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Using This Guide

Building science literacy includes teaching science content as well as building familiarity with the work of scientists. Providing the opportunity to participate in inquiry-based explorations helps learners identify with the scientific process and build their own research skills. They learn about the work of scientists by actively participating in the research process themselves. This guide is designed to support you to build research skills among program participants, aligning with the best practices in the field. The research activities in this guide can be completed at your institution, at home or a combination of the two!

This guide contains several sections. The first activity is focused on learning how to observe animals like a scientist would. The second activity is an original research project using these observation skills. Next is a lesson on how to share the research results like a scientist. Finally, the guide concludes with information on how to encourage explorations in the home. Throughout the guide you'll find information on the process of field research and tips for conducting research projects.

Let's get started!

Frequently Asked Questions

1. We live in the city. What do we do if there is no wildlife to observe?

Even the most urban of areas will have some type of plant or animal life for you to explore. While you may not have acres of pine trees or animals roaming, there is likely a wealth of living things to observe. Ants, spiders, and pigeons are just a few examples of this urban wildlife.

2. What ages would learn best from these activities?

While the activities are written for learners fourth grade and above, the process of observing animals is relevant to all ages, including adults. Some activities contain a modification suggestion that would make it more appropriate for younger participants.

3. What do we do when there aren't any animals to observe?

Many animals are active even in extreme weather, but you may have to look a little harder to find them. Another option is to observe household pets or classroom animals such as fish in an aquarium.

4. Can exploring animals be dangerous?

It is unlikely that you will encounter dangerous animals in schoolyards, parks, or other public areas. However, animals may bite someone that gets too close or a bee sting can make a day outside very unpleasant. Remind participants to observe animals without touching, determine a safe distance to keep, and be aware of any participant allergies, especially to bee stings. If you decide to conduct observations in more natural areas, check with rangers or other officials about how to stay safe.





Organizing Your Research Day

A little preparation will ensure your research goes smoothly. Here are some tips to get your planning started.

An ideal observation area would be within walking distance of your institution. Scientists rely on multiple observations to inform their research. A nearby location allows for more frequent observations on the part of your participants. Examples would be an open area on grounds, along the sidewalks around the institution, or a nearby park or nature area.

- **Check on Area Logistics** – Getting to your observation area may require participants to leave grounds. Determine if permission slips will be needed. Plan your route and review appropriate safety procedures.
- **Allow Enough Time** – Provide sufficient time for participants to collect the desired amount of data by accounting for the transportation time needed to get to the site as well as time to settle into a new learning environment.
- **Demonstrate Care for Nature** – Nature should be left undisturbed during participant observations. Prior to leaving the observation area, take a few moments to assure that it is exactly as you found it.
- **Plan for Emergencies** – Bring along a cell phone as well as emergency contact information.
- **Plan for Bathroom Breaks** – If you will be in a natural area without restrooms, determine in advance what your bathroom strategy will be.



Building Research Skills

Before starting an original research project, participants must first build their research skills. Scientists rely on an inquiry-based approach for learning more about the world around them.

An inquiry-based approach to scientific exploration includes:

- Making observations
- Posing questions
- Examining books and other information sources
- Planning investigations
- Using tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

A single activity or lesson doesn't need all these elements to be considered inquiry-based. Aligning with even one is a great start!

Ethology and Ethograms

Studying an animal's behavior can provide scientists with valuable information that can aid in conservation efforts. The study of animal behavior is called ethology. Scientists use ethograms to help with this research.

When scientists conduct animal observations, they rely on specific procedures in order to collect data that is as accurate as possible. Researchers use an ethogram as part of these procedures. Ethograms are a list of all the possible behaviors an animal might exhibit. Using an established ethogram helps ensure the data collected by lots of different scientists is similar enough to be compared. As you can imagine, scientists might use different ethograms for different species to capture the unique behaviors of each. Scientists might also use different ethograms for the same species. These ethograms may be more specialized and focus on types of behavior such as maternal care or social aggression.

There are many different ways to collect data on animal behavior. In interval sampling, observers note what an animal is doing at pre-set, evenly-spaced time intervals. This allows the researcher to get a clear "snapshot" of an animal's behavior at a precise moment in time. When multiple observations are combined, researchers can begin to draw conclusions about which types of behaviors might be most common for a species, or when certain types of behaviors are most likely to occur.



Activity 1: Using an Ethogram

Activity Overview

In this activity, participants will learn how to use an ethogram to study animal behavior. Observations can be conducted anywhere animals can be found: a schoolyard, nearby park, or backyard.

