Battleship: Exploring How to "See" with Ears
(Instruction Page 1)

Materials:
   3 lengths of yarn – 1m, 2.5m, and 4m
   Noisemaker
   Blindfold

Purpose:
   Answer the following questions by conducting an investigation, making observations, recording data, and drawing conclusions based on that data.

   1) Can and do humans use sound to make observations about location of objects around them?
   2) How accurate are humans at using sound to echolocate?
   3) How accurate are humans at perceiving distance and direction of sound?

Guided Investigation:

   Objective:

   During this investigation each student will have an opportunity to test his or her ability to accurately echolocate. Each member will rotate through the following roles:
      1 - submarine listening for nearby battleships
      2 – battleships emitting sounds that the submarine can detect
      1 – facilitator and data recorder
   The submarine will be blindfolded while the two battleships strategically position themselves around the submarine. They will then give off two sets of sounds using their noisemaker. The goal of the submarine is to listen to the noise emitted by the battleships and "sink" them. Correctly pointing in their direction and giving a correct distance (1, 2.5, or 4 meters) accomplish this.

   Instructions for setting up experiment:

   1. Refer to the diagram below to help you visualize what the gaming area will look like.

   2. The two players representing battleships (shown as a triangles) must position themselves at a distance of 1 meter, 2.5 meters, or 4 meters (represented by dotted lines) from the center point marked with tape. They should use the yarn to help them measure those distances from the center. They are free to choose where they want to be located around the center point.

   3. As they position themselves, the submarine should be standing to the side, blindfolded, and ears covered.

   4. When the battleships are set, the facilitator will positions the submarine on the tape facing forward (represented by the star).

   5. When everyone is set, the facilitator with tap the submarine on the shoulder so they know to uncover their ears.
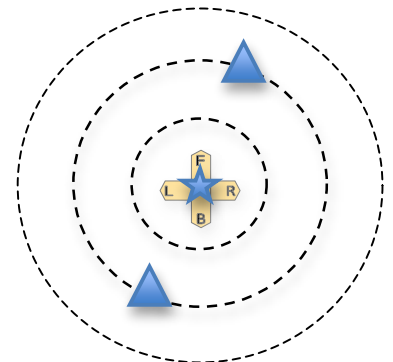
6. The two battleships will use their noisemakers to give off two sounds approximately 4 to 5 seconds apart. They should not make the sounds at the same time.

7. As the battleships make the noises, the submarine must remain facing forward and listen for directions and distance of the battleships.

8. After the battleships have made two sounds each, the submarine will try and sink the battleships by pointing in the battleship's direction and giving a distance of 1m, 2.5m, or 4m.

9. The battleship should verbally indicate whether the submarine hit or missed them. Note: The submarine does not have to point exactly at the battleships center. If they point extremely close to the ship, it is considered a hit. The facilitator has the final say if it is a close call.

10. The facilitator's job is to plot the position of the battleships on the observation sheet. They should mark where the battleships are located on the "map" using the following key:

    Red dots = Sunk battleship

    Blue dots = Submarine aimed in the correct location but missed distance

    Black dots = Missed battleship

11. The students will rotate positions and play again. This will happen until everyone has had a chance to be the submarine.

12. If your classroom is equipped with an interactive whiteboard, you will need to plot your dots on the master map displayed on the interactive whiteboard. If not, your teacher should have a master map drawn on the board for you to plot your results on.

13. Once everyone has plotted their results, fill in the data table provided and graph the results.

14. Using the information from your results, write a brief conclusion paragraph. Make sure they conclusion answers the three questions

    - *Can and do humans use sound to make observations about location of objects around them?*
    - *How accurate are humans at using sound to echolocate?*
    - *How accurate are humans at perceiving distance and direction of sound?*

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(Data – page 3)

Battlefield Map:

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KEY

Red dot = Sunk battleship

Blue dot = Correct location but
          missed distance

Black dot = Missed battleship
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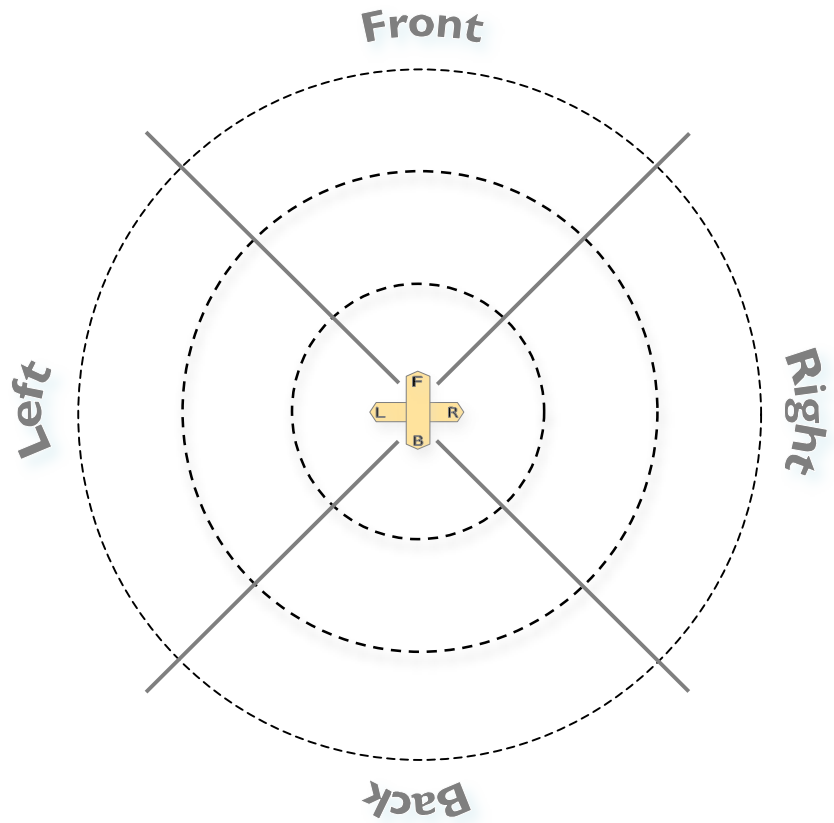

Class Data:

	Sunk (red dots)			Correct Direction (blue dots)			Missed (black dots)		
	1m	2.5m	4m	1m	2.5m	4m	1m	2.5m	4m
Front									
Right									
Left									
Back									