



## *Natural Inquirer* Scientific Process Module



### **Unit 2: Lesson 3: Designing the Experiment and Answering the Question**

**Background:** This part of the scientific process involves designing and implementing data collection, analyzing data, and reporting the findings. This hands-on part of the scientific process is the part most often engaged in by students. As you can see, this part of the scientific process is just that: a part of the process. A successful science project should include all of the parts, even if they are truncated because of time or other resource constraints. Data collection and analysis are the parts of the scientific process that are the most fun for students, educators, and scientists!

Some of the things scientists consider when designing data collection are:

1. How can I measure and record the quality that I am interested in? (For quantitative studies only.)
2. How can I maintain consistency in data collection?
3. How can I account for outside influences, such as time of day or year, environmental variations, etc.?
4. How will I summarize and compare the data?

Scientists collect data through observation, asking questions (in social sciences), and the use of technology. Sometimes the scientific process involves setting up experiments and sometimes it involves observing and recording what happens naturally. The research presented in the *Natural Inquirer* involves both experimental designs and non-experimental designs. Environmental scientists sometimes use a laboratory to set up their experiments, but often experiments are set up in the outdoor environment.

It is important for scientific data to be accurately collected and recorded, and for scientists to maintain their honesty and integrity throughout the process of data collection and analysis.

Once data are collected and recorded, they are entered into a computer program for analysis. Analysis serves one or two purposes: To summarize and/or compare the data. It is important to emphasize that computer programs do not “do” the analysis. Scientists do the analysis using computers and other technologies as tools.

After the data have been summarized and/or compared, the findings must be presented for the review of other scientists (and eventually for the users of the findings, such as doctors, environmental managers, or the public). Scientists use charts, graphs, maps, figures, and text to

present their findings. At a minimum, a research paper includes the sections presented in the *Natural Inquirer* articles: Introduction, Method, Findings, and Implications. We will cover “Implications” in a subsequent lesson.

**Objectives:**

- Students will be able to read and explain information from a science article.
- Students will be able to describe at least two different methods for studying a scientific problem.
- Students will be able to design their own way to solve scientific problems.
- Students will be able to explain the importance of accurately recording information and making good observations.

**Time:** 3 class periods

**Materials:**

- *Natural Inquirer* journals
- *Natural Inquirer* reading guide
- Notebooks
- Pencils

**Procedure:**

1. Assign students to groups of 3 or 4 students and assign the group an article from the journal.
2. Ask each group to read their assigned article paying particular attention to the Methods section in each article and ask the students to fill out the reading guide as they go.
3. After the groups have finished reading and filling out the reading guide, ask each group to present a brief synopsis of the question that the scientists answered and how they went about answering the question.
4. Ask students to fill in the reading guide as the other groups report about the different articles.
5. After the short presentations, discuss similarities and differences among the different articles as a whole class.
6. After the class discussion, either ask the groups to think of a science problem or provide the groups with a problem and ask them to think of a way to test the problem. Note: Students may want to use ideas from previous lessons so they may need to use their portfolios.
7. Ask the students to write up their question and proposed way of testing it.
8. Share different student ideas and discuss ways to design experiments. This is a good opportunity to talk about different types of science including social science.

**Assessment:**

The reading guide and the students’ proposals for testing a problem can be used as formal assessments. When completed, these items should be placed in the students’ scientific process portfolios. Additionally, class discussion and participation can be used as an informal assessment.

**Modifications:**

Students that have trouble reading can be paired with a reading buddy. Students who would like an extra challenge can read two articles and make comparisons between the two articles.

**Extra Resources:**

*Natural Inquirer* Web Site

<http://www.naturalinquirer.usda.gov>