Objective

Participants will use an ethogram-based data sheet to record animal behavior.

Materials

- Ethogram and Observation Datasheet (see page 9 and 10)
- Information on Ethology (see page 6)
- Clipboards
- Stopwatch
- Pencils

Inquiry Connections

- Making observations
- Use tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

Activity Preparation

To prepare for the activity, first determine which animal the participants will be observing. It's best to select the type of animal they will most likely encounter in the study area. We've provided data sheets from which to choose.

Procedure

Before beginning the observation, explain to participants that they will be learning about

ethology, or the study of animal behavior. Provide participants with a copy of the selected ethogram data sheet and a clipboard. Explain they will be using interval sampling during the activity. With interval sampling, they will not write down everything they observe about the animal, but instead will record what behaviors they observe at selected time intervals (see page 6 for more information). The ethogram data sheet will guide them in what behaviors to look for and record.

You can now take participants to the study site (school yard, park or zoo) and ask them to identify their focus animal. More than one participant can observe the same animal as long as they are not lumped too closely together. Before using their data sheets, allow participants some time to simply observe the animal and discuss what they see with a peer.

Discussion topics can include:

- What can you tell me about the animal's appearance and behavior?
- What do you think the animal might do next?
- What have you learned by watching the animal?
- What do you think will be the most common behavior for this animal?
- What do you think would be the least common behavior for this animal?

Participants will now focus on collecting their data. Either provide participants with a stopwatch or serve as the time keeper, announcing each interval "time" to facilitate data recording. Encourage participants to remain quiet throughout the entire length of the observation. Loud noises may affect animal behavior.



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FIND OUT MORE

EthoSearch Website

Participants may have selected species for which an ethogram has not been included in this guide. By visiting www.ethograms.org, you can have access to ethograms for all types of species that have been created by scientists and used in actual research. Some of them might be a little too complex for younger participants, but you can easily modify them to meet your own needs. There are also additional participant-friendly ethograms created for use by teachers on the site.

After data is collected, encourage discussion about what participants observed. Suggested discussion questions include:

- What behavior occurred most often? Is this different from what was predicted?
- What behavior occurred least? Is this different from what was predicted?
- What conclusion can be made about the animal's behavior from your observations?

Modification for Younger Participants

A modified data sheet will be appropriate for younger learners. Several behaviors can be combined so there are fewer categories to identify. Intervals may be increased to 30 seconds to allow more time to write.

Extension

Challenge participants to create their own ethograms for a pet or other local species. They can determine which behaviors to include based on their own observations. They can then group these behaviors into 3-5 commonly observed categories.



Ethogram and Observation Data Sheet: Bird

Researcher _____

Self-Preening

The bird is manipulating its own feathers with its beak, stretching, or any other maintenance behavior, including sunning.

Feeding

The bird is foraging (looking) for or consuming food items.

Manipulate Object

The bird is moving any object in its beak or toes, such as wood, rock or perch.

Vocalizing

The subject is vocalizing and not performing any other active behavior simultaneously.

Locomotion

The bird is performing any locomotor behavior such as walking, flying, pacing, hopping, running or jumping.

Resting

The bird is inactive, possibly lying down or perched. No other behavior is occurring. Eyes may be open or shut.

Not Visible

The bird is off exhibit or you cannot see the bird you were observing.

Other

You see a behavior other than the ones described above.

Ethograms that are part of this activity guide have been modified and condensed in order to be more developmentally appropriate for participants.

Time	Self-Preening	Feeding	Manip. Object	Vocalizing	Locomotion	Resting	Not Visible	Other
0:15								
0:30								
0:45								
1:00								
1:15								
1:30								
1:45								
2:00								
2:15								
2:30								
2:45								
3:00								
3:15								
3:30								
3:45								
4:00								
4:15								
4:30								
4:45								
5:00								
Total								

Notes

Ethogram and Observation Data Sheet:

Researcher _____

 (species)

Feeding

The animal is eating food or drinking water. This includes chewing the food.

Social

The animal is engaging in a friendly interaction with another animal.

Self-Groom

The animal is engaging in grooming or other self-care activity.

Active

This is a behavior that the animal does on its own, such as running, playing, flying, walking or climbing.

Inactive

This is when the animal is sleeping, relaxing, or just sitting still not doing any other behavior.

Not Visible

The animal is off exhibit or you cannot see the animal you were observing.

Other

You see a behavior other than the ones described above.

