NYC Environmental Protection

Understanding the Effectiveness of Different Sound Devices

Description:

This lesson will have students test sound measuring devices to determine each tool's accuracy. Students will use sound meters and smartphone applications to analyze the validity of various sound measuring instruments.

Objectives:

- Compare the validity of sound meters and various smartphone applications to measure sound
- Study the accuracy of different sound measuring instruments such as applications and sound meters

Vocabulary:

Decibel, sound

Materials:

- Sound meter or smartphone applications (i.e., Arduino Science Journal, CDC NIOSH Sound Meter App)
- Stereo speaker or phone
- "Sound Recording" worksheet
- Online Tone Generator
- DEP Loudness Scale
- Khan Academy Logarithmic Scale Video

Background Information:

In the past, sound measurement instruments were expensive and not easily available. Now, at the beginning of the new millennia, the ubiquity of cellphones has changed this. With cellphones, sound measuring is something anyone can do.

However, it is important to determine the accuracy of these measurements in recording sound data. Therefore, the validity of these tools must be tested before using them to collect our own sound data.

Method:

- Introduce students to the concepts of sound and noise. Discuss how they are measured. Make sure to review the decibel scale, pointing out that decibels are measured on a logarithmic scale.
- Instruct students on how to use the various sound measurement devices.
- Have students use cellphones, computers, tablets, or other devices capable of downloading the various sound applications, such as the Arduino Science Journal and CDC NIOSH Sound Meter App. Allow students to learn how to use the applications individually before testing begins. Provide time for students to get comfortable using the sound meters.
- Begin testing the devices in three different rounds. Test and compare the devices by using an Online Tone Generator. An online tone generator will play a pure tone at different decibel levels. For each round, use a different decibel level to determine the effectiveness of each device.
- Use the "Sound Recording" worksheet at the end of this lesson to record every sound reading in a table. Be sure to have consistent units and explain why this is so important.
- Visualize the sound data in a bar graph. Name of the sound measuring device should be on the X axis and decibel level recorded should be on the Y axis.
  - When graphing, be sure to mention that decibels are measured on a logarithmic scale. For example, a sound at 40dB is twice as loud as a sound at 30dB. Use Khan Academy's Logarithmic Scale Video for more information.

Discussion:

- Which of these sound measuring devices do you think are the most accurate? Why?
- How would you apply these sound measuring devices in everyday life?
- Why is it important to create accurate and accessible sound measuring devices?

Extension:

- Do a cost comparison of the different devices to determine how the price of each tool compares to its effectiveness.
    - Does this change your opinion, why or why not?
- Find new sound measuring applications to test.
    - Are these smartphone applications accurate?
- Using your applications, try collecting sound and noise data in other environments.
- Complete a statistical analysis for the data collected.
    - Calculate the mean, median, mode and standard deviation for the data set.

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Sound Recording Worksheet

Directions: Use the table below to record the information from different applications.

	Sound Test 1	Sound Test 2	Sound Test 3
Online Tone Generator Decibel Level			
Sound Meter			
Sound Application #1			
Sound Application #2			
Sound Application #3			

Directions: Using your sound intensity data from the different applications, graph the data as a bar graph. Make sure to label each axis.

Title: _____