Introduction to the Scientific Method and Writing Hypotheses

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Learning Goal

Learn about the scientific process, recognize the presence and impact of science on daily life, and how to make and write testable hypotheses.

Students’ Learning Objectives

- To understand the importance of the scientific method to increasing knowledge and understanding of the world around us and ourselves
- To learn about the key steps in the scientific method
- To recognize that the scientific method is cyclical
- To learn how observations, evidence, and scientific hypotheses contribute to the scientific method
- To learn what makes a hypothesis testable
- To learn how to write hypotheses based on observations
- To recognize invalid hypotheses

Target Grade: 10th Grade biology or integrated science

State Standards

H.3.S.1 Based on observations and science principles, formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.
H.3.S.4 Identify examples from the history of science that illustrate modification of scientific knowledge in light of challenges to prevailing explanations.
H.4.D.6 Evaluate ways that ethics, public opinion, and government policy influence the work of engineers and scientists, and how the results of their work impact human society and the environment.

**Unit Summary**

This unit will introduce a guest scientist to the classroom for the rest of the year. As part of explaining what he/she does and why, he/she will introduce the steps of the scientific method, using examples from his/her own research. This introduction will be brief as students at this level are likely to be familiar with the scientific process and will emphasize the cyclical nature of the process. Students will have the opportunity to explore science at work in the world around them through a sharing exercise. Students will also learn how observations are used to develop hypotheses, what makes a hypothesis “good” versus “bad,” and how to develop valid, testable hypotheses.

**Required Knowledge/Skills**
Students should already be familiar with the basic steps of the scientific method.

**Activity Plan**
This activity is designed to be completed in one 60 minute class period. Additional activities could be added for use in a 75-80 minute class period. The first part is an introduction to the scientific process. The second part is the development of testable hypotheses.

**Part I**

**Scaffolding – Scientific Method**
The guest scientist will introduce the scientific method, using current research to provide examples. The cyclical nature of the process and the use of observations to develop hypotheses will be emphasized. A short question and answer session will be used to encourage students to recognize the roll of science in everyday life.

**Activity**

**Materials needed**
Newspapers or magazines (be sure to preview them to make sure that they have science relevant stories).

**Method**
1. Have the students work in small groups. Each group should have access to a couple of newspapers and magazines. A combination of local, national, and global news is best. Each group should try to identify as many science relevant stories as possible.
2. After locating articles, have students make a list of science topics addressed in current events. Discuss a few of these topics as a larger group.

Part II

Scaffolding – Hypothesis Writing
The guest scientist will explain how the important features of a scientific hypothesis. The if/then/because formula will be introduced. Examples of good and bad hypotheses will be presented. Call students’ attention to the fact that even “good” hypotheses can disproved and that this is the most basic nature of the scientific process.

Activities

Materials Needed
LISELL Lesson Starter – Coordinating Hypothesis, Observation and Evidence

Method
As a large group, prepare 2-3 hypotheses based on provided observations. Use examples from LISELL Lesson Starter. Be sure that students understand the process of writing a hypothesis and why a hypothesis must be testable.

Have the students break into the small groups used in Part I. Each group should do 2-3 more examples from the LISELL Lesson Starter. During this process the teacher and scientist should walk around the room and make sure that students are developing testable hypotheses.

Alternative
Instead of using the LISELL Lesson Starter examples, students can identify hypotheses from the scientific literature using articles provided by the teacher or guest scientist. Care should be used to select scientific literature with little jargon and technical discussion. Have students re-write the hypotheses in the literature using the if/then/because template.

Possible extension
If students successfully master the LISELL Lesson Start examples, each group should attempt to identify a testable hypothesis in 1-2 of the science related articles from Part I. Students should write the hypotheses using the if/then/because template.

Credits
LISELL Lesson Starter was retrieved on 17 August 2014 from http://www.ncela.us/files/uploads/43/2LessonStartersHypothesisObservationEvidence.pdf