SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Sound Shield Design Challenge	Grade 4 Light and Sound

Lesson Plan

Description

In this hands-on science and engineering lesson, Grade 4 students will apply the engineering design process to design and construct a sound shield. They will apply what they have learned about the properties of sound, how it travels through a medium, and how materials can modify sound. To assess their designs, they will use Micro:bit sound meters to measure sound levels with and without the shield. Students are encouraged to use clean items from the recycling to reduce their environmental impact.

Learning Outcomes

Students will be able to:

1. Identify properties of sound and understand how different materials can modify sound.
2. Apply the engineering design process to construct a sound shield.
3. Use Micro:bit sound meters to measure and compare sound levels with and without the sound shield.

Specific Expectations

C2.4 describe properties of sound, including that sound travels through a medium as a wave and that sound can be absorbed or reflected and modified

C2.6 describe how different objects and materials interact with light and sound energy

Introduction

1. Sounds Waves - Play the video "Sound – For Teachers"
2. Discuss the following questions:
    a. How does sound travel?
    b. What sounds are very loud to you?
    c. Do you ever find it too loud? What can you do to protect your ears from noise?
    d. What if you can't cover your ears? Could you build something larger?
3. Engineering design process - play the video "The Engineering Design process: Crash Course Kids #12.2" Note you can also refer to the Ontario Science Curriculum for more information: https://www.dcp.edu.gov.on.ca/en/curriculum/science-technology/context/processes
4. Discuss the following questions:
    a. How can you design and build a model of a sound shield to protect your classroom from outside noise?
    b. How can you test that it works?

Action

1. Review the Engineering Design Process using the template and handout linked in slides.
2. Divide the students into small groups.
3. Provide each group with a Micro:bit sound meter and materials for building the sound shield.
4. Ask: How can we build a sound shield to reduce noise by at least 50%? Make sure they consider that the sound shield must be big enough to hold a Micro:bit and battery pack.
5. Imagine (research): Instruct students to brainstorm designs for their sound shields. They should consider materials and shapes that can absorb or reflect sound effectively. What items from the recycling will we use? Which are good insulators? What shape will it be? Look up ideas online.
6. Plan: Draw a design of their idea. Before you do, remember how we are testing our sound meters with Micro:bits
7. Create and test: build your sound shield! Students will have 25 minutes to complete it.
8. After they are done building put the shield aside and build a sound sensor with Micro:bits. Follow the slides and code the sensor. Download it to the Micro:bit
9. Play music loudly in the classroom (not too loud!) and have students measure the volume with the Micro:bit. Have them cover the Micro:bit with their shield and measure the difference.
10. Improve (re-design): How can we improve the design? Give them ten minutes and additional supplies.
11. Re-test the shield.
12. Present - have students share their work with an adjacent group and compare what worked and what they would improve.
13. Debugging - go through the debussing process if their code isn't working.

Consolidation/Extension

Reflection prompts

- What were some of the challenges in your design process?
- What would you change if you had to do this over again?
- What was the biggest challenge with coding a Micro:bit?
- Why did we use items from the recycling instead of new craft supplies?

Extension

- A more advanced option is to have them make a sound level logger to monitor how loud or quiet different places around you get over time https://Micro:bit.org/projects/make-it-code-it/sound-logger/

Accommodations/Modifications	Assessment
Although it is ideal to have two Micro:bits for every 1-3 students, sometimes the technology is unavailable. Students can try building their system and using the emulator within MakeCode to see if it works. Tinkercad also has a virtual Micro:bit option, although it is quite advanced.	Often with projects such as these, anecdotal assessment is always the richest. Seeing students and their "EUREKA!" moments and working through various challenges at their own level is incredible. There will also be a rubric provided to quantify their work.

Additional Resources

Additional resources through the BBC Micro:bit website, Black Gold School District Micro:bit page and Teach Engineering are also available to explore.