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COMMUNITY RESOURCES FOR SCIENCE

BASIS Lesson Plan

Lesson Name: Hear All About It! (Sound)

Grade Level Connection(s): NGSS Grade 1, Physical Science, Waves: Light & Sound
FOSS Grade 2, Physical Science: Module 5, Back and Forth

**Note to teachers: Detailed standards connections can be found at the end of this lesson plan.*

Teaser/Overview

In this fun, hands-on lesson, students will explore sound waves through the concept of vibration. Students will enjoy talking with their classmates through their own “telephone”, listening to a stereo hanger, and playing a homemade guitar!

Lesson Objectives

- Students will use sight, touch, and hearing to observe vibrations that result in sound.
- Students will work collaboratively in pairs and small groups to carry out simple investigations about sound waves.
- Students will better understand that sound results from vibrations that travel from their point of origin to a person’s ear, through sound waves.

Vocabulary Words

- **Sound:** Vibrations that travel through from their point of origin to a person’s ear
- **Observation:** Something you notice with your senses (by seeing, feeling, hearing, etc.)
- **Hypothesis:** A guess based on what you know and observe about the world
- **Vibration:** a shaky, back and forth motion
- **Sound waves:** pattern (wave) that particles make when they vibrate to create sound

Materials

Scientist Volunteers will bring:

- Strings (16 short pieces)
- Paper cup “telephones”, two paper cups attached with string (6)
- Metal hangers, each with two strings attached (6)
- Metal spoons (6)
- Plastic spoons (6)
- Homemade “guitars” (4)
- Talkie tapes

Materials teachers should provide:

- Pencils
- Markers (for writing students’ names)

Classroom Set-Up

Students should begin together on the carpet, but they will need to be seated next to a partner that they will work with on the first activity. They will then be separated into three groups to rotate through three different stations; at each station, they will work in pairs.

Classroom Visit

1. Introduction (10 minutes)

Role Model Introduction:

Being a role model is an important part of being a BASIS volunteer! Begin your lesson by explaining who you are and what you do as a scientist. Feel free to tell your “story” as if giving an elevator pitch to first graders: Why did you become a scientist? What questions are you trying to find answers to? What do you do in your job? Why should students relate to you? Feel free to bring in photos, specimens, and other props. Let your personality shine through!

Teaching Tip: What is “science”?

- In a 1st grade classroom, you may be introducing students to science for the first time!
- Ask students what they know about science.
 - What is science? (Asking questions; finding answers; etc.)
 - What kinds of things do scientists do?
 - Have students ever done any science before? (They probably have, even if they didn’t think of it as science!)

**Topic Introduction:**

After you introduce yourselves as role models, take some time to introduce the topic of this lesson: **sound and vibration**. It may be helpful to keep the suggested take-away in the back of your mind throughout the lesson: **Vibrating materials can make sound and sound can make materials vibrate.**

1. Introduce the phenomenon that the class will explore: sound
 - Get the kids thinking about sound with a fun back-and forth. Invite students to repeat after you: whisper “Hello!” at various volumes: whispering, speaking quietly, speaking in a normal tone, speaking loudly.
 - Guide a class discussion: how did you know what word to say? How did you know how loudly or quietly to say it?
 - Guide students to the first important vocabulary word: **sound**. (eg “What was I sending from my mouth to your ears? What do we call that? What do our ears listen to? Etc.).
 - Note: You may wish to introduce other sound-related phenomena up front to get kids excited: eg bring in your own musical instrument or play a handmade “guitar.”
2. Activate students’ prior knowledge with a discussion of sound. Use a KWL chart.
 - What do students *know* about sound? (record on board; you may wish to structure this in categories, eg what kinds of sounds are there, what kinds of things make sounds, etc.)
 - What do students *wonder* about sound? (record their questions on board)
3. Introduce the learning experience
 - Today we’re going to explore one of our questions: How does sound travel from an object to our ears? Does anyone have any thoughts or guesses?
 - Let’s see if we can gather some information to help us make good guesses (**hypotheses**).
 - Pair up students (groups of 2, a few of 3 is okay). In a moment, we’re going to give each pair of students a string. Your challenge is to work together with your partner to see if you can have your string make a sound. If you can make a sound right away, then your additional bonus challenge is to make five different sounds with your string.
 - Give each pair a piece of string (approx. 1ft in length). Go around and ask students what they observe. Does it make a sound? If not, what can we change about the string when we try again? [string must be pulled taut to produce a sound, but try to allow students to come to that conclusion on their own]
 - Once they make a sound, focus their attention on the string. What do they notice it’s doing? Is it moving? How so?
 - Repeat, with the other member of each pair plucking the string. Hopefully every pair is able to make some noise by vibrating the string.
 - Can we make the vibrations sound a certain way? Have students experiment with different ways of making sound with their string.