Ethograms that are part of this curriculum guide have been modified and condensed in order to be more developmentally appropriate for participants.

Time	Feeding	Social	Self-Groom	Active	Inactive	Not Visible	Other
0:15							
0:30							
0:45							
1:00							
1:15							
1:30							
1:45							
2:00							
2:15							
2:30							
2:45							
3:00							
3:15							
3:30							
3:45							
4:00							
4:15							
4:30							
4:45							
5:00							
Total							

Notes

Conducting Field Research

Now that participants have practiced basic research skills, it's time to apply them to an original research project. Allowing participants the opportunity to select original research questions and actively explore these topics of interest parallels the work of practicing scientists and provides an authentic view into the research process.

This next section outlines two types of research projects for you to conduct with your participants. Each allows participants to identify areas of personal interest on which to focus their explorations but has a standard procedure for easy implementation.



Facilitating Participant Research Projects

1. Guide participants in selecting appropriate research questions. Topics that are broad enough to retain participant interest, but focused enough for them to demonstrate success, should be the goal.
2. Support participants in creating an action plan for the research process. Timelines and benchmarks will ensure participants complete their project in the allotted time frame and stay organized throughout the process.
3. Provide sufficient time for observations and data analysis. Flexible and frequent observations are critical to collecting quality data.
4. Highlight aspects of the research that tie to other topics, such as math and language arts. This reinforces how the science process relies on skills in all academic areas.
5. Demonstrate project authenticity by making connections between participant research and research conducted in your community or your institution.



Activity 2: Behavioral Research Study

Activity Overview

Before starting this activity, ensure participants have completed Activity 1. It will be important for them to be comfortable using an ethogram before initiating an ethogram-based research study. This activity will allow participants to select a research focus of their choice: either comparing the behavior of two different species or observing the behavior of a single species over time.

Objective

Participants will utilize an ethogram to conduct an original study of animal behavior.

Materials

- Ethogram and Observation Data Sheets (page 9 and 10)
- Activity Budget Template (page 14)
- Access to a park, schoolyard, or nature center/reserve
- Pencils
- Clipboards
- Field journal

Inquiry Connections

- Making observations
- Posing questions
- Examining books and other information sources
- Using tools to gather and analyze data
- Proposing answers, explanations, and predictions
- Communicating results

Procedure

During this project, participants will focus on behavior of one or two species found in the area surrounding their school or home. In preparation for the project, allow participants time to take some general observations of the study site in which they will conduct their observations. Participants should record their observations in their field journals, noting general facts about the environment as well as the types of species they see.

Once participants gain familiarity with the animal populations that live in the area, have them select a focus species for their study.

Help participants learn a little more about their species by connecting them with books, information from reliable websites, or other content sources. After participants have learned a little about the behavior of their selected species, have them identify a behavior-related research question. Examples might include:

- Does the season affect squirrel behavior?
- Does a male or female sparrow spend more time being active?
- How does a rabbit spend most of its time?
- Is a squirrel more active than a pigeon?

Be sure to set aside time to review each participant’s research question before the data collection process. As discussed in the tips on page 11, an appropriate scope to the project is critical. In addition, ensure the research question is measurable and objective such as the examples above.

After review of their research question, but before beginning to collect data, have participants record their predictions in a field journal. Review the sample observation they conducted as part of Activity 1 including the process of interval sampling and the role of an ethogram.

Depending on the species participants select, you can provide them with copies of the bird ethogram on page 9 or a copy of a species-neutral ethogram on page 10. You may also want to create your own species-specific ethogram (see Find Out More on page 8). Provide each individual participant or participant group with a clipboard and stopwatch, and set aside several observation sessions for data collection.

After several observations have been completed, allow participants time to analyze their data. A sample data analysis template has been provided to help with this process. After participants have identified which behaviors were observed most frequently, encourage them to draw conclusions from these observations. Encourage them to address:

- How these results were similar to or different from their predictions
- What these results might tell them about the species
- What other questions might be interesting to explore
- What limitations there are to their observations



