SCIENTIFIC INVESTIGATION!

Teacher's Guide

Subject: Life Science
Topic: Scientific Investigation

Summary:
When students think of scientific investigation, they think mostly of experiments. During this activity students will explore other forms of scientific investigation and begin to build a broader tool box of processes that can support or bring about scientific knowledge.

Objective(s):
After completing the field lab, students will be able to:

1) Identify another form of scientific investigation: scientific observation.
2) Understand and analyze the difference between an experiment and observation - two forms of scientific investigation.
3) Examine a scientific situation and determine the most appropriate form of investigation to obtain the necessary results.

Ecosystem(s):
Dependent upon the state park being visited.

Equipment:
Clip boards, pens, chart paper, markers, Student Data Sheet

Background:

- Vocabulary: scientific investigation, science observation, science experiment, hypothesis, independent variables, dependent variables and control groups
- Reference Material: ***www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml***
  www.batesville.k12.in.us/physics/phynet/aboutscience/Observation.html
  www.hospiweb.scotcit.ac.uk/lectures/observat.shtml
  www.mcli.dist.maricopa.edu/proj/res_meth/rmvl/natobs_desc.html
- Equipment Training: Scientific observational methods – as compared to scientific experimental methods - should be reviewed with the student prior to start of this lesson.

Procedure (Engage, Explore, Explain):

1) Ask students to brainstorm various things a field scientist may study at a state park and why those studies may be important.
2) List all ideas on chart paper. Then explain to students the difference between an experiment (must involve the identification and control of variables) and data collection for scientific observation.
3) Create a T-Chart.
4) Place students in groups of 5 and ask them to take the list of ideas on the chart paper and categorize them on the T-chart as things studied by science experiment or things studied by scientific observation.
5) Ask students to think about whether one method used to derive scientific knowledge may be better suited to a particular situation than another.

6) Set up the activity:
   - Announce to your students that they will take on the task of gathering observational field data similar to those collected by District/Park Biologists.
   - Explain that, unfortunately, the odds of a large group of teenagers seeing animals are slim to none and ask them why (due to general noise).
   - Conclude that the animal species that will be studied is the humans at the park.
   - Explain that we will collect the data by observing the visitors at the park and, utilizing the key displayed below, we will translate that data to represent the long-tailed weasel population in Florida at the state park.
7) Hand out 30 Student Data Sheets per group of 5 students.
8) Review with your students the data sheets and explain nonbiased observations.
9) Place students into small groups.
10) Describe the locations of the observations. (This is a great place to utilize chaperones who have attended the trip with you.) Possible locations are campground, bathrooms, picnic area, playground, museum, visitor center, and trail head.
11) Review with your students the need for courtesy, respect for the people who will be part of their data collection.
12) Set a time frame of thirty minutes. Agree to reconvene at a central location.
13) Conduct the data collection. Each observation of a subject person should be recorded on a separate data sheet.

The following can be accomplished at the state park or at school:

14) Using the following key, summarize an individual group's observational data. Total up the individual data sheets and place data in the appropriate box. Utilizing the key, correlate each data category with one that would be collected by a professional biologist. Be sure students understand that you will use the data collected to represent the characteristics of a long-tailed weasel population as though that was the species observed.

KEY & GROUP SUMMARY:

TOTAL NUMBER OF PEOPLE OBSERVED:

Sleeve Length (=) Tail Length	None	Short Sleeve	3/4-Length Sleeve	Long Sleeve
	1-2 inches	2-3 inches	3-4 inches	> 4 inches
Shoes (=) Weight	Sandals	Flip-Flops	Tennis Shoes	Boots
	1-1.3 oz	1.3-2 oz	2-2.3 oz	2.3-3 oz
Height (=) Height of the weasel	Tall (more than 5 feet)		Short (5 feet or less)	
	Taller than 3 inches		3 inches or shorter	
Pants Length (=) Body Length (exclude tail)	Shorts	Capri		Long
	1-2 inches	2-3 inches		3-4 inches

15) Have each individual group analyze its data. Discuss what the data could mean. Allow students the opportunity to share their opinions and thoughts during this part of the process.. Guide the students through discussing the following: How many total "animals" were in the population you observed? Describe the smallest animals by weight, height and body length. What was the total number of small weasels observed? What are the total numbers of short-tailed, animals? Describe the biggest animals by weight, height and body length. What was the total number of the longest-tailed weasels observed? Is there a group that falls in the middle? How many different ways can you describe the population from your data?
16) After gathering all 5-member groups into one large group, have students share their observations. Display the summarized data set on a large piece of chart paper.
17) Now, in the large group, discuss the students' data. Compare populations: In which locations were the largest population numbers observed? In which locations were the smallest populations found? What location had the largest number of big weasels (by weight, height and body length)? What could that mean in terms of the size of the animal? Food supply? Any other factors? How many different ways can you compare the populations?
18) From the data that was collected, the students may still have questions about the weasel. Have the students set up a hypothetical, lab science experiment that could serve to answer a question. For example, is weasel body weight related to its diet? Create a hypothesis about that question, and describe an experiment that could be used to test the hypothesis about the weasel. Remember to include the independent variables, dependent variables and control group that you will be utilizing.

Sunshine State Standards:
Science: SC.7.N.1.3
Language Arts:
Mathematics:
Social Studies:

Student Data Sheet

Full Name: _____ Date: _____

School (teacher): _____ Time: _____

Location: _____ Observation #: _____

Utilizing the chart, below, record observations of each individual.
Place a check in each box, based on the what you see.

Sleeve Length	**None**	**Short Sleeve**	**3/4 Length Sleeve**	**Long Sleeve**
Shoes	**Sandals**	**Flip Flops**	**Tennis Shoes**	**Boots**
Height	**Tall (>5 feet)**		**Short (<5 feet)**	
Pants Length	**Shorts**	**Capri**	**Long**	

Assessment:

Use the following rubric to score the below the writing prompt:

	0	1	2	3
Hypothesis	None was presented.	Hypothesis was stated, but not in question format.	Hypothesis was stated.	A strong and relevant hypothesis was stated and was placed in question form.
Independent Variables/ Dependent Variables	No variables were identified.	1 variable was identified.	2 variables were identified.	3 or more variables were noted. Both independent and dependent variables were identified.
Control Group	No control group was identified.	Student made reference to control group but was not clear on the exact group.	Student has a thoughtful control group identified but is not obtainable.	Student has a thoughtful control group identified that is obtainable and measureable.
Overall Proposed Experiment	Experiment has no validity.	Proposed experiment was on topic but did not have a strong basis.	Proposed experiment is on topic with all appropriate pieces.	Proposed experiment is on topic, easy to follow, has validity and it addresses testing the hypothesis.

Portfolio Journal

Portfolio Journal Prompt:

From the data that was collected the students may still have questions about the weasel. Have the students set up a hypothetical, lab science experiment that could serve to answer a question. (For example, is weasel body weight related to its diet?) Create a hypothesis about that question, and describe an experiment that could be used to test the hypothesis about the weasel. Remember to include the independent variables, dependent variables and control group that you will be utilizing.