Lesson: Exploring a Topic with the Scientific Method

Objectives (Key concepts, skills and knowledge)
- Explains the scientific method as a step-by-step method for creating, testing, and reporting scientific hypotheses
- Develops a question that can be tested
- Defines “variable.”

Common Core State Standards
Writing 2, 4, 7, 10
Speaking and Listening 1

Evidence of Student Success
- Understands the steps of the scientific method
- Participates in experiment using the scientific method

Preparation
- Read Lesson.
- Make overheads (or charts) of the following handouts: Scientific Method Handout, Planning an Investigation. (Determine if you would also like your students to have copies of these as handouts. If so, make one copy per student).
- Your class will need a question to drive your scientific method experiment. Ideally, your class will participate in creating the question. However, if you are limited on time, you may determine the topic-based question that your class will research ahead of time. Come up with one on your own or use the chart below to find a question and related experiment.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Related Web References Providing Experiment Ideas</th>
</tr>
</thead>
</table>
| Weather | [http://www.weatherwizkids.com/WxExperiments.htm](http://www.weatherwizkids.com/WxExperiments.htm)  
36 weather experiments done with easy to find materials  
[http://www.srh.noaa.gov/epz/kids/experiments.shtml](http://www.srh.noaa.gov/epz/kids/experiments.shtml)  
Weather experiments for kids proposed by the national weather service |
| Plants  | [http://mgonline.com/experimentsforkids.html](http://mgonline.com/experimentsforkids.html)  
5 simple plant experiments each written to answer a specific question [http://www.julianrubin.com/plantprojects.html](http://www.julianrubin.com/plantprojects.html)  
Many experiments classified under narrowed down botany topics such as |
Decide if you would like to use the Writing A Hypothesis Worksheet to guide your students in writing a hypothesis. If you’d like to use it, make a copy for each student.

1. Overview of Scientific Method 5 minutes

Tell your students that scientists use a process called the scientific method to carry out experiments as they study our world. Point to your chart showing the steps of the scientific method—and briefly explain each step.

**Step One: Ask A Question**
Ask a Question: What do you wonder about? To start the scientific method, you form a question that focuses on what you’d like to find out. Your question should be testable, specific and clear. Your question should also have independent and dependent variables.

**Step Two: Develop a Hypothesis**
The next step is to think about what you already know and get more information about your question. Then, you write a sentence that tells what you think the answer to your question will be. Lots of times people write their prediction by saying, “If ______ happens, then _________ will happen.

**Step Three: Design an Experiment**
In the third step you ask, “How can I test my hypothesis?” You create an experiment - a series of actions - that you will follow to find out if your hypothesis is right.

**Step Four: Collect Data**
Next you do your experiment! As you are doing your experiment, you need to keep track of what’s happening! Make sure you’re writing down what you see happening in your experiment in your Writer’s Notebook. Observe with your senses. You can write observations in the form of words, charts, graphs –
any method that best fits the information that you are collecting.

**Step Five: Draw Conclusions**
After your experiment is completed, you look back at your data and ask yourself, “What does all that data mean?” Then you figure it out. Think about what it tells you about your question. Write down what it tells you.

**Step Six: Communicate Results**
Scientists always share their results with others. Ask yourself, “Who else needs to know what I found out?” It’s important to share what you learn when you’re doing research! Write down your findings in a scientific report so that others can learn from you.

**Step Seven: Plan Further Inquiry (Pose New Questions)**
The final step in the process is to ask yourself, “What else can be done?” Think about what other experiments you (or others) could do to continue to research your question.

---

**2. Conduct an Experiment Using the Scientific Method**  
**Time will vary**

Explain that students will be actively participating in the scientific method today as you research your topic! Explain that you will be progressing through each of the steps to learn more about (plants, weather or natural disasters).

**Ask a Question:** At this point, you should share the question that you’ve chosen or create a question together.

**Develop a Hypothesis:** Review the definition of “hypothesis” with your students. (A prediction that can be tested to see if it is true or not.) Explain to students that their hypothesis should answer the class’ question written in the first step! Tell them that they are each going to formulate a hypothesis. Before students write a hypothesis, they need to make sure they understand the question that your class has developed (or that they have written independently). Then, they write the hypothesis, or their prediction, in response to that question. Important points to make:

- A hypothesis is NOT just a random guess, it’s based on background knowledge and a review of accepted facts followed by critical thinking.
- A hypothesis needs to explain specific changes. If A is changed, then B will happen. You may
want to introduce students to the If _____________, then _______________ format to make sure their hypothesis meets this criteria. However, be sure to point out that all hypotheses do not have to be in this format.

