What is Sound? – Teacher's Guide

1. "What is Sound?" Handout

This lesson uses a simple handout to diagram how sound waves travel. It's important to start with the diagram as a concrete way to present an abstract concept.

Provide your child(ren)/student(s) with the handout and review the following sample script to introduce and discuss how sound works before starting the pan flute activity.

Sample Script to Introduce Lesson:

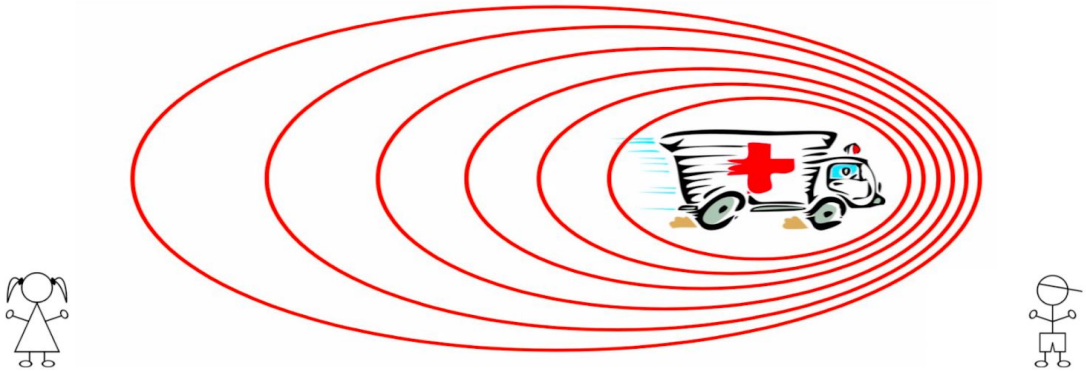
Sound is a type of energy made by vibrations. When an object vibrates, it causes the nearby air molecules to vibrate and move away from their resting position (AKA where they were before the vibrations started). All those vibrating air molecules bump into more nearby air molecules, and then those air molecules then bump into even more nearby air molecules. The vibrations from all these air molecules bumping into each other move in a pattern called sound waves. When you hear something, you are sensing the vibration of air molecules.

Think about when someone whispers compared to when someone yells. Whispering disturbs fewer air molecules and requires less energy. The air molecules will only move a short distance before returning to their starting position. This means the sound won't travel as far and won't be very loud. That's why you need to be close to someone who is whispering if you want to hear them.

On the other hand, yelling causes a much greater chain reaction of air molecules bumping into each other. More energy goes into starting these sound waves, so the air molecules will move much farther from their starting position. As the sound waves move away from the source of the sound, the amount of energy stays the same, but the area gets larger. What does that mean? It means a lot of energy in a small area will be louder than a lot of energy in a big area. That's why sound fades as you move further away from the source.

Sample Script to Explain Ambulance Diagram:

The ovals around the ambulance represent sound waves. Notice how the sound waves on the right side are close together, while the sound waves on the left side are spread apart. The boy is closer to the ambulance, which is the source of the sound, so the siren will sound louder to him. The energy of the sound waves lose strength the further they travel away from the source of the sound, which is why the siren won't sound as loud to the girl. Have you ever been passed by an emergency vehicle with its siren on? This explains why that siren gradually gets louder as it gets closer to you, and then gradually gets softer as it drives away.



2. **Sound Waves & Distance Experiment**

What you will need:

- ▢ Big outdoor space (where your children/students can safely move 40-50 feet in a straight line without any barriers)
- ▢ Something to play music (phone, radio, wifi speaker, etc.)

Activity:

a. Play a song and turn it up to a medium volume. Do NOT change the volume at any point in time!
b. Stand as close as possible to the source of the sound. This is position one. Is the sound loud?
c. Take 15-20 big steps away from the source of the sound. This is position two. Is the sound as loud as it was when you were standing in position one?
d. Take another 15-20 big steps away from the source of the sound. This is position three. How does the sound in position three compare to the sound in position one?
e. Discuss with your child(ren)/student(s) how the sound gets softer when they are farther away from the source of the sound. Explain how the energy of the sound did not change. Instead, the area (distance) changed. In a small area, the energy created is louder. In a large area, the energy created is softer because there's more space.