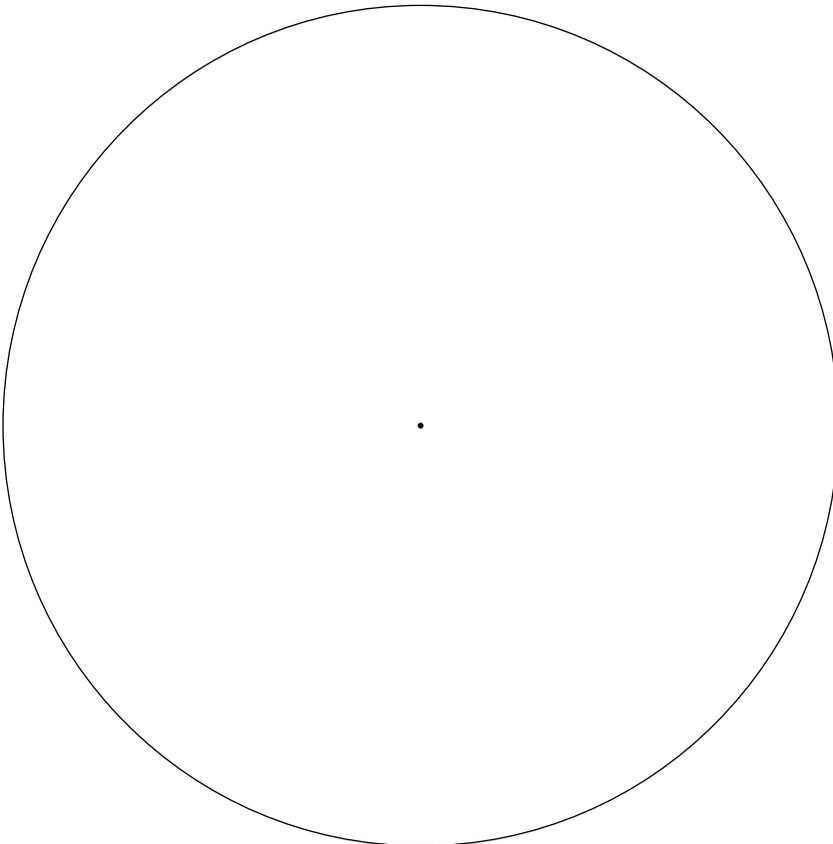
Activity Budget:

Researcher _____

(species)

Behavior	Percentage of Observed Time (Observation 1)	Percentage of Observed Time (Observation 2)	Percentage of Observed Time (Observation 3)	Average Percentage
Feed				
Social				
Self-Groom				
Active				
Inactive				
Not Visible				
Other				

Using the circle below, create a rough estimate pie chart summarizing your data. Be sure to label each section.





Disseminating Discoveries

One of the most important parts of conducting research is sharing the results of this work. This can help other scientists and the public better understand the world in which we live. Some scientists may present their findings at a professional conference or write articles for scientific journals. Others may incorporate their discoveries into a new museum exhibit or even a children's book. You might see a scientist on a television show or conducting a radio interview. There are as many ways to share scientific discoveries as there are to make them!

Activity 3: Participants Sharing Research Results

Activity Overview

Once participants have completed their original research activity, it's important to provide them with the opportunity to share what they have discovered. This replicates the work of practicing scientists and reinforces information learned.

Objective

Participants will disseminate their research findings among their peers.

Inquiry Connections

- Using tools to gather, analyze and interpret data
- Proposing answers, explanations and predictions
- Communicating results

Procedure

Once participants have completed their research projects, inform the participants that they are going to have the opportunity to present what they have learned to others. You may decide to allow them to select their dissemination method, or you may assign the format. Some participants may select multiple methods of dissemination. Suggested options include:

- Posters to be displayed on school grounds
- Written research reports that can be bound and displayed in the school library or classroom
- Culminating event such as a science celebration or classroom museum

- Website or multimedia project
- Oral presentations for small or large groups
- Children's books

Whatever the method of dissemination, you will want to require key elements to ensure the project is comprehensive. These might include:

- Title for the research project
- "Researcher" (child) name
- Research question
- Predictions
- Information about animals that were observed
- Procedure used by participants
- Summary discussion of the data
- Conclusions

Encourage participants to be creative and provide them with all necessary materials to be successful such as art supplies, pictures, display boards or access to a computer. Varying the project type to support younger participants or participants with special needs will ensure success for all learners.



Connecting with Families

There are many locations where people can conduct research. All of the activities in this guide can easily be amended to implement at home. You may want to send a blank notebook home with each participant to serve as a field journal. On the inside cover, you can provide suggestions for observations and activity prompts by using a template like the one below.



Research at Home

Use your field journal to record observations and discoveries. Here are sample topics to get your started:

- Observe what time of day domestic animals are most active
- Compare behavior of dogs and cats
- Observe how squirrels use different areas of their environment
- Compare behavior of different types of wild birds