- A hypothesis should be as specific as possible. (Share the hypothesis example that focuses on specificity at http://www.sciencekidsathome.com/science_fair/what-is-a-hypothesis.html#more.)
- Before a hypothesis is written, students need to consider their own background knowledge about the question and use their In2Books science texts to look for any additional information that will help them in forming a hypothesis.

If you’ve decided to use the Writing A Hypothesis Worksheet, model how to use it and then distribute it at this time. Guide students through completing the worksheet to each create their own hypothesis. If you are not using the worksheet, use your own method to guide students in writing a hypothesis, or write one together as a class.

**Design an Experiment:** Show students the Planning an Investigation overhead. Guide students through the process of planning an investigation to test a hypothesis. Based on your time and resources choose one of the following methods: Discuss the students hypotheses and through class discussion come up with one class hypothesis that is specific, clear and reasonable. Plan an investigation together that tests this hypothesis. Divide students into small groups. Allow them to share their hypotheses and choose one (or mix theirs to form a group hypothesis) to be the groups’ hypothesis. Allow the group to plan an investigation together. Allow individual students to plan individual investigations using their own worksheets to match their individual hypotheses. Based on how you choose to proceed, the next four steps will either be completed as a whole class, as groups or as individuals. You may need to complete the next four steps during another session if you need time to gather necessary materials and review individual or group plans.

**Collect Data:** Next do the experiment(s) planned in the previous step! Remind students that they need to keep track of what’s happening by collecting data! Refer to your data collection plan written during the previous step.

**Draw Conclusions:** After your class experiment(s) is/are completed, guide students in the process of drawing conclusions. Demonstrate for students how you look back at your data and ask yourself, “What does all that data mean?” Think about what it tells you about your question. Instruct students to make
notes in their Writer’s Notebooks on what conclusions they can draw from what they observed during their experiment. Students should address their question and explain whether or not their hypothesis was supported. Lead a class discussion after students record their thoughts to give them the opportunity to share their conclusions.

**Communicate Results:** Scientists always share their results with others. Explain to your students that in the next lesson you will be guiding them through the process of writing a science report. Even if you all did the experiment together, it’s still a valuable experience for each student to write his/her own science report.

**Plan Further Inquiry (Pose New Questions):** The final step in the process is to ask yourself, “What else can be done?” Think about what other experiments yourself (or others) could do to continue to research your question.

**Additional Resources**

Scientific Method

- Ask a Question
- Develop a Hypothesis
- Design an Experiment
- Collect Data
- Draw Conclusions
- Communicate Results
- Plan Further Inquiry (Pose New Questions)
<table>
<thead>
<tr>
<th><strong>Name</strong></th>
<th><strong>Planning an Investigation</strong></th>
</tr>
</thead>
</table>
| **INTRODUCTION**  
(Including your question and your hypothesis. Briefly explain your experiment.) | | |
| **MATERIALS**  
(List all of the materials you will need.) | | |
| **PROCEDURE**  
(What will you do? Write step-by-step directions.) | | |
| **DATA COLLECTION PLAN**  
(How will you collect data? What measurement results do you need? Will you use charts, graphs, photographs, sketches, observation notes…?) | | |
Writing a Hypothesis Worksheet

**STEP 1 STATE YOUR TOPIC**

The topic I am researching is ____________________.

Remember to:
Be specific! Don’t write a general topic like “weather.”
Narrow your focus: write “melting snow.”

**STEP 2 WRITE A QUESTION**

- Keep it simple. Make sure it interests you! Ask a specific question.

A question I would like to answer is ____________________.

**STEP 3 THINK ABOUT WHAT YOU ALREADY KNOW**

Write 3 important things you already know about this topic.

1. __________________________________
2. __________________________________
3. __________________________________

**STEP 4 FIND NEW INFORMATION**

Reread your In2Books Informational Book and read other resources to find other important information about your question.

1. __________________________________
2. __________________________________
3. __________________________________

**STEP 5 WRITE YOUR HYPOTHESIS**

- Predict the answer to your question. You may want to use the words: “If...then...”
- Be specific, clear and reasonable.

My hypothesis is: ____________________________________________

__________________________________________

__________________________________________