Uncommon Sense!

activity NINE

Objective: Students will practice echolocation as a way to identify objects and positions.

In The Film: While underwater, Dr. Kathleen Dudzinski observes the behavior of many dolphins. She uses her specially designed video array to detect and, hopefully, decipher the sounds made by the animals she studies. The distinct chirps, squeaks, squawks, whistles and clicks dolphins make seem to represent some sort of communication between them. Are these sounds used only when the animals are communicating, or do they make sounds for other purposes? Scientists tell us that these animals find hidden prey (or even each other) in the vast ocean by using their specially evolved echolocation systems.

Materials:
- ☐ A large room or a large outdoor area
- ☐ A blindfold
- ☐ Pencil
- ☐ Paper

Teacher Prep Notes: This activity is designed to be done in a classroom but can be effectively done on the playground or in a large indoor or outdoor space. Caution should be used when students are blindfolded. The activity can be done with obstacles, such as desks and chairs, in place. Continue the activity until all students get the chance to be "it" or conduct the activity over several days. Students may record their experiences as part of a creative writing exercise.

FACT BOX: The use of echolocation gives dolphins a very detailed image of their surroundings. Dolphins may actually be able to locate a pea-sized object from a distance of between 16 to 656 feet (5 to 200 m) and they may be able to determine if a female dolphin is pregnant by the types of echoes returned to them.

Background: Animals who live in darkness or in murky waters have evolved to be able to hunt in these environments. They use a highly specialized type of sonar to help them detect objects in their surroundings. Dolphins and bats are animals who have adapted to their environments by developing echolocation systems.

To Do:

1. Gather students in a central location of the room. Ask them to listen to the sounds around them. Ask them to list what sounds they hear and determine if the sounds tell them anything about the location of the sound-maker. For example, do the sounds from the birds chirping from the window tell students anything about where the birds are located? Do the sounds from the hallway tell them anything about where the hall-walkers are or what they are doing?
2. Now ask students to make clicking sounds with their tongues. Make sure that each student is able to make the same sound and that each person is able to make the sound loud enough to be heard by the entire group.
3. Select one person to be "it" and ask them to wear the blindfold. This person will stand in the center of the room. To disorient this person, have them turn around in place three times and ask them to search out and tag class members. The person with the blindfold should make clicking sounds whenever he or she needs information (update on student locations) about the others. The person who is "it" must rely upon hearing to find classmates. When another class member is tagged they will sit out and observe the remainder of the activity.

   The other class members will not be blindfolded. They will each walk around the room, trying not to be tagged by the person wearing the blindfold. These students are free to go anywhere in the room but they must repeat the clicking sound each time it is made by the person with the blindfold. The clicking sound is the only sound that any class member may make once the activity begins. NOTE: Students may not run during this activity!

   The person with the blindfold will emit clicks and will receive answer clicks from the other class members, which will tell the locations of the students. Continue the activity until more than half of the class has been tagged.

Once the activity is over, ask the student who wore the blindfold to describe his or her experiences.

- Did they have an easy time finding their classmates? Why or why not?
- Could they easily hear the clicking sounds locating the other students?
- What outside factors affected how well they heard the clicking sounds?
- How effective at avoiding being tagged were the other students?

• Did they find the clicks to be helpful when trying to avoid being tagged?

Discuss how this land-based version of echolocation can be related to how dolphins and bats use this specialized tool.

What's Going On & Why? Dolphins transmit high-frequency sound waves (higher than can be detected by the human ear) to get an auditory image of their surroundings. This is called echolocation and is a highly developed adaptation found primarily in bats and dolphins. Dolphins use echolocation to determine size, shape, speed, distance, direction and maybe even internal structures of objects in the water.

During echolocation, dolphins produce ultrasonic clicks from within their nasal passages and emit them through the rounded front of their head. This area contains the melon, a fluid-filled organ that acts as an acoustic lens to focus sound into beams. The fluid in the melon is the same density as the seawater. The sound waves travel through fluids with similar densities without distortion. This gives a clearer signal to the dolphin.

The clicks travel through the water, bounce off an object and send an echo back to the dolphin. When the echoes return to the dolphin, the animal's lower jaw acts as a receptor for them. The jaw contains a fluid-filled cavity where these echoes are passed along, via the auditory nerve, to the middle then inner ear of the animal, and finally to hearing centers of the brain.

In this activity, the student who wore the blindfold emitted a clicking sound each time he or she required information about their surroundings. They made the clicking sound primarily when they wanted to know if another student was within tagging range and this represents the sounds made by dolphins who use echolocation. The clicking sounds made by the other students in the class represent the echoes that are returned to the dolphin, giving it information about its surroundings.

Key Words:

sonar an apparatus that transmits and receives sound waves in water. Sonar is used in submarines to locate (and possibly identify) water depth and other objects.

echolocation the auditory feedback system used by some animals which allows them to pick up reflected echoes from sounds generated by objects in the water providing the animal with information to determine an object's location.