Oregon State University
SMILE Program

Envision, Believe, Succeed
precollege@oregonstate.edu 110 Snell Hall 541-737-9424

Wind Chimes: A Symphony for Wind

Lesson Materials

- wind chimes
- weather app.
- recording device (sound meter or smart phone)
- notebook and a variety of pencils (regular and colored)
- a variety of materials suitable for building wind chimes

Highlighted NGSS

Disiplinary Core Ideas:
- PS2.A: Forces and Motion
- PS2.B: Types of Interactions

Crosscutting Concepts:
- Patterns
- Cause and Effect

Science & Engineering Practice:
- Planning & Carrying Out Investigations
- Obtaining, Evaluating, & Communicating Information

Contact: SMILE Program
http://smile.oregonstate.edu/

OVERVIEW

This lesson plan provides a hands-on and interactive way for students to explore the characteristics of sound using wind chimes as a data collection tool. Additionally, students will design and build their own wind chimes.

INTERESTED IN LEARNING MORE?

Check out the background information at the end of lesson

GUIDING QUESTION(S): What information can wind chimes give us about how windy it is outside?
- After practice and observation, could you estimate wind speed simply by listening to a wind chime?
- Could your ear become as good as the weather forecast?

HYPOTHESIS: By listening to wind chimes over time, we can estimate how fast the wind is blowing. The louder the chimes ring at their loudest point (maximum loudness), the gustier the wind. And by counting how often the chimes ring over time we can tell how steady the wind is.

LESSON OBJECTIVES

Students will:
- understand how sound can be measured using wind chimes as a tool
- experiment with using different materials and see how they respond to wind
- collect sound data from wind chimes
- design and build windhimes

precollege@oregonstate.edu 110 Snell Hall 541-737-9424

Part 1: WIND CHIME DATA COLLECTION

PROCEDURE

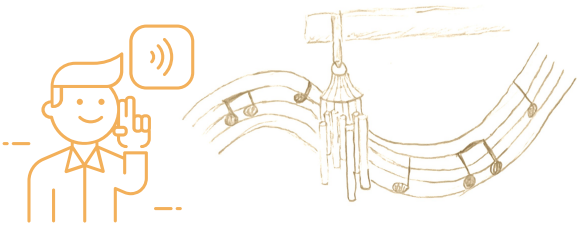
1. Ask students if they have wind chimes at home or *if they have* seen and listened to them.
    1. What is *the purpose of* a *wind chime?*
    2. *Listen to ideas and share a* little of the history of them.

2. Discuss: wind chimes are pretty to listen to, but they can also be more than that. The wind chime is a "sonification" of the wind. Have students turn and talk: ***What information can wind chimes give us about how windy it is outside?*** Tell students that they are going to test the following hypothesis (or their own):
    By listening to wind chimes over time, we can estimate how fast the wind is blowing. The louder the chimes ring at their loudest point (maximum loudness), the gustier the wind. And by counting how often the chimes ring over time we can tell how steady the wind is.

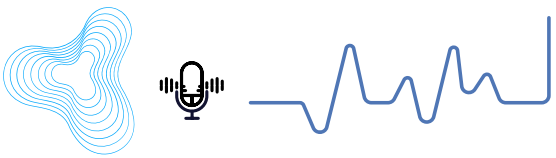
3. Let students know that they will test this hypothesis by listening to and collecting data from wind chimes. Before they go outside, have them check the weather to see what the wind speed will be during the activity. Have them record the value in a science notebook.

4. Take students outside to a location with some wind- somewhere as exposed, out in the open and away from buildings as possible, etc. Have them hang the chime. Before students begin collecting data, have them practice their observation skills by just quietly listening for 1-2 minutes.

    Ask:
    - What did you ***notice?***
      How often did the chimes ring? How loud were they on a ***scale of*** 1 - 5 where 1 *is softest* and *5 is loudest?*



5. Tell students that they are going to use a sound meter to collect data from the wind chime. Demonstrate how to use the recording device to capture the sound of the wind chimes. Tell students that they are going to record the values at 15 second intervals over a 5 min period. After the data is collected, have them calculate and record: maximum loudness and average loudness. **Have students share their observations and take aways relating wind chime behavior. Have them refer back to their hypothesis. Ask:**
    - *Were you able to prove your hypothesis? Why or why not?*
    - *How accurate was your data compared to the predicted weather? Do you think after enough data collection and observation, you would get more accurate to the forecasted wind speed? Why or why not?*



Teaching Tips

No wind? Or want students to practice? Hang wind chimes inside with a fan & change speed and location as students observe and record.

