wrap, scissors, table salt, a ruler, a marker, and a sound speaker, cell phone, or earphones).
Step 2: Use a ruler to measure roughly 5 cm from the bottom of the plastic cup and mark this in several places all the way around the cup. Draw a line joining these marks around the cup.

Step 3: Use the scissors to cut off the bottom of the cup, cutting along the line.
Step 4: Stretch a piece of plastic wrap over the open end of the cup. Secure it tightly with a rubber band.
Step 5: Create a tight surface by gently pulling the plastic wrap.
Step 6: Sprinkle salt on top of the stretched plastic.
Step 7: Hold the cup over the top of any small sound speakers, cell phone, or earphones while playing loud music. Remind students to protect their ears!
Step 8: Carefully observe the salt crystals. Students describe what they see.
Step 9: Try different types of music and volumes. Students describe what they see.
Step 10: With older students, reread pages 22-23 and 24-25 to explore ways in which pitch and decibels influence sound.



Bravo! We just made a model eardrum! First, reread the sidebar on page 11 that explains what the eardrum is. Remind students that when airwaves travel into our ears, they make our eardrums vibrate. This vibration makes tiny hairs in our ears shiver which sends the sound energy to our brain. Discuss the results of the sound experiment. Explain that the sound waves from the speaker, cell phone, or earphones travel to the plastic on the cup (which is like our eardrums) and make the plastic vibrate. This vibration or sound energy, in turn, makes the salt move.

End the lesson by allowing students an opportunity to reflect and share what they noticed, liked, or would change about the experiment.

Lesson Five: Group & Individual Work
Putting it all together
Target Grade Range: K - 5th Grade

Standards:
CCSS.ELA-LITERACY.RI.K.10
CCSS.ELA-LITERACY.RI.1.10
CCSS.ELA-LITERACY.RI.2.10
CCSS.ELA-LITERACY.RI.3.10
CCSS.ELA-LITERACY.RI.4.10
CCSS.ELA-LITERACY.RI.5.10

Materials:
- Scissors
- Copies of tic-tac-toe board and 'x' and 'o' pieces
- Pencils
- Copies of Exit Tickets

Lesson:
Think about all that we've learned about the science behind sound! Let's brainstorm different sounds and think about whether they happen naturally or not, whether they communicate something, and, if so, what they might communicate. Draw a t-chart table on the board to record the different sounds and for what reason they occur (see sample below).

DIFFERENT SOUNDS

Sound	Does the sound happen naturally?	Does the sound happen to communicate something?	What does the sound communicate?
A cellphone ringing		✓	Someone is trying to talk to you.
The wind blowing	✓		

During this lesson we'll review what we've learned about the science behind sound in a fun way! Choose the tic-tac-toe board that works best for the grade level and skill sets of your students (see samples below). Explain that students will need a partner to

play Sound Tic-Tac-Toe. Distribute one copy of the tic-tac-toe game board and the 'x' and 'o' pieces to each set of partners. Students will decide which partner willl use the 'x' pieces and which partner will use the 'o' pieces. Partners will take turns choosing a box on the game board, responding to the instruction or question, and then covering the box with their game piece. The first player to cover 3 consecutive boxes (vertically, horizontally, or diagonally) wins. Students can replay the game as many times as time allows.

Name: _____

SOUND TIC-TAC-TOE

SHOW WHAT YOU KNOW!

Share one fact about sound from the story.	Share why sound is important.	Name a sound that an animal makes.
Share your favorite part of the story.	Name a sound that you hear everyday.	Share your favorite illustration from the story.
Name an electronic sound.	Share an interesting fact you learned from the story.	Share one question you still have.

Name: _____

SOUND TIC-TAC-TOE

SHOW WHAT YOU KNOW!

How does sound travel?	Name one new fact you learned while reading.	Name a sound that happens to communicate something.
Define echolocation.	Name a sound that happens naturally.	Describe how we hear sound.
How do we measure sound pitch?	What do we use to measure the energy in the vibrations?	Name one question you still have.

At the very end of the lesson, distribute Exit Tickets (see sample below). Ask students to write or draw three new things they learned about sound, two things about sound they want to know more about, and one question they still have about sound.

Name: _____

3, 2, 1 EXIT TICKET

3	What are THREE new things you learned about sound?
2	What are TWO things about sound that you want to know more about?
1	What is ONE question you still have about sound?

Optional Extensions

Social Studies - Introduce students to Helen Keller (born in 1880), who became deaf and blind when she was 19 months old. Students will research her life, especially her experiences living without sound. Students can create a timeline of her life, or write a short biography of her accomplishments.

Science - Use what you've learned about sound to create a guitar! Wrap several rubber bands around an empty tissue box lengthwise. Gently pluck each rubber band. What do you notice about the rubber bands and the sound they make?

Writing - Encourage students to pay extra attention to the sounds they hear in everyday life. Students will keep a log of daily sounds using a sound journal for 3 - 7 days. At the end of this time period, students will write about any patterns or consistencies they see in their sound journal.

Art - Play different sound clips with different pitches (including high, medium, and low). Encourage students to draw sound waves to show the pitch frequency of each sound (high peaks for high-pitched sounds and low peaks for low-pitched sounds). Students will repeat this process for each sound clip played, intersecting sound waves as they see fit. Finally, students can use art supplies to decorate and design the sound

waves to create a piece of abstract art.

Math - Count the different sounds you see captured in the illustrations of your 2 favorite pages in the story. Depending on their grade and skill level, students can count the sounds pictured in different illustrations on 3 or more pages to find a total number of sounds.

Name: _____

SOUND TIC-TAC-TOE

SHOW WHAT YOU KNOW!

Share one fact about sound from the story.	Share why sound is important.	Name a sound that an animal makes.
Share your favorite part of the story.	Name a sound that you hear everyday.	Share your favorite illustration from the story.
Name an electronic sound.	Share an interesting fact you learned from the story.	Share one question you still have.

Kids Can Press
www.KidsCanPress.com

Sounds All Around
Written by Susan Hughes
Illustrated by Ellen Rooney

Name: _____

SOUND TIC-TAC-TOE

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SOUND TIC-TAC-TOE

GAME PIECES

X	X	X
O	O	O
X	O	X

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SOUND TIC-TAC-TOE

GAME PIECES

X	O	X
O	O	O
X	O	X

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Sounds All Around
Written by Susan Hughes
Illustrated by Ellen Rooney

Name: _____

3, 2, 1 EXIT TICKET

3	What are **THREE** new things you learned about sound?
2	What are **TWO** things about sound that you want to know more about?
1	What is **ONE** question you still have about sound?

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