

TIMED OBSERVATIONS

Students observe the behavior of a group of animals and use a sample protocol to quantify what they see.

Many people think of math as calculations. But numbers are just another way of visualizing and modeling things we observe. The more that students are exposed to math as a tool for visualization and problem solving, the more they will be able to creatively employ it in their own learning. Conducting timed behavioral observations of animals is one way of using numbers to help us learn about an organism. This turns general observations into more precise data that can be used for deeper analysis and understanding of the animal. Quantitative data on animals' behavior offers a window into patterns that we otherwise might not be able to see. Making timed observations at intervals is also a strategy students can use in other settings to gather numerical data.

NATURAL PHENOMENA

This activity requires a group of animals that can be easily observed. This could be a flock of birds (ducks, pigeons, blackbirds, robins on a lawn), ground squirrels, deer, antelope, lizards, or other cooperative species. Animals that exhibit repeated behaviors and that are less likely to run away, hide, or fly off are ideal. The animal group should be close enough that you will not need binoculars or other magnification to observe their behavior, but not so close that they will be disturbed by students talking. This activity could occur spontaneously when you see a group of animals. You can also try to find local areas where animals tend to congregate so that you can plan the activity. Keep your eye out. Lizards often cluster in the morning sun, ducks and waterfowl congregate at flat bodies of water, and larger birds such as crows, ravens, or seagulls frequent many urban areas.

PROCEDURE SUMMARY

1. Record the behaviors of five different individuals every 20 seconds.
2. At every 20-second mark, make a tally next to each type of behavior one of the five animals is doing.

DEMONSTRATION

When the whiteboard icon appears in the procedure description: Build your demonstration page in four stages. First identify the behaviors you observe. Then create sample data (tally marks) as you describe making timed observations. When the data is in, show students how to create a graph from the data. Finally, use the data you collected to record questions or describe patterns you see.



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Time

Introduction: 10 minutes
Activity: 30 minutes
Discussion: 20 minutes



Materials

- Journals and pencils
- Stopwatch(es) with countdown function or watch(es) with second hand



Teaching Notes

If you have many stopwatches, give one watch/stopwatch to each group. (Wristwatches with second hands or phones with stopwatch features work too.) If you have only one stopwatch, you or an assistant can call out a signal at the appropriate intervals. It's best to give students time to play around with a stopwatch beforehand so that they are familiar with using the tool when they begin this activity.



PROCEDURE STEP-BY-STEP

1. Observe the animal species for 5 minutes, asking students to make a list of the kinds of behaviors they see.

a. "We are about to observe these animals for five minutes. As we do, focus on the animals' behaviors. What are they doing?"



b. "In your journal, draw or write to make a list of the kinds of behaviors you see. What are the behaviors that you see the most often or poses or positions that the animals hold for longer periods?"

2. Tell students to focus on making observations of the animals' behaviors, not trying to explain the behaviors.

a. "Try to avoid making assumptions about the reasons for behaviors; instead, describe what you see."

b. "For example, instead of saying 'looking for predators' say 'standing, head and ears up.' Any questions? Begin."

3. After 5 minutes, ask students to share some of the behaviors they observed, then put the common behaviors into categories (feeding, lying down, vocalizing, etc.).

a. "What were some of the most interesting or common behaviors that you saw? What poses did they do frequently or for long periods of time?"

b. "Let's sort these into major categories, such as feeding, being still, moving, calling, and so on."

4. Compile what your students share into a short list of clear, unambiguous categories on a whiteboard. (Four to ten categories is a good range, fewer for younger students, more with older observers.)



5. Tell students they will record their observations every 20 seconds.

a. "In just a moment we will use a system to quantify and record our behavioral observations. Our goal is to find out what these animals do and how they spend their time."

b. "To do that, we will look every twenty seconds and tally the behaviors we see."

6. Divide students into groups of three, then explain the procedure.

a. "In each group, there will be an observer, a recorder, and a timekeeper."

b. "Every twenty seconds, the timekeeper will say 'Now!' Then

LYING DOWN	SITTING UP	RUN-WALK	EATING

the observer will look up and say the behaviors they see each individual animal doing at that moment. Then the recorder will put down tally marks on the data table (one for each animal) each round.

