Web Unit Plan

Title: Dangerous Decibels

Description: Students learn about different properties of sound and conduct research to determine the effect of different environmental sounds on teens. They share their findings in a digital product that makes recommendations for addressing problems based on potentially harmful sounds.

At a Glance

Grade Level: 6–8

Subject sort (for Web site index): Science

Subject(s): Science

Topics: Sound

Higher-Order Thinking Skills: Critical Analysis, Interpretation of Data

Key Learnings: Sound Waves, Decibels

Time Needed: 2 weeks, 1 hour daily

Background: Sarah Langdon, Raleigh Hills K–8, Beaverton, OR

Unit Summary

Students investigate sound in their environment, particularly how sounds impact their lives. At the beginning of the unit, students review the properties of sound and think about the sounds in their environment.They identify the different sounds in their environment and place them into categories for analysis. Students complete a project where they develop a research question, collect data in the field about different sounds, and analyze their data. They use what they have learned to create a digital product that makes recommendations about teens and sound. At the end of the unit, students share their products and take an exam over the science content.

Curriculum Framing Questions

- **Essential Question**
  How am I affected by the world around me?
- **Unit Questions**
  When are sounds too loud?
  What meaning can I make from raw data?
  How can I persuade others?
- **Content Questions**
  What is amplitude?
  How are waves created?
  How do different kinds of waves travel?

Assessment Processes

View how a variety of student-centered assessments are used in the Dangerous Decibels Unit Plan. These assessments help students and teachers set goals; monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

Instructional Procedures

Unit Preparation

- Create a Dangerous Decibels wiki for use throughout the unit.

- Arrange for use of decibel reader probes and microphone probes. (See Internet Resources for sources.)

Unit Introduction

1. Conduct a discussion of the Essential Question, *How am I affected by the world around me?* Use the following discussion prompts as needed:
   - What features of your environment affect you?
   - How are your senses affected by your environment?
   - How, why, and when do you control the impact of your environment on your life?
   - What role does sound play in your environment?
   - What impact does sound have on your life?
   - Why should we be concerned about too much noise, or noise pollution?
2. Ask students to review sound waves by completing the Brainstorm-Share-Journal Graphic Organizer. Direct students to:
   a. Fold and tear a piece of notebook paper into four sections, labeled Brainstorm, Changes, Questions, and Journal.
   b. Work independently to brainstorm what they know about sound waves. (Give adequate time, and stop all students at the same point.)
   c. Find a partner (or assign one) and exchange information from their brainstorm.
   d. Add to the "Changes" section with anything they would like to add or alter from their original thinking in the brainstorm section.
3. Allow students to meet with at least one or two other classmates to discuss their thoughts about waves and sounds in the environment.

Phase 1: Sounds in Our Environment

1. Prepare students for the following activity by conducting a short discussion about the sounds in the school environment:
   a. What are some of the sounds you would hear around the school?
   b. How loud are these sounds?
   c. What impact might the loudness of some sounds have on students?
   d. What factors would effect the volume of the sounds?
2. Ask students to keep a record the types of sounds they hear throughout the day, using the Environmental Sounds Record. Conduct a quick mini-trial of the process by modeling an example with sounds in the classroom. Discuss some standard ways to describe sounds—loud/soft volume, short/long, high/low pitch, etc.
3. When students return with the completed records, ask the class to brainstorm some categories they could use to organize the sounds. Model how they can define attributes of the different sounds to create new categories.
4. Place students in groups of 3 to 5, and ask them to cut individual sound descriptions apart the forms so the sounds can be categorized in different ways.

Encourage them to be creative in the categories they experiment with but to settle on some categories that they think would be useful for describing the impact of the sounds. Use the Categorizing Observational Checklist to assess students' skills while they work.