To help them grasp this idea, fill a small cup up to the brim with water. Then take the cup and dump it into a large pot. In the cup, there appears to be more water because it's in a small container. In the pot, there appears to be less water because it's a large container. In both containers, though, there is still **exactly the same amount of water**. It just happens to be more spread out in the pot, which makes it appear to be less when compared to being in the cup.

It's similar to sound! When you're close to the source of the sound, the energy created by the sound waves appears louder because there's a small distance between you and the source of the sound. When you're farther away from the sound, the energy created by the sound waves appears softer because there's a greater distance between you and the source of the sound. The energy, however, stays the same.

3. **Question ◆ Prediction ◆ Summary Chart:**

3.1. Question

Explain that every experiment must start with a question. If you don't have a question, then you don't have any reason to do an experiment. The question guides the experiment, the experiment itself is the way in which we try to answer the question. Guide your student(s) to think about how sound works, and lead them to ask: Does sound change when it travels through different length straws? Why or why not? Write the question on the space provided. This is a good time to talk about different types of punctuation: question marks vs. periods.

3.2. Prediction

After writing down the guiding question, give them a moment to brainstorm ideas about what might happen. In a complete sentence, help them write their ideas in the space provided. Review capital letters for the first letter of the sentence, as well as periods to indicate a full stop showing the sentence has ended. Some sample predictions might include:

It will sound different because

3.3. Summary

After the pan flute has been completed and tested, explain that you now have the evidence you need to answer the guiding question. Revisit the question and their prediction. Then write a complete sentence about their findings. Explain how scientists use the summaries from experiments to share their discoveries with other people. Ultimately, using the scientific method helps us learn about the world around us by asking questions and using evidence to back up the answers to those questions.

For this particular experiment, it may be helpful to have additional information to help them summarize their findings. Use the following details and sample script to help fill in any gaps:

- Sound is a wave, a vibration traveling through the air to your ears.
- The way a sound wave sounds to your ear is known as its pitch.
- The wave that creates it is measured in frequency, or the number of sound waves that hit your ear in a certain amount of time.
- A high-pitched sound is made by a high-frequency wave
- A low-pitched sound is made by a low-frequency wave.

Sample Script:
If you vibrate solid objects (aka move solid objects back and forth) they make the air around them move back and forth, or vibrate, too, creating sound waves. This happens when you blow through the straws in your straw pan flute. The straws are all different lengths, so they vibrate with different frequencies which creates the different pitches of sound that you hear. These pitches create different notes that allow you to play a song.

The more vibrations created, the higher frequency and pitch.
The fewer vibrations created, the lower frequency and pitch.

For an extra challenge, let them practice playing simple songs using their straw flutes. Try something like Baa Baa Black Sheep, Jingle Bells, or Twinkle, Twinkle, Little Star.

4. Pan Flute Experiment

What you will need:

- ▢ 8-10 disposable straws
- ▢ Ruler
- ▢ Sharpie
- ▢ Scissors
- ▢ Tape
- ▢ Handout to record guided question, prediction, and summary

Activity:

a. Leave the first straw alone.
b. Use your ruler, Sharpie, and scissors to trim ½" off the second straw.
c. Use your ruler, Sharpie, and scissors to trim 1" off the third straw.
d. Use your ruler, Sharpie, and scissors to trim 1½" off the fourth straw.
e. Continue cutting each straw ½" shorter than the last straw until you have them all cut.
f. Place a long piece of tape on a smooth, flat surface with the sticky side UP.
g. With the tops all flush, line up the straws from longest to shortest on the piece of tape.
h. After sticking all straws to the tape, fold the tape over to secure the straws on the other side.
i. Play the pan flute by blowing air across the top of the flush side.

Have them experiment with the sounds the straws make by blowing harder or softer. Instruct them to blow softly over the longest straw, and then use the same amount of energy to blow softly over the shortest straw. Is the sound different even though the same amount of energy was used? Why do you think that is?