

<b>Topic:</b>	<b>Previsit lesson to INFINITY Science Center: Environmental Monitoring Interactive Stations</b>
<b>Lesson Title:</b>	<b>How do scientists collect data?</b>
<b>Grade Level:</b>	<b>4<sup>th</sup> – 5<sup>th</sup> Grades</b>
<b>Science Domain:</b>	<b>Physical Science</b>
<b>Purpose:</b>	Students will learn about ocean buoys and how scientists use the data collected to make informed decisions about the environment.

Connecting to the Next Generation Science Standards: [www.ngss.nsta.org](http://www.ngss.nsta.org)

Students who demonstrate understanding can:	
Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. (NGSS 4-PS4-1)	
<b>4-PS4-1 Waves and Their Applications in Technologies for Information Transfer</b>	
<b>The materials/lessons/activities outlined below are intended to help students reach the Performance Expectations listed below.</b>	
<b>Performance Expectations:</b>	<b>Connections to Classroom Activity Students:</b>
<b><i>Science and Engineering Practices</i></b>	
<b>Analyzing and Interpreting Data</b>	
Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. <ul style="list-style-type: none"> <li>Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)</li> </ul>	I can collect data from a website and create a data table based on information collected from an ocean buoy.

<p><b>Connections to Nature of Science</b></p> <p><b>Scientific Knowledge is Based on Empirical Evidence</b></p> <ul style="list-style-type: none"> <li>• Science findings are based on recognizing patterns.</li> </ul>	<p>I can collect water temperature data collected from an ocean buoy and look for patterns</p>
<p><b><i>Disciplinary Core Idea</i></b></p>	
<p><b>PS-4: Wave Properties</b></p> <p>Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.</p> <ul style="list-style-type: none"> <li>• Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).</li> </ul>	<p>I can observe waves in a water demonstration and look for patterns in amplitude (height of the wave) and wavelength (spacing between wave peaks) and communicate the information to others.</p>
<p><b><i>Crosscutting Concept</i></b></p>	
<p><b>Patterns</b></p> <ul style="list-style-type: none"> <li>• Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.</li> </ul>	<p>I can observe waves in a water demonstration and look for patterns in amplitude (height of the wave) and wavelength (spacing between wave peaks) and communicate the information to others.</p>

<p><b>Teacher Background Information</b></p> <p>To help you plan for your field trip to the INFINITY Science Center in Pearlington, MS, teacher background information is included in the section for the Environmental Monitoring exhibit. The Environmental Monitoring exhibit showcases live data feeds covering three topics: ocean conditions, air quality and river conditions. You and your students will explore the environment while learning about the role of data collection in scientific research.</p> <p>There are six interactive computer stations located within the Environmental Monitoring exhibit, with signs clearly indicating the type of information available at each station. Each, touch-screen station, gives visitors a first-hand look at environmental data, the scientists who collect them, and the valuable insights that those data can yield.</p> <p>The stations or kiosks include the following topics: <b>ocean conditions, air quality, and</b></p>
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**river conditions.** There are two identical kiosks for each topic located within the exhibit for a total of six kiosks. This lesson plan primarily focuses on ocean conditions and how buoys collect data such as water temperature and wave height.

When visitors visit the exhibit they will have the opportunity to interact with the live data from the different collection sites and with on-screen instructions can navigate the maps featured. Videos will be embedded within the screens with scientists explaining how they collect the data and why it is important they do so.

For additional teacher information about Wave Properties and 4-PS4-1 Waves and Their Applications in Technologies for Information Transfer, you may want to watch the following video by Paul Anderson, with Bozeman Science videos at Bozemanscience.com.

<https://www.youtube.com/watch?v=4S-MevRKGZs>

#### **Statement of Learning Objective:**

Students will learn about buoys and how scientists use the data collected to monitor the environment.

