

ECOS Inquiry

1. Contributor's Name: Matthew Corsi and Flo Gardipee

2. Name of Inquiry: Echolocation Marco Polo

3. Goals and Objectives:

a. Inquiry Questions: How do bats use echolocation to navigate and capture prey?

b. Ecological Theme(s): Observation skills development, sensory adaptations and other adaptations in nocturnal bats.

c. General Goal: To demonstrate how sound can be used without vision as an auditory skill while simultaneously teaching students about local bat species and their specific adaptations.

d. Specific Objectives:

- 1) Demonstrate how sound can be used without vision as an auditory skill in animals.
- 2) Assist student in developing awareness of similar and divergent adaptations within a species, such as bats.
- 3) Teach students about local bat species.
- 4) Develop observational skills in students through guided inquiry.

e. Grade Level: 1-5

f. Duration/Time Required:

→ **Prep time:** Minimal.

→ **Implementing Exercise During Class:** 45min - 1 hr

→ **Assessment:** 10 minutes

4. Ecological and Science Context:

a. Background (for Teachers): Auditory observational skills are an important component of ecological literacy. Demonstration of the power of listening to make observations is best done when vision is not an option. Bats use hypersonic vocalizations to locate and capture prey and to navigate. These vocalizations reflect or echo off of the objects and the bat analyzes the sensations in a manner that allows them to very precisely tell where objects are, how fast they are moving, etc. In short, bats can use echolocation instead of vision to navigate and hunt. Bats play a surprisingly important ecological role, and have evolved many unique adaptations such as echolocation that will be interesting for students to learn about. Students will emulate bat behavior through role playing in the echolocation described below.

b. Background (to present to Students): Listening is one of the most important observational skills we have. Some animals use their abilities to listen to find prey, avoid predators, and to find their families. Bats do not have good vision and fly at night anyway, so they need a better way to observe the world around them. Bats use a very special type of listening observation called echolocation. For this type of observation, bats make a sound that our ears are not even capable of hearing. These sounds echo or bounce off of all of the objects around them and bats use their specially adapted ears to know how far away objects are, how big they are, how they are shaped, and how fast they are moving. In a way, bats are capable of “seeing” with echolocation.

5. Motivation and Incentive for Learning:

Bats are intriguing to young students because of the mythology and mystery that surrounds them. Learning to navigate without the use of sight is a fun experience.

6. Vocabulary:

Echolocation

Various common names of local bat species

7. Safety Information:

Students will be excited about this investigation because it is much like a game and full of physical activity where some students may be blindfolded. It may be wise to break the class into groups so that blindfolded students are not running into each other.

8. Materials List (including any handouts or transparency masters):

- Blindfold
- Preserved bat specimens can be borrowed from the Natural History Museum in the UM Division of Biological Sciences
- Observation worksheets (see below)
- Mammal field guide for bat identification

9. Methods/Procedure for students:

a. Pre-investigation work: An ecologically relevant children's literature story about bats will read by or to students before the investigation is completed. All students will draw the name of a local bat from a hat. Students will then learn about their bat species from and they will pretend to be that bat species during the investigation. The process of echolocation will be described to the students and instructors will describe how playing Marco Polo is similar, but different from echolocation.

b. Investigation work: All students will get an opportunity to navigate without the luxury of vision. A species name will be chosen and all of the students that are playing as that species will be blindfolded. Each species will have 5 minutes to tag as many moths (students not playing bats at the time) as they can by playing Marco Polo. Moths must sit in place when they are tagged. Students playing bats should be instructed that they are not allowed to run during the exercise. Students playing moths are not allowed to take more than 3 steps between replies of "Polo!"

Students will be given the opportunity to observe bat specimens and record specific observations regarding similarities and differences between them on a worksheet. They will answer questions regarding these observations with respect to adaptations specific to bats and different species of bats (see attached worksheet). This will serve as a form of guided observation and inquiry. Bat specimens can be placed at several observation stations. Stations should have multiple species so students can easily compare the features of the bats at a single station.

1) What evidence (data, samples) do students collect?

Observations from game playing and looking at museum specimens.

2) How do students present the evidence (data)?

Through reflection on observations, and observation worksheets.

3) What conclusions are drawn from the evidence students collect?

Auditory observation is a powerful skill. Adaptations can be common across a species and specific to a certain species as well.

4) Include examples of data sheets. (See attached worksheet.)

10. Assessment:

Students will be assessed according to observational skills and conclusions based on observations recorded on the worksheet.

11. Extension Ideas:

Students could build a dichotomous key based on observation of common and divergent features among the different bat species. Bat boxes may be built and placed in the schoolyard. Students could visit the bat boxes on a regular basis to determine occupancy and make observations with binoculars.

12. Scalability:

This inquiry may be scaled to most grade levels. The worksheet may not be appropriate for lower grades and could be simplified to a few basic questions.

13. Science Standards Accomplished:**K-4**

Unifying Concepts and Processes: Form and function

Life Science: Characteristics of organisms

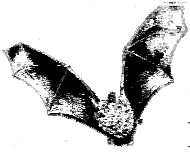
5-8

Unifying Concepts and Processes: Form and function

Life Science: Diversity and adaptations of organisms

14. References:**15. List of Experts and Consultants:**

16. Evaluation/Reflection by Fellows and Teachers of how it went: We ran this inquiry with both 1st and 5th graders. The Marco Polo exercise was very well received by students and instructors alike, especially by the 1st grade group. As long as we made it very clear what was and was not acceptable handling procedure for the museum specimens, the students were very respectful (consult museum curator regarding what handling techniques are considered acceptable). We used the bat observation worksheet in the 5th grade class to some success; however, we learned that it is very important for students to only compare bat specimens at a single station. It is too difficult for students to remember feature differences when rotating from one bat specimen to another.



Bats of Montana: Observation Worksheet

Name _____

Name three features that all of the bat species appear to have in common:

1.

2.

3.

Why do you think the bats share these features?

What purpose do you think these common features have?

Which of these features do you think help bats survive? And why?

Name three features that are different between the bat species observed:

1.

2.

3.

Why do you think some bats are different from each other?

What purpose do you think these different features have?

Do you think that any of these differences could help a bat species survive better?
Which ones and why?