- Bring back students together as a class. What did they observe or notice? Gather some observations.
- Let's look at one other example, everyone tilt your head back slightly and place two fingers on your neck (next to your throat), and make an "ahhhh" sound with your mouth. What do you notice this time?
- The movement you felt with your fingers is called a **vibration** (write on board, define).
- Do you think vibrations have to do with making sound? Let's figure it out!

Teaching Tips: Guide Discussion with 1st /2nd Graders

- Be explicit about new vocabulary so that all students can follow along.
- Wait 2-3 seconds before calling on anyone to answer a question.
- Consider using "pair-share" technique to encourage participation: instead of taking answers right away, have students turn to a partner to share first.
- Remind students of the difference between statements and questions if need be: questions start with question words like who/what/when/where/why/how!

2. Learning Experience (35 minutes)

Students will be split into three groups. Each group will head to one of three stations set up around the room; at each station, they will interact with a new volunteer and explore sound vibrations in a new way. One volunteer (or the teacher) will keep time; every ten minutes, the groups will rotate to a new station. Remember that all three of these stations are designed to address the takeaway in a particular way: **Vibrating materials can make sound and sound can make materials vibrate.**

Station A: Telephone

Question 1: Can we use vibrations to communicate something like words?

- Before passing out materials to the students, choose one student to participate and model the activity with you. This will help to guide the student exploration once they have materials.
- Give each pair of students 2 paper cups and 2 paper clips and guide them through the following steps (help if necessary, especially with poking the holes):
 1. Poke a hole in the center of the bottom of each paper cup, using the sharp tip of the pencil.
 2. Thread one end of the string through the cup (from the outside in).
 3. Knot the string inside the cup so the knot prevents the string from slipping out if pulled.
 4. Repeat with the second cup.
 5. To secure the string, place a paper clip between the knot and the bottom of the cup.
- Partners can use the phone by speaking into the cup while the other person listens by placing the open side of the cup to their ear. Take turns speaking and listening. Have students whisper so they know the sound is traveling through the string. What happens when the string hangs down? Does the sound make it across? What if we had a really, really long string?



- Guide the group in discussion: Can you hear your partner speak to you? How do you think this telephone works? What is doing the vibration? What is initiating the vibration? Where is the vibration ending up? Etc.

Question 2: Can we change the sound we hear by changing our actions?

- Invite students to experiment. What if you try and stop the vibration in the string by pinching it? What happens? What about if the string hangs on the ground? What if we change the material of the string? (try with yarn if time allows).
- Guide students to the conclusion that vibrations are created when we send our voice vibrations through the string. Connect to the take-away: **Vibrating materials can make sound and sound can make materials vibrate.**

Classroom Management Tips: Station Rotation

- It helps to keep things orderly. When it's time to rotate, have the leader announce that all students should stand up in place and NOT MOVE until you say so; point out where each group will move to; confirm that everyone understands; THEN instruct students to move to the next station.
- Have a volunteer keep time and tell station leaders to wrap up at 9 minutes.
- Remember that students might visit your station first, second, or third: don't assume prior knowledge from another station!

Station B: Stereo Hanger

Question 1: Can we make sound by creating vibrations on a string?

