The Science Behind Algonquin's Animals

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How Much Wood Could A Woodpecker Peck?

Grades: 7-10
Subject: science
Skills: observation, data collection, analysis, graphing
Duration: 60-120 minutes plus allotted time to complete experiment
Vocabulary: experiment, variable, hypothesis

Objectives:

Students will be able to: 1) create a scientific question.
2) design and carry out an experiment.

Method:

Students work through the process of designing a scientific question and create and carry out an experiment to answer that question.

Background:

Wildlife researchers and biologists ask a lot of questions about how plants and animals interact with their environment and try to find significant patterns to help answer these questions. Students need to understand that scientific research is not a magical process, but one in which systematic steps are taken to answer questions.

The first step that researchers must do to prior doing any research is to ask questions about their research subject and then design experiments to answer those questions. Formulating a question that can be answered by carrying out an experiment can be fairly difficult.

There are certain steps which wildlife researchers use to find answers to their own questions. The scientific method is the 'tool' that researchers use to find answers to questions. It is the process of thinking through the possible solutions to a problem and testing each possibility to find the best

solution. The following steps describe the scientific method which researchers use in answering their own questions:

- **Observe** natural processes until they think they see a **pattern** in the events they are observing.
- Define **questions** to investigate based on their observations. These questions often arise from findings of earlier research.
- Develop **hypotheses** (testable guesses) to try to answer their questions.
- Systematically **collect** and then **analyze** information (**data**) to test the hypotheses in an experiment. The experiment will have three variables, independent, dependent and controlled.
- Look at **results** then come to **conclusions** about whether their hypotheses are correct (supported or not supported). Often they ask even more **questions** based on what they have observed.

Materials:

✓	Items Required	Quantity
	elevated large bird feeder or feeding platform	one
	bird feed (different types)	enough for study
	suet	enough for study
	bird identification book	one
	binoculars (optional)	several pairs
	graph paper	one per student

Procedure:

1) In developing a research question students often develop questions that are too vague, making them difficult and often impossible to answer. The questions can often be modified so they are more specific and allow the students to devise a practical experiment to answer their question.

2) The first step to take in helping students to formulate a good question is to ask them to brainstorm questions they have about birds. Have the students create a list of questions about birds and lists these on the blackboard or overhead.
3) When a good list of questions has been compiled, have the students look over the questions and think about them and to put them into two categories. Category 1: 'Look it up.', Category 2: 'Experiment'.
4) Category 1: 'Look it up', are questions that can be answered by researching the information in books, articles, or the internet. For example, if one of the questions asked was "Why do birds migrate?", the answer can be found in the book, "***1001 Questions Answered About Birds***".
5) Category 2: 'Experiment', are questions that can be answered by designing and carrying out an experiment. For example, questions such as "What do birds eat?" and "What kind of birds like to live in Black Spruce forests?" are questions that students can modify to make them more specific in order to create a research experiment.
6) Have the class use the question "What do birds eat?" and transform it into a more definitive question in order to design an experiment. Encourage the students to use their own knowledge of birds to come up with questions and to design an experiment.
7) The question "What do birds eat?" is too vague in order to design an effective experiment. Instruct the students that they need to modify the question so that they can carry out an experiment. If students are having trouble modifying the question ask them some leading questions to get them started:
    - Do we mean all birds?
    - What birds are we talking about then? (should get responses like birds at the park, birds at the zoo, birds at a feeder, etc.)
    - What have you seen these birds eat?
    - What birds would be easiest to study? (feeder birds, something the student can easily access without leaving the classroom or school)
    - What food would we be studying then?
    - What type of bird food?

8) At this point it should become evident to students that they can not study all birds and all the different food sources. They should narrow down the selection to birds they see at bird feeders and to the food that birds are provided.
9) At this point have students brainstorm a new question based on the birds they want to study and the type of food that the birds will be provided. The question should be more defined than "What food do birds eat?". It should have components dealing with types of seed and feeder birds, e.g. "What types of seed do feeder birds eat?"
10) Once the students have decided upon a question they now need to design an experiment. In designing the experiment to answer the question there will be many variables that must be considered. These may include: what type of seed to use, type of feeder, height of feeder, how to count birds, influence of weather, and time of day. Each of these protocols, and any others the students come up with, should be discussed and debated.
11) Each class or group that starts with the question "What do birds eat?" will formulate different questions and design different experiments. This lesson is to be undefined and has no correct answer. If the procedure is successful, the class's experiment will provide an answer to the question. A student who can accomplish this procedure is on the way to becoming a researcher.

Variations:

Once students have an understanding of how to formulate a question and create and experiment to answer that question pick another question from the initial list and have the class as a whole revise the question. Once the question is revised divide the class into small groups. Have each group create an experiment based on the same question. This is to demonstrate to students that there can be several different ways to answer one scientific question. Have each group conduct their experiment and compare results at the conclusion of each, to determine how much variation exist between each method.

Extensions:

1) Have students observe the different beak types of different and research the function of each and compare this to food selection.
2) As students become more familiar and experienced with a subject their questions become more interesting and focused. After they have completed their initial experiment, have them brainstorm new questions. With the new list of questions have them repeat the process of revising a question and creating a new experiment.

Evaluation:

Ask the students to:

1) Graph the results of their experiment.
2) Revise a question from the list of experiment questions or create a new question not on the list.
3) Create an experiment from the revised question they have formulated.