5. After students categorize their sounds and share their categories with the class, ask the Unit Question, *When are sounds too loud?*
6. Ask students to respond in their journals to the prompt, *What are some ways to judge whether a sound is too loud or too soft?*

Phase 2: All about Sound

1. Review basic concepts about sound from previous units and grades. Review key vocabulary related to sound and sound wave patterns. Discuss relationship of volume and pitch of sounds with amplitude and frequency of sound waves. You may wish to use the interactive sites, Components of Sound at www.ndt-ed.org/EducationResources/HighSchool/Sound/components.htm* and Listening to Waves at www.absorblearning.com/media/item.action;jsessionid=991258DC748F286B0B33A4F615A62761?quick=qg to demonstrate some of these concepts.
2. Use the site, Interactive Sound Ruler [http://www.nidcd.nih.gov/health/education/decibel/decibel.asp] to prepare students to think about the connection between decibels and hearing.
3. Show a chart similar to the following to the class and ask students to vote on how dangerous each type of sound is to a person's hearing. If you wish, you could ask students to rank the sounds using the *Visual Ranking* [Link to tool] thinking tool. Conduct a discussion on their reasons for their opinions, particularly on what would make a sound sometimes dangerous and sometimes not dangerous.
    - 1—Not dangerous at all
    - 2—Maybe dangerous
    - 3—Definitely dangerous

Sounds	**1**	**2**	**3**
Conversation with a friend			
An exciting moment at a football game			
A jet taking off			
A baby crying			
iPod or MP3 player			
Getting yelled at by an adult			
Using a snow blower			
Fireworks			
Television			
Car stereo			

4. Demonstrate the use of probes to practice measuring sounds, and give students the opportunity to measure different sounds in the classroom and place them in a continuum from completely safe to very dangerous.

Phase 3: Dangerous Decibels Project

1. Place students in heterogeneous groups of 3 to 5 for the project.
2. Ask groups to do some Internet research on the effects of different kinds of environmental sounds, or break up Noise-Induced Hearing Loss www.nidcd.nih.gov/health/hearing/noise.asp* into sections for a jigsaw activity.
3. Conduct a whole class discussion during which groups share their research findings and discuss the impact of different kinds of noise on hearing. Encourage students to think about long term impact of noise pollution and how it might affect their lives.
4. Explain the project: Your group will create a digital product [https://sites.google.com/site/zdhalmek]—a wiki, blog, electronic newsletter or brochure, video, or podcast—with information and recommendations about preventing hearing loss from noise. Introduce the Project Rubric.
5. Introduce the research process that students follow during the project and distribute the Project Plan Checklist and the Research Process Checklist to help students monitor their progress:
    a. Identify a Question or Problem (Example questions: How do the sounds in our environment affect us? What are good and bad sounds in our neighborhood? Why do the sounds in our everyday lives matter?)
    b. Collect Data or Evidence
    c. Analyze Data
    d. Draw Conclusions
    e. Share Findings
6. Based on students' research questions, prepare students for fieldwork, on and off the school grounds.
7. As students work through the project, conduct mini-lessons on relevant critical thinking skills, such as:
    - Creating a good research question
    - Determining data needed to answer the question
    - Developing a project plan
    - Recording data
    - Classifying data
    - Identifying patterns in data
    - Making inferences about data
    - Determining cause and effect
8. During project work, include frequent opportunities for self- and peer assessment.

9. When projects are completed, schedule time for students to share their digital products and discuss their findings.
10. Assess students' projects using the Dangerous Decibels Project Rubric.

Phase 4: Final Assessment

1. Assess student learning with a final exam over important content concepts.
2. Ask students to write final reflections on their learning throughout the project, including learning about sound, conducting research, collaboration, and critical thinking.

Prerequisite Skills

- Basic knowledge about how sound travels from one place to another
- Basic graphing skills (idea of change over time, axes, labeling, and so forth)

Differentiated Instruction

Resource Student

- Reduce the number of concepts needed to master
- Place students in heterogeneous groups so they can receive help from peers and provide assistance to others in their areas of expertise
- Provide partially completed project plans
- Establish daily routines for checking progress and setting goals

Gifted Student

- Instruct an advanced student to complete an independent research on a related topic, such as light, ocean waves, or hearing aids
- Encourage effective leadership
- Point students toward tutorials in online tools for advanced data analysis and display

English Language Learner

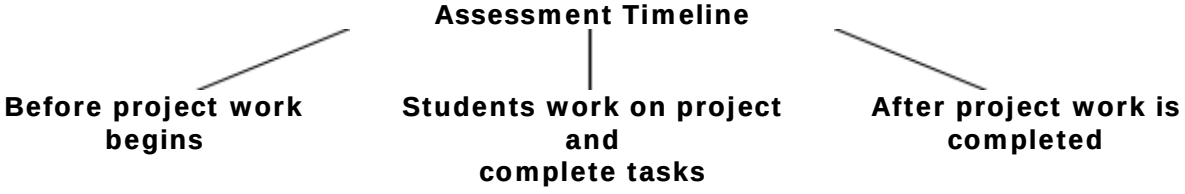
- When possible, make pictures available for new vocabulary
- If possible, get books in students' first language with pictures or related ideas
- Place students in heterogeneous groups so they can use language in an authentic situation, get help from group members when necessary, and provide help to others in their areas of expertise