Ideally, students can collect data multiple times, hopefully during different wind speed forecasts. Saving and comparing the data each time.

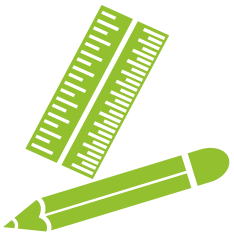
precollege@oregonstate.edu 110 Snell Hall 541-737-9424

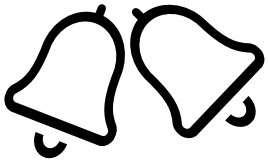
Part 2: BUILD A WIND CHIME

1. Let students know that they are going to make their own wind chimes to create a wind symphony that is most interesting to them AND that they believe will be most successful at collecting wind data. Provide students with a variety of materials that produce different sound vibrations (wood, pottery, bamboo, shell, metal, etc.). Give them time to experiment with the different sounds made by each material.
   Ask: *Which of these materials do you think would be most effective for capturing sound data? Why?*

2. Tell students that the sound produced by wind chimes is influenced by many factors, including the materials, dimensions, and design of the chimes. Longer tubes produce lower frequency tones, while thicker and denser materials produce a more sustained sound. As they create their own wind chimes, they should keep this in mind.

3. Provide students with a variety of materials to choose from and encourage them to create a design plan before they begin building. When they have their first iteration done, invite them to test it out using a fan. From there they can re-iterate and refine to complete a final build. Students can hang wind chimes up outside and continue collecting data.
   Discuss:
   - *Which wind chime designs were the most effective? Best materials? Best shape? Length of strings?*





Part 3: ARTISTIC INTERPRETATION OF WIND

1. Tell students that they are now going to take a more artistic approach and capture the wind data from the chimes by using colors, shapes, pictures to draw representations of what they hear (provide an example). Prompt students to visually represent what they are hearing about the presence, direction and speed of the wind. Provide students with clipboards, paper, and colored pencils. Give them time to sit, listen and draw.

2. When students are done, have them reflect on the differences between using data points and art to capture sound. Have students pair up and **discuss:**
   - *Which experience did you prefer, why?*
   - *From the data about wind you collected, identify and describe the part that gave you the most insight.*
   - *Looking at artistic images of wind, what characteristics can you interpret most clearly? What artistic choices helped you see these characteristics?*
   - *Which of the two representations do you think is more effective? Why?*

3. Lead a discussion with students about the value of incorporating an artistic approach in science. Share that scientists often express changes in the environment with graphs and charts.

Part 3: ARTISTIC INTERPRETATION OF WIND CONT.....

Have students ponder:

- *what do graphs and charts mean to a non-scientist?*
- *how could a more creative and artistic expression of data connect in a different way?*

4. Reflect

Why is it important to collect and communicate about environmental data?

- *What kinds of things can sound specific data tell us?*

As an example, share about "The Changing Arctic Marine SoundScape" and how we are able to hear the sound of climate change.

BACKGROUND INFORMATION

Wind chimes have been found world wide and from more than a thousand years ago made from found materials such as bone, shells, and bamboo. The original purpose of wind chimes has varied depending on the country and region. Farmers in Bali are said to have used them in their fields to scare off birds whereas in China they were used for prayer and meditation and made out of pottery and later metal.

No matter what they are made from or intended for, wind chimes are instruments that reflect what is happening in nature. They are quickly recording wind data such as the presence, direction, and speed. Wind chimes capture the power of the wind and turn it into a symphony for wind.

For more information on wind chimes check out Encyclopedia.com: https://www.encyclopedia.com/manufacturing/news-wires-white-papers-and-books/wind-chime

The development of this lesson was supported by Chet Udell, PhD an environmental sensor researcher in the College of Agricultural Sciences at Oregon State University.

Udell is the creator of the WeatherChimes app. which collects weather data and turns it into music. For more information:
Chet Udell: chet.udell@oregonstate.edu; open-sensing.org

Career Corner

To pursue a career in environmental sensing, can consider majors and programs that focus on environmental science, engineering, computer science, and data analysis. Careers in environmental sensing involve using technology and scientific methods to monitor, collect, and analyze data related to the environment. Jobs include remote sensing specialists, environmental scientists.