THE SCIENCE OF FRINGE

EXPLORING: THE SCIENTIFIC METHOD

A SCIENCE OLYMPIAD THEMED LESSON PLAN
SEASON 2 - EPISODE 21: **NORTHWEST PASSAGE**

Overview:
Students will learn about the scientific method and how it can be used to collect data through experimentation and observation in order to formulate and test a hypothesis.

Grade Level: 9–12

Episode Summary:
Peter spends the night in a town in the state of Washington and finds out that a waitress he spoke with the night before was murdered. He believes Newton is trying to track him down and is responsible. As he works with the local sheriff to solve the murder, a deputy goes missing and another victim is found. Peter is able to localize the possible murder site by collecting data from the victims and the locations where their bodies were found. Using those results, Peter and Sheriff Mathis are able to solve the case.

Related Science Olympiad Event:
Experimental Design - Given a set of unknown objects, teams will design, conduct, analyze and write-up an experiment.

Learning Objectives:
Students will understand the following:

- The scientific method is a technique for investigating phenomena and acquiring new knowledge.
- A scientist typically proposes a hypothesis, and then designs experiments to test the hypothesis.
- Key facets of the scientific method are documentation and repeatability.

Episode Scenes of Relevance:

- Peter and Sheriff Mathis designing an experiment to measure the time of assault of the victims.
- Peter and Sheriff Mathis using the experimental results to calculate possible locations of the murderer.
- View the above scenes: http://www.fox.com/fringe/fringe-science

Online Resources:

- Fringe “Northwest Passage” full episode: http://www.fox.com/watch/fringe
- Science Olympiad Experimental Design event: http://soinc.org/exper_design_c
- Scientific Thinking and the Scientific Method: http://www.freeinquiry.com/intro-to-sci.html
- Scientific Methods, an online textbook: http://emotionalcompetency.com/sci/booktoc.html
- Using the Scientific Method: http://www.sciencemadesimple.com/scientific_method.html

Procedures:

1. Tell your students that they are going to learn about the scientific method and how it is used to design experiments in order to answer questions.
2. Have your students research the scientific method in resources such as science textbooks and websites and discuss what they have learned.
3. Divide your class into groups. Have each group complete the following activity:
    a. Materials: small coins of various denominations
    b. Tell the class that you think that flipped coins don't always have a 50:50 chance of landing on either side. You'd like them to use the scientific method to test this.
    c. Each group must first devise a specific hypothesis regarding why there might not be an even chance of either face ending up. Examples include:
        i. Edge design impacts the weight balance
        ii. Starting orientation of the coin is more likely due to full numbers of rotations
        iii. Flipping technique biases the outcome
        iv. The amount of artwork on each face makes one side heavier
    d. Next, come up with an experiment that can be conducted in the classroom to test this hypothesis.
    e. Conduct the experiment and record the data and results from it.
    f. Analyze the data from the experiment and interpret the results.
    g. Present the hypothesis, experimental data, and analysis to the rest of the class.
4. Discuss with the class the process they went through to follow the scientific method for this activity. Be sure to address:
    a. What form the hypotheses were expressed in.
    b. Whether or not the experiment was designed to account for other possible variables.
    c. Was the documentation each group provided sufficient for others to retest their hypothesis?
    d. Was enough data collected to reach a statistically significant conclusion?

Additional Discussion Suggestions:

- Can the data from the various groups be combined to address other hypotheses?
- If more sophisticated equipment were available, what other experiments could be designed?
- Can modeling or computer simulation be used in place of actual experimentation?
- What is the difference between inductive and deductive reasoning?

Extension to Other Subjects:

History: Many famous scientists have contributed to the development and adoption of the scientific method, including Aristotle, Galileo, and Newton. Over time, how has the method changed?

Physical Education: Sports teams often rely upon the scientific method during practices in order to develop gameplans. Discuss examples of this within your own school.

Social Studies: Review current science related stories in the news and discuss what the hypotheses and experiments involved are.

National Science Standards Alignment:

H.A.1 Abilities necessary to do scientific inquiry

a. Identify questions and concepts that guide scientific investigations.
b. Design and conduct scientific investigations.
c. Use technology and mathematics to improve investigations and communications.
d. Formulate and revise scientific explanations and models using logic and evidence.
e. Recognize and analyze alternative explanations and models.
f. Communicate and defend a scientific argument.