7. If the animals are relatively still, students can observe the behaviors of the same individuals in each observation. If this is difficult to track, they can choose individuals at random with each observation.

a. "Try to record the behavior of the same five to ten animals with each observation. If they move too much to track, choose random animals each time."



b. "Keep track of observations with tally marks next to your behavior sketches, or make a table of the behavior categories like this."

c. "We are going to observe for fifteen minutes. We will change roles every five minutes. Each of you will get a chance to take all of the roles."

8. Give students a moment to copy the template data table (as shown on your whiteboard) and record the date and time in their journals.

a. "Take a moment to copy the template for the data table into your journal."

b. "Before you begin, write the time, location, and weather in the corner of your page."

9. Distribute stopwatches and explain how to use them. If these are a new tool, students will need a little time to play with them.

10. Tell students to begin their observations, then pay attention to how they are doing, offering support or redirection as needed.

11. After the animals have left, or after students have completed 10–15 minutes of observations, call for their attention.

a. "Please stop your observations, and write down the time that you stopped recording behavioral observations."

12. Explain how to graph the data: Make columns for each behavior on the x-axis, and the frequency of each behavior on the y-axis. Demonstrate on a whiteboard.



a. "Make a simple bar graph to compare the frequencies of each behavior type. On the horizontal (x) axis, you will create one column for each behavior type."

b. "On the vertical (y) axis, you will show the frequency of observations for each category."

c. "Figure out how high the longest bar will go first to make sure you have enough room for your graphs, then mark the units of measurements on the horizontal (x) axis."

DISCUSSION

Lead a discussion using the general discussion questions and questions from one of the Crosscutting Concept categories. Interperse pair talk with group discussion.

General Discussion

Use the graph and students' initial observations to discuss trends and patterns in the data and to build group understanding of the organisms' behaviors.

- a. "Let's use our graphs to discuss what we learned about these animals. What behaviors did you see the most?"
- b. "What behaviors were uncommon?"
- c. "What general statements can you make about the behavior of these animals at this time?"
- d. "What are some possible explanations of these patterns?"
- e. "Do you think this pattern in behavior is consistent for this species in other geographic locations? Why or why not?"
- f. "How do you think the patterns of behavior might change if we repeated the activity at different times of the day or year?"
- g. "How might this change if there were predators present?"
- h. "What could you do to get an even better understanding of the way these animals behave? How would you design your experiment or structure your observations?"

Cause and Effect

- a. "Did you see any behavior that seemed to have been triggered by some other event or stimulus? What is your evidence for this?"
- b. "Some of the behaviors we saw may have been a response to forces or threats that we cannot see. Can you think of anything that we can't see that might influence the animals' behavior?"

Structure and Function

- a. "What were some of the structures you noticed while observing these animals? Describe them in detail."
- b. "Pick a structure and think about how it might function to help this organism survive. Connect your explanation of a specific structure to the environment. For example, don't just say 'Its legs help it run.' Think about the specific

shape of the animal's legs, and what you observed when it was running. Do the legs help it run quickly over a specific kind of surface? How do they work?"

Stability and Change

- a. "Did the level of animal activity stay the same, or were there times when the animals were more still and more active? Why?"
- b. "After a disturbance, how long did things take to get back to a less active state or for the animals to return to the most common behaviors you observed?"
- c. "After the disturbance, did things go back to the way they were before, or did there seem to be some new level of activity or behavior?"
- d. "How might these patterns change at a different time of year?"

FOLLOW-UP ACTIVITIES

Practicing Percentages

1. **Convert the raw observations to percentages. This is good way to integrate math skills with a science exploration.**
 - a. "How can we convert the number of observed behaviors to a percentage? [Divide the observation count for one behavior by the total number of recorded behaviors.] Let's calculate the percentage of time these animals spent doing each behavior."
 - b. "Add the percentages to the graph below each column."

Responding to Disturbances

Repeat the activity after a mild disturbance (e.g., a student walking near the animal group). This time, keep separate logs for each minute after the disturbance. How long does it take for the group behavior to return to the predisturbance baseline?

Engaging in Further Research

Do further research and reading on the species students observed. Students' baseline observations will set them up to be curious to know more. They could read scientific papers, internet articles, field guides, or other sources to learn more about the characteristic behaviors and life histories of this animal. Or they could read about animal behavior in general, looking up information on how groups of animals tend to interact, behave in the face of disturbance, and the like.