Credits

Sarah Langdon participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

THINGS YOU NEED

Assessment Plan



• Discussion	• Brainstorm-Share-Journal Graphic Organizer	• Project Plan Checklist • Research Process Checklist	• Project Rubric • Teamwork Self-Assessment • Journals	• Project Rubric	• Exam • Final Reflection

A discussion of the Essential Question, *How am I affected by the world around me?* identifies students' preconceptions about environmental influences on their lives. Before students begin studying the properties of sound waves, ask them to complete the four sections of the graphic organizer—Brainstorm, Changes, Questions, and Journal—to determine their prior knowledge about sound waves and set goals for the unit. The teacher uses the Categorizing Observational Checklist while students work on organizing their data to identify topics for mini-lessons and further instruction. The Project Rubric is used by students as a self-assessment tool while they work on their projects, and by the teacher as a grading tool at the end of the unit. A Project Plan Checklist and a Research Process Checklist can help students manage their work. Periodically during the group work portion of the unit, students fill out a Teamwork Self-Assessment. Students write in daily journals to monitor their own progress toward the goals they set at the beginning of the unit and their understanding of the content and skills they are using in the project. At the end of the unit, students take a final exam on their understanding of sound waves and sound in the environment and write a final reflection on their learning.

Content Standards and Objectives

Targeted Content Standards and Benchmarks

Oregon Science Standards

- 6.2P.1 Describe and compare types and properties of waves and explain how they interact with matter.
- 6.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct an investigation that uses appropriate tools and techniques to collect relevant data.
- 6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.
- 6.3S.3 Explain why if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one variable.
- 6.4D.1 Define a problem that addresses a need and identify science principles that may be related to possible solutions.

Student Objectives

Students will be able to:

- Measure waves using frequency, wavelength, and amplitude
- Accurately measure and record data about sounds
- Analyze data to identify trends and patterns
- Display data effectively to communicate conclusions and applications
- Interpret data and apply conclusions to the real life problem of excessively loud sounds in the environment

Technology and Resources

Internet Resources

- Components of Sound
  www.ndt-ed.org/EducationResources/HighSchool/Sound/components.htm*
  A series of interactive tools to illustrate different properties of sound.
- Dangerous Decibels
  www.dangerousdecibels.org/*
  A site for students with information about noise-induced hearing loss.
- Headphones and Hearing Loss: Is Loud Music Making Teens Deaf?
  www.cbsnews.com/8301-504763_162-20014372-10391704.html*
  An article discussing a study about teens' response to information about loud music and hearing loss.
- Interactive Sound Ruler
  www.nidcd.nih.gov/health/education/decibel/decibel.asp*
  A simple interactive demonstration of sounds of different decibels.
- Interactive Sound Waves
  www.grc.nasa.gov/WWW/K-12/airplane/sndwave.html*
  A tool that illustrates the sounds made by airplanes.
- Listening to Waves
  www.absorblearning.com/media/item.action;jsessionid=991258DC748F286B0B33A4F615A62761?quick=qg*
  An interactive illustration of how different sounds correspond to waveforms of different frequencies and amplitudes.
- Loud Music and Hearing Loss
  www.abelard.org/hear/hear.php*
  A comprehensive site about music and hearing loss with a nice table comparing the danger of different sounds.
- Noise-Induced Hearing Loss
  www.nidcd.nih.gov/health/hearing/noise.asp*
  An article describing the ways in which sound can result in hearing loss.
- Pasco
  www.pasco.com/products/probeware/index.cfm*
  A commercial site with information about Pasco probeware for the classroom.
- Vernier
  www.vernier.com/probes/*
  A commercial site with information about Vernier sensors and probes.

Technology—Hardware

- Decibel reader probe (Vernier or other decibel reader)
- Microphone probe

Other Resources

- Audiologist Guest Speaker
- In-school field trip for data collection

