Can You See the Music?

PDQ 1 - Good Vibrations

Grades: 5-8
Time: 5 -15 minutes
Subject: Physics
Topics: Sound, Wave Properties

Overview

Catch a wave by listening to some sounds, seeing how they travel, and capturing them with both low and high-tech tools.

Background

Sound waves are created by vibrations at the source of the sound, such as a drum beat. These vibrations are transmitted through a medium, such as air, and can be felt physically. This is how a microphone works! As sound waves impact the microphone, a component in it moves. This movement is converted into electrical energy that can then be viewed, recorded, stored, or played back! In this PDQ, you will "see" sound waves causing grains of rice to move as well as see a visual display of the sound's intensity using Google Science Journal and databot™.

Objectives

Understand and Recognize:

- That sound is transmitted in waves.
- A microphone (sound sensor) vibrates from sound waves and converts this vibration to electrical energy.

What You'll Need

- Cereal bowl or open mouth container to stretch plastic wrap across
- Rice Grains -about 1 Tbsp
- Metal pan or pot and a metal spoon
- databot™ + Google Science Journal + Arduino IDE

Important Terms

Microphone: A microphone, sometimes referred to as a mike or mic, converts sound into an electrical signal.

Sound Wave: Sound is a vibration that travels in waves through a medium, such as air (or water, wood, etc.) These invisible waves have specific attributes such as frequency and amplitude. When a sound wave interacts with your eardrum, the vibrations of the wave are converted into a sound that you "hear" thanks to that amazing brain of yours!

Vibration: Vibration is an oscillating (back and forth) movement, like a vibrating reed in a clarinet. This vibration results in a soundwave that then travels through a medium, like the air.

decibel (db): Sound intensity is measured in units called decibels. The decibel scale is logarithmic, which means doubling the decibel units does not double the output, it can increase as much as 100 times! Normal conversation is about 60 dB, a soft whisper around 30 dB, and a lawn mower about 85 dB.

Prep (5 mins)

- Upload the Sound Intensity GSJ program to databot™, and place databot™ next to the bowl.
- Connect Google Science Journal to databot™ and open the databot™ sound sensor intensity function

PDQ 1 (10 mins)

- Stretch plastic wrap tightly across your bowl and place about 20 grains of rice on the tight surface. *(You are about to hit the pot with the spoon closely to the rice. What do you think will happen?*
- Bang the pot or pan with your spoon next to the bowl and rice and observe what happens.
- Experiment by hitting the pot louder and softer. *Is it possible to hit the pot right next to the bowl, but the rice doesn't move?*
- Go further by maintaining a steady level of sound but moving away from the rice. *Does the distance seem to change the effect of the sound?*

**databot™ has a sound sensor, a microphone, built in. Microphones work by picking up sound vibrations and then converting the vibrations to electricity. You should see the sound level being displayed on GSJ.*

The Unit of measurement is decibels. Some examples of decibel levels: a pin drop = 10; rustling leaves = 20; babbling brook = 40; conversation = 60; alarm clock = 80; motorcycle = 100; rock band = 110; thunderclap = 120.

- Look at the grains of rice and the comparative sound intensity reading. *Is there a decibel level below which the rice does not move?*
- Try to maintain a sound level but move the source away from databot™. *Does the intensity stay the same regardless of distance or does it change?*

Great Work!

PDQ 2 coming up! Ready. Set. Go.

Another PDQ!

Educator Resources

Prep

- If you have not used databot™ and Google Science Journal before, go through the setup and use procedure.
- Upload and test the databot™ sound intensity program with Google Science Journal. Test your display connection.
- Study the background information and familiarize yourself with the learning objectives and terms for this activity.
- Setup and test the rice grain experiment and conduct the PDQ yourself before conducting it for your class.

Objectives

Understand and Recognize:

- That sound is transmitted in waves.
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NGSS

- NGSS PS4.A Wave Properties

Misconceptions

- Sound is not dangerous. (Highlight the decibel levels at which damage to hearing can occur in your discussion).

Guiding Questions

- Why can databot™ pick up the sound even when the rice does not move?
- What do you think is the average decibel level in our classroom when we are working quietly.
- What about when we are having discussion like this one?

Additional Resources:

CDC: What Noises Cause Hearing Loss?
https://www.cdc.gov/nceh/hearing_loss/what_noises_cause_hearing_loss.html
Explain that Stuff - Sound
https://www.explainthatstuff.com/sound.html

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