#### **Common Learner Misconceptions:**

Please refer to the following website as a reference of Common Misconceptions about Oceans:

<http://beyondpenguins.ehe.osu.edu/issue/polar-oceans/common-misconceptions-about-oceans>

#### **Materials:**

- Chart paper and markers
- Pictures of different types buoys (PowerPoint included with lesson)
- Graph paper and pencils
- Container or basin to hold water. Obtain a clear or translucent container with a minimum dimensions: 12"x12" depth of at least 6" for students to view wave action from all sides. A clear storage box will work well and can be purchased cheaply locally. The container can be larger, but consider the size of your sink or how you will fill with water in your classroom.
- Straws for students to blow in to create wind waves
- Set of small marbles
- Set of larger marbles
- Cups to hold the marbles until they are in use
- iPad or iPhone with slow motion camera if one is available
- Camera to take pictures at the exhibits at the Infinity Science Center

#### **Vocabulary:**

- waves
- amplitude – height of a wave

- wavelength – spacing between wave peaks
- patterns
- environment
- temperature

**Safety:**

The usual safety conditions apply in this lesson plan. Prior to the field trip, review the Conduct and Behavior Code of Conduct with your students for the INFINITY Science Center @ <http://www.visitinfinity.com/am-site/media/conducts-standards.pdf>

Safety Rules available for download from NSTA (National Science Teachers Association):

<https://www.nsta.org/docs/SafetyInTheScienceClassroomLabAndField.pdf>

NSTA: Field Trip Safety

<http://www.nsta.org/docs/FieldTripSafety.pdf>

**Adaptations/Accommodations for Exceptional Students:**

ELL students may need help with understanding the vocabulary. Pair students with a partner to help with directions and label the materials with the English word and also the student's native language when learning new material. Considering pairing students who may need additional help while researching the information in the computer lab or in the classroom.

**Literacy and/or Media Connections:**

Information is included below to help teachers and students explore various websites to build content knowledge about how scientists collect data to make informed decisions.

<http://www.ndbc.noaa.gov/> National Data Buoy Center – students can click on the interactive map to find buoys in various locations around the globe.

[http://www.education.noaa.gov/Special\\_Topics/Data\\_Resources/#page=All](http://www.education.noaa.gov/Special_Topics/Data_Resources/#page=All)

NOAA Education Resources

<http://www.miseagrant.umich.edu/lessons/>

Teaching Great Lakes Science website

<http://oceanservice.noaa.gov/facts/find-tides-currents.html>

Tide and current data from NOAA's Center for Operational Oceanographic Products and Services (CO-OPS) website.

<http://www.icommops.org/dbcp/data/datauses.html>

This website can be used to help educators and students understand how buoys are used to collect data. Some buoys are moored and some are drifting buoys at sea.

From this website students learn that buoys can be used to collect data to help meteorologists and oceanographers make informed global forecasts of weather and ocean conditions.

The following is a list of how some buoys are used to collect data:

Weather forecasts, marine forecasting, hurricane or cyclone forecasts, seasonal forecasting, safety at sea, and assistance to fisheries.

## **5E Instructional Process: This lesson could take 3-5 days to complete**

### **Engage:**

#### **Activity**

1. Pose the following questions to your students and allow time for them to record their thoughts in their science notebook: ***How do scientists collect data? Why is it important to collect data?*** Create two charts with the questions listed at the top and record the students' ideas as they share with the entire group. Keep the charts and display again at the end of the lesson and add new information to the chart in a different color marker.
2. After discussing their ideas, tell the students that when the class visits the Environmental Monitoring exhibit at the INFINITY Science Center they will learn how scientists collect data and use that information to inform citizens and help with decision making. They will see three kiosks or stations at the Environmental Monitoring exhibit: Ocean Conditions, Air Quality, and River Conditions. During this lesson we will explore how scientists collect data from oceans with buoys.

#### **Guiding Questions**

1. How do scientists collect data?
2. Why is important to collect data?

### **Explore:**

#### **Activity:**

1. Write the following question on the board and ask students, ***“What is a buoy? Where could you see a buoy?”*** After listening to their responses, show a picture of a buoy and ask students if they have ever seen in a buoy in a river or an ocean. ***“What purpose do buoys serve for scientists? What purpose do they serve for the general public?”***
2. A PowerPoint with pictures of various buoys is included with the lesson plan. Preview the PPT first to determine what is needed to help your students develop content knowledge of buoys and how they are used to help scientists. Hide slides that are not relevant at this time and use later in the lesson if needed. The PPT is designed to help you and your students understand how buoys are used to collect weather and ocean data. When you visit the Environmental Monitoring exhibit at the INFINITY Science Center you and your students will be able to interact with the kiosks to learn more how buoys are used in the real world.
3. If possible, collaborate with the Media Specialist, art teacher, and/or Computer Lab teacher to schedule time for students to research how buoys are used and what purpose they serve. A handout with four questions about tides and currents

for possible research is included with this lesson. The research part of the lesson could take one or two days to complete.

**Guiding Questions:**

1. What is a buoy?
2. Where would you see a buoy?
3. What purpose do buoys serve for scientists?
4. What purpose do buoys they serve for the general public?

**Research Questions:**

1. What are tides?
2. What are currents?
3. What are some tools that scientists need to measure currents?
4. How are ocean buoys used to learn about tides, currents, and weather forecasting?

**Explain:****Activity**

1. After your students have completing the research activities about buoys, allow time for students to share what they have learned from their research and to further extend their learning by challenging them to create a data table with information gather from a buoy of their choosing in the Gulf of Mexico.
2. To provide further information to the students, share the PPT about buoys again and focus on the slides on the National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center website. As you click through the slides, use the Bay Waveland Yacht Club, MS station and the data collected at this stationary buoy as an example. Search and Research Data (SAR) can also be accessed from this buoy. The following data is collected at this particular buoy:
  - Wind direction
  - Wind speed
  - Wind gust
  - Atmospheric pressure
  - Air temperature
  - Water temperature
  - Wind speed at 10 meters
  - Wind speed at 20 meters
3. Ask students to collect water temperature data for the Bay Waveland Yacht Club using a standardized time of the day, such as 6:00 AM, 12:00 PM and 6:00 PM for example or only write the highest temperature for each day. Decide what you want your students to collect and record on graph paper. Depending upon your math standards, you may choose to have your students create different types of graphs, such as a bar graph or line graph.
4. After students have created the graphs, allow time for them to share with other groups to explain how they collected the data and what patterns did they find over time.

**Guiding Questions (Questions are from the PPT)**

1. What can you learn from the data collected at this buoy? (Bay Waveland Yacht Club)
2. How often is information collected at this buoy?
3. What does WDIR stand for?
4. What is the temperature difference for the times shown in this chart?
5. What other pattern(s) can you observe from looking at the data collected at this site?

**Elaborate:****Activity**

1. After students have collected data from the buoy website, set up a model or several models if you have enough containers of “lake” for students to observe. Gather materials: container filled half way with water and a pencil. Have one of the students gently tap the side of the container and observe the waves. **How do the waves move?** (They spread out until they reach the end of the container and then travel back.)
2. Allow time for the water to become still and then place a small object (cut a straw to 5 cm) that floats in the water and then tap the side of the container. **What happens to the straw as waves are created?** (The straw will move up and down, but for the most part will stay in place and does not travel with the wave. Energy moves through water bumping from one water molecule to another to the next.) Activity reference source:  
<http://www.nsta.org/publications/news/story.aspx?id=53134>
3. Students may also drop marbles in the water and measure the height of the drop with a ruler and record the results. It is often difficult to see the wave action, but if you have access to a camera with slow motion, then video tape and play back. Most phone cameras and iPads now have this capability.
4. The video link below will help students further understand how buoys work in the ocean with a better understanding of waves. View the following video first to check to be sure the link is appropriate for you and your students to view. What Causes Waves? Produced by Socratica  
<https://www.youtube.com/watch?v=EWekVzsBcXE>
5. The second video is a Bill Nye the Science Guy video about ocean currents. This video is 19:02 minutes long, but can be stopped and discussed along the way.  
<https://www.youtube.com/watch?v=IWpAYSGzbWg>

**Guiding Questions**

1. What causes waves?
2. What causes tsunamis?

**Evaluate:****Activity**

1. Observe your students as they research websites learning about waves, tides, and as they collect the data from the buoy. Can they explain their thinking by designing a brochure about waves, tides, buoys?
2. Revisit the charts you created with your students from the Engage section of the lesson. ***How do scientists collect data? Why is it important to collect data?*** Ask your students to create a new heading in their science notebook: I use to think, but now I know..... Allow time for students to answer the two original questions and add new information.
3. What technology and/or research skills should be practiced and strengthened in collaboration with the media specialist in order for your students to be successful?
4. Remind students, they will be visiting the INFINITY Science Center soon and they will learn more about scientists and how they collect data at the Environmental Monitoring Stations. Remind students to take a camera if one is available and we will use the pictures to review the exhibits after we return to school.