- Before passing out materials to the students, choose one student to participate and model the activity with you. This will help to guide the student exploration once they have materials.
- Each pair of students will receive one metal hanger with two pieces of string attached.
- Guide students through the following steps:
 1. Tie one piece of string on each end of a metal hanger (let the hanger hang upside down).
 2. While only holding on to the string, wrap the ends of the string around the index fingers and place the index fingers close to your ears. Don't push your fingers too far into your ears!
 3. The partner will then tap the metal hanger with a metal spoon.
 4. Switch off roles with your partner
- Guide the group in a discussion: What did you observe? What did you hear? What did you feel? How do you think this is possible? How did the vibration happen, and what did it cause?

Question 2: Can we change the sound we hear by changing our actions?

- Invite students to experiment. What if you tapped the metal hanger with your finger? Etc.
- Guide students to the conclusion that vibrations are created when we tap the hanger, and different vibrations make different sounds. Connect to the take-away: **Vibrating materials can make sound and sound can make materials vibrate.**

Station C: Homemade guitars

Question 1: Can we make sound by creating vibrations in a string?

- Demonstrate the homemade guitar for students with a single note. What do they observe? What do they hear? What do they **see**?

Question 2: Can we change the sound we hear by changing the vibrations somehow?

- What about when you move your finger to different places on the neck?
- Pass around the guitar so each student can have a quick try plucking the string and observing (feeling, seeing, hearing) the vibration up close.
- If you have time, pass a guitar out to each pair of students and have them experiment *respectfully* (eg no breaking the string, not being so loud as to disrupt the other stations)
- Guide students to the conclusion that we can change the sound by changing the length of the string, because that affects the vibrations. Connect to the take-away: **Vibrating materials can make sound and sound can make materials vibrate.**

3. Wrap Up: Review and Discuss the Learning Experience (10 minutes)

Students should return to the carpet for an all-class discussion.

- What question were we trying to figure out? (how sound travels from objects to ears)
- What did we learn at station A with the telephones?
- What did we learn at station B with the stereo hangers?
- What did we learn at station C with the homemade guitars?
- What is sound? (Vibrations that travel from an object – or person – to a person's ear through vibrations called waves)

You may want to share one last demo, such as Science is Fun talkie tapes; however, give these a few tries first to be sure you can get them to work! If you're comfortable with them, feel free to guide a conversation, eg:

- This is another way to create specific sounds by controlling the vibrations: these ribbons have tiny bumps on them.
- When I move my fingernail across them, the bumps interrupt and change the ribbon's vibrations – just like we did by speaking into our telephones, changing the way we touch the hanger, and changing the position of our fingers on the guitar.
- Show students how to make the tapes "speak" using one attached to a "speaker" (plastic cup). Do students hear anything? What? Any words?
- Tell students the tapes are actually designed to say "Science is fun!" Try again – can they hear it now?
- Can students make the noise themselves?
- Any questions?

4. Connections & Close (5 minutes)

Connections to the real world around students:

Depending on how much time is left, guide students to discuss other ways that vibrations and sound waves are manifested in their lives. You may want to bring in props and demos: a guitar, a drum, a harp, a slinky... get creative!

Close:

Leave a few minutes for students to ask questions about science, about being a scientist, and about becoming a scientist. Then, thanks and goodbye!

Follow Up: After the Presentation

Teachers who wish to extend the impact of this lesson may find the following CRS web pages useful:

- <http://www.crscience.org/educators/helpfulreports>
- <http://www.crscience.org/educators/treasuretrove>

Standards Connections

NGSS:

- Connections by topic
 - Physical Science: 1. Waves: Light and Sound
- Connections by disciplinary core ideas:
 - Physical Science: 1-PS4 Waves and Their Applications in Technologies for Information Transfer
- Connections by scientific & engineering practices
 - 1. Asking questions & defining problems
 - 3. Planning and carrying out investigations
 - 6. Constructing explanations and designing solutions
- Connections by crosscutting concepts
 - 2. Cause and effect: Mechanism and explanation
 - 7. Stability and change
- Connections by performance expectation:
 - 1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

FOSS:

Physical Science: Grade 2. Module 5, Back and Forth