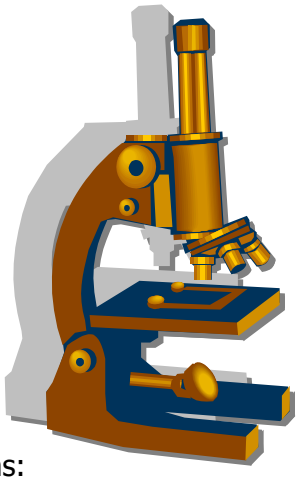
#9399
THE SCIENTIFIC METHOD



CLEARVUE/eav
2000
Grade Levels: 7-12
15 minutes
1 Instructional Graphic Enclosed

DESCRIPTION

Two teenagers apply the scientific method to solving everyday problems: explaining a burned-out light bulb and exploring the possibility of falling toast landing jelly-side down. Defines terms and offers other examples to demonstrate the scientific method in use.

ACADEMIC STANDARDS

Subject Area: Nature of Science

- Standard: Understands the nature of scientific inquiry
  - Benchmark: Knows that scientific inquiry includes evaluating results of scientific investigations, experiments, observations, theoretical and mathematical models, and explanations proposed by other scientists (e.g., reviewing experimental procedures, examining evidence, identifying faulty reasoning, identifying statements that go beyond the evidence, suggesting alternative explanations)

- Standard: Understands the scientific enterprise
  - Benchmark: Knows that throughout history, many scientific innovators have had difficulty breaking through accepted ideas of their time to reach conclusions that are now considered to be common knowledge

- Standard: Understands the nature of scientific knowledge
  - Benchmark: Knows that scientific explanations must meet certain criteria to be considered valid (e.g., they must be consistent with experimental and observational evidence about nature, make accurate predictions about systems being studied, be logical, respect the rules of evidence, be open to criticism, report methods and procedures, make a commitment to making knowledge public)

INSTRUCTIONAL GOALS

1. To identify the nine steps of the scientific method in order.
2. To understand the difference between "hypothesis" and "theory."
3. To list the three reasons to use scientific method.
4. To discuss the components of an experiment and how each affects its outcome.

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BEFORE SHOWING

Ask students to define *scientific method* and to identify some of the ways they use it in their daily lives. Can they name any specific steps they used? Ask them what kinds of experiments they have performed in the past and what sort of results they generated. Have they ever had to reconsider a hypothesis? Have they ever proven a hypothesis?

AFTER SHOWING

Discussion Items and Questions

1. How did the program's description of the scientific method compare with the students' definition(s)? What in the program most challenged their conception of what the scientific method is?
2. What are the nine steps of the scientific method? Ask students to define and give examples of each step. Is the order the steps are completed important? Why?
3. What is a *hypothesis*? What role does the equation "A causes B to C" play in forming a hypothesis? What is a *theory*? How do hypothesis and theory differ?
4. Name some popular theories that have been disproven or proven. Can students think of any theories that are currently being reviewed? How many times do they think a hypothesis should be tested before it becomes a theory? How many times do they think a theory should be tested before it is considered proven?
5. When do people use the scientific method? List the three reasons. Is it important to have results that can be reproduced? Why?
6. What is an *experiment*? What are the components of an experiment? What happens to the control group? Why is it important to have a control group? What happens to the experimental group? Why is it important to have an experimental group? What is an *independent variable*? How many independent variables can an experiment have? How does having too many independent variables affect the experiment?
7. Define *causal relationship*. Can students give examples of causal relationships? How does that definition affect the hypothesis? The outcome of the experiment?

Applications and Activities

Have students, working individually or in groups, use the scientific method to evaluate a problem of their own choosing, preferably a problem they deal with in their own life. Provide them with the handout as an aid in this activity. (See INSTRUCTIONAL GRAPHICS.) Have them document each stage of the process. How do they complete the equation "A causes B to C"? How will they design the experiment? What will be the independent variable of the experiment? Are they able to prove their hypothesis? Are there any other possible ways to explain the results of the experiment? Students can present their finding to the class for general discussion.

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RELATED RESOURCES

Captioned Media Program

- Conducting an Experiment (Revised Edition) #2367
- Learning How Scientists Work: Preparing a Successful Science Fair Project #3052
- Scientific Method #2521
- Scientific Method #9400

World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.

- **SCIENCE FAIR CENTRAL**

http://school.discovery.com/sciencefaircentral/

A comprehensive guide to creating your science fair project! Presents project ideas to help you get started, search the database for over 300 science fair questions, provides tip sheets for Astronomy, Biology, Chemistry, Earth Science, and Physical Science projects, check out science contest for students in grades 5 through 8, and more!

- **YOUR SCIENCE FAIR PROJECT RESOURCE GUIDE**

http://www.ipl.org/div/kidspace/projectguide/

Are you looking for some help with a science fair project? This Internet Public Library (IPL) site will guide you to a variety of helpful and specific Web site resources and will lead you through the necessary steps to successfully complete a science experiment. Text throughout has highlighted words to click on for explanation of specific vocabulary.

- **THE SCIENTIFIC METHOD**

http://biology.clc.uc.edu/courses/bio104/sci_meth.htm

Extensive explanation of steps that make up the scientific method. Provides several observation, hypothesis, and "conclusion" examples.

- **THE SCIENTIFIC METHOD**

http://www.biology4kids.com/files/studies_scimethod.html

The scientific method is the way scientists learn and study the world around them. It can be anything from a leaf, to a dog, to the entire universe. Provides a brief explanation of each step before moving on to the next stop on tour.

INSTRUCTIONAL GRAPHICS

- SCIENTIFIC METHOD HANDOUT

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Scientific Method Handout

1. **Observation.** By observing a problem, the next steps of the scientific method are set in motion. Example: The light is out.

2. **Questioning.** The observer asks why there is a problem, and what could be the cause of that problem. Example: Why is the light out?

3. **Hypothesis.** Questioning leads to forming a hypothesis, which is a theory explaining the problem that has not been tested. Example: The light is out because the power has gone out.

4. **Prediction.** Based on the hypothesis, a prediction is made as to what the hypothesis will mean. Example: All other lights are out, and the lights will come back on when the power does.

5. **Experiment.** In order to see if the hypothesis and prediction are correct, an experiment must be performed. Example: See if lights in the neighborhood are out.

6. **Analysis.** What were the results of the experiment? Example: The lights in the neighborhood are not out.

7. **Decision.** The results of the experiment did/did not confirm the prediction. Example: The light did not go out because the power went out.

8. **Repeat Step 3** (if necessary)**.** If the results of the experiment did not confirm the prediction, formulate a new hypothesis. Example: The light bulb burned out.

9. **Theory.** A theory is a hypothesis that holds true and explains the existing facts, while also predicting new ones. Example: The light bulb had burned out. When a light bulb burns out, it will no longer work.

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