

Incorporating the Science of Emerging Pathogens in Secondary School Curricula Draft Proposal

Busy Beetles

**Paula Miller
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Abstract:

The action of this plan is designed to allow Biology 10 grade students in an environment of conducting Scientific Method on an article on how beetles destroys trees. The students will use the research article to analyze the scientific question, hypothesis, independent and dependent variable, and make a table using the information from the research-based article.

Students will also experience using Team Based Learning (TBL), to help the students be prepared for the lesson by using TBL ingenious Readiness Assurance Process. It will also teach the students how to apply the course concepts to solve interesting real-world problems. The action plan will take place in two 54 minute classes.

Rationale

This project will target 10th grade students in a Biology course, in which they must learn how to effectively use scientific method. Learning how to use the scientific method is used during the entire course of Biology and a requirement for the state of Florida. "Busy Beetles" will allow the students the opportunity to learn about the research study that was done on one way trees are being killed off. After reading the research-based article, conducted and written by Tony Vorster from Colorado State University Co-written with Yamina Pressler and Paul Evangelista, the students will learn how beetles bore their way through tree bark and introduces the blue stain fungi. In which is the blocking of the water movement. The students will read the article and apply the scientific method, to find the hypothesis and independent and dependent variable.

Description of teaching unit or module(s), including expected outcomes:

The unit Nature of Science is expected to be taught over a span of 9 days. However, two days will be utilized to focus on scientific method and using **TBL**.

- **SC.912.N.3.4:** Recognize that theories do not become laws, nor do laws become theories; theories are well supported explanations and laws are well supported descriptions.

- **SC.912.N.3.1:** Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer.
- **SC.912.N.1.2:** Describe and explain what characterizes science and its methods.
- **SC.912.N.4.1:** Explain how scientific knowledge and reasoning provide an empirically-based perspective to inform decision making.
- **SC.912.N.4.2:** Weigh the merits of alternative strategies for solving a specific societal problem by comparing a number of different costs and benefits, such as human, economic, and environmental.
- **SC.912.N.1.4:** Identify sources of information and assess their reliability according to the strict standards of scientific investigation.
- **SC.912.N.1.5:** Describe and provide examples of how similar investigations conducted in many parts of the world result in the same outcome.
- **SC.912.N.1.6:** Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.
- **SC.912.N.1.7:** Recognize the role of creativity in constructing scientific questions, methods and explanations.

Learning Outcomes are as follows:

Students will be able to:

- Pose questions about the natural world, (Articulate the purpose of the investigation and identify the relevant scientific concepts).
- Conduct systematic observations, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable.
- Examine books and other sources of information to see what is already known.
- Plan investigations, (Design and evaluate a scientific investigation).
- Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probe ware, meter sticks, microscopes, and computers) including set-up, calibration, technique, maintenance, and storage).
- Pose answers, explanations, or descriptions of events.

Employ appropriate methods for accurate and consistent observations; conduct and record measurements at appropriate levels of precision. Follow safety guidelines).

- Generate explanations that explicate or describe natural phenomena (inferences).
- Use appropriate evidence and reasoning to justify these explanations to others.
- Communicate results of scientific investigations, and evaluate the merