Teacher Notes: Frequency and Amplitude

Introduction to Mobile Robotics > Frequency and Amplitude Exploration

Description of the Unit

In this activity, students will take data using the Sound Sensor and View Mode and analyze the data to determine what properties of a sound wave the sensor is most sensitive to.

Unit summary: students will…

- Set up and run an experiment using the LEGO Sound Sensor
- Record, organize and analyze data
- Visually present data in the form of a graph
- Investigate the properties of sound waves and of the Sound Sensor

Prerequisites:

- Have Personal Assistant robot with Sound Sensor attachment built
- Have speakers set up on each computer that students will use to capture sound data
- Clap On, Clap Off Activity
- Present to class the Frequency and Amplitude slideshow from Teacher's Curriculum CD and have class discussion (optional)
- Review of sound wave properties, waveform properties (frequency, amplitude and wavelength) and using View Mode (optional)

Central Concepts

Math • Means • Graphs and Tables • Wave Functions • Linear Relationships	**Science** • Sound waves • Decibels • Amplitude & Frequency • Data Acquisition
Technology • Robotic Sensing • Sensor-Based Responses • Input-Output Loops • Thresholds	**Communication** • Method Critiquing • Organizing Information into a Table • Describing Proportional Relationships

Approximate classroom time: 2-4 class periods (45-minute periods)
Approximate homework time: Up to 1 hour (Conclusions section)

Note to the teacher

This Exploration can be done with either the Taskbot or the Robot Educator model (REM). It does not require any programming in the LEGO MINDSTORMS Edu NXT software. Students will use the View Mode on the NXT to take Sound Sensor readings and record the data.

This Exploration requires computers to have speakers, so that they can play sound files that are embedded in the lesson. Make sure that speakers are set up on at least one computer, and, if necessary, create a schedule or list and assign each team a time slot at the computer(s) to capture their data.

This activity may be difficult in a noisy classroom. Encourage students to speak in whispers so that their conversations do not affect the operations of the other Sound Sensors in the room. Students will use

tones of varying amplitudes and frequencies and capture data from them. It is a good idea to encourage students to verify their data by playing the sound files more than once with the robot still set up.

Also note that the NXT is set by default to shut down after 15 minutes of inactivity, which includes giving readings in View Mode, and may shut itself down during the course of this Exploration. You can change this by going into the “Settings” menu on the NXT and then selecting the “Sleep” option and resetting as necessary.

Students will be able to:

1. Follow directions to conduct a guided partial inquiry
2. Learn about amplitude, frequency and units in which to measure them
3. Apply and describe the various points of experimental procedure:
    a. Measurement technique
    b. Multiple trials
4. Organize and analyze data collect through experimentation
5. Write a conclusion that summarizes the lessons learned in the Exploration