The Teacher is a Beacon, The Students are Buoys

Key Concepts:

1) Ocean currents can be mapped by using drifting buoys that communicate about their location with a central beacon
2) Scientists collect data to help them identify movement patterns of ocean currents, animals, and even humans

Background

In the episode of *Tumble Science Podcast for Kids* "The Science of Ocean Sounds," Dr. Amy Bower demonstrates that she uses drifting beacons to help her understand the way giant "rivers" move and circulate water through the ocean. As she describes in the episode, Amy drops buoys into the ocean, where they drift around, following the ocean currents. Periodically, her central beacon sends out signals to these buoys, and she uses the data collected to determine their location and eventually build maps of the currents in the ocean.

Materials

- Poker chips, cardboard cutouts following a template (printout provided), playing cards with different-colored backing, or some other small item students can carry around to record their movements - 10 for each student or each student group
- Ten buckets or other small containers
- Data recording sheets and student handouts (printouts provided)
- A noise maker of some kind (bell, whistle, other sound maker for the "beacon" signal… or use our recording of Dr. Amy Bower's beacon)
- Sonification resources / handout

Teaching Hints

In "The Teacher is a Beacon, the Students are Buoys" the students will simulate Dr. Bower's work mapping ocean currents by tracking their own movements through a classroom during a normal morning, week, or afternoon. Periodically through a day, the teacher should send out a signal of some kind indicating that students should stop what they're doing and deposit one of their numbered tokens into the nearest bucket–all while taking careful note of the time, the numbered token, and the number of the bucket they deposited their token in. In addition, this activity provides practice in collecting data, plotting data, coming up with creative ways to represent data, and also identifying and explaining patterns in data.

This activity can be performed with any size group and in any time frame, though longer intervals and larger groups of students might yield more interesting datasets for students to analyze and explore.

This activity can be divided into two phases: the data collection phase, when students are simply responding to beacon "calls" by placing tokens in buckets and making notes of location and time; and the data analysis phase, when students can interact with the data they've collected in several different ways. In the latter phase, you can incorporate different means of analyzing data and looking at patterns, and perhaps even use some interesting ways to represent data sonically.

This activity is designed to pair with *Tumble Science Podcast for Kids'* episode "The Science of Ocean Sounds." It may be most useful to listen to the entirety of that podcast episode as a class and complete some of the listening guide resources prior to starting this investigation.

Key Words

- Ocean currents
- Buoys
- Beacons
- Data
- Data sonification

Handouts for Students

The Teacher is the Beacon, the Students are Buoys

Did you know that the ocean has enormous "rivers" within it? These are called "ocean currents," and scientists like Dr. Amy Bower have been curious to learn about ocean currents for many years. There are many different tools that scientists have used to learn about ocean currents, but one of them is a system of **drifting buoys**. These buoys are dropped into the ocean, and drift around in the current, all while communicating with a **sound beacon**. Every so often, the sound beacon sends out a signal, and the buoys respond by telling the beacon where they are in the ocean–and that way scientists like Dr. Bower can make a map of ocean currents!

In this activity, we'll simulate Dr. Bower's ocean current mapping by taking on the roles of the beacons and the buoys. On the first day, your teacher will act as a beacon, sending out a signal. You'll be acting as a buoy, receiving your teacher's signal, and using that as a cue to make note of your location in the classroom at that time.

Materials

- Ten tokens or poker chips (your teacher will provide each of you with these)
- Data recording sheet handouts
- Ten buckets for putting your tokens in, spread out throughout the room.

Procedure

Day 1 - Data Collection
1. Gather together your tokens. Make sure you have ten tokens, and that each of them are numbered correctly, 1 through 10
2. Put all of your tokens in your pocket or in a bag that you'll carry with you while you're going about your business in the classroom.
3. Make sure you also have a notebook or the data collection handout with you at all times for this project–if you can't take notes, you won't be able to get good data!
4. Place the ten buckets around your classroom.
   a. If your teacher has already placed them around the classroom, simply notice where they are. It may help to draw a map of your classroom with major landmarks (like the teacher's desk, the your own desk, activity stations, and so on) marked out. Draw on your map where each of the ten buckets are located.
   b. You may want to make a map of your classroom with key landmarks–things like desks, bookshelves, windows, and so on–with the locations of each bucket shown.
5. *Then,* just go about your day!
6. Ten times throughout the day, your teacher will play a beacon sound. When you hear the beacon sound, you should:
   a. Record the time on your data sheet, and the number of the token (the first time you hear the beacon, use token 1, the second time you hear the beacon, use token 2, and so on)
   b. Find the closest bucket to wherever you happen to be standing–it may not be the one directly in front of you!
   c. Place the correct token in that bucket
   d. Record on your data sheet which number bucket you placed your token
   e. Once you've done all that, return to what you were doing before!
7. Repeat the last step until you've recorded and deposited all ten tokens.

Day 2 - Data Analysis
1. The next day, have your class count up the number of tokens in each bucket. You can divide up into ten groups to count tokens for each bucket, or find some other way to work together to get an accurate count.
2. Record your data on the handout or in your science notebook.
3. You should already have data of your own progress through the classroom recorded from yesterday!

Analysis and Interpretation

1. Looking at your own data sheet, could you make a "current map" that shows where you are in the classroom at different times? Did you notice any patterns that you can explain? Were there some buckets you were always close to? Were there some buckets you were never close to? Why do you think that is?

2. Looking at the class's data sheet, do you notice any patterns? Which bucket had the most tokens in it? Which bucket had the least? Can you explain why?

3. How does the class's data sheet compare to your own? Did you visit some places that most of your classmates didn't? Did the class visit some places that you didn't?

4. In "The Science of Ocean Sounds," Dr. Bower spends a lot of time talking about how she uses sound to help her identify patterns in data. Can you think of any creative ways to represent the data you've collected that might make it easier for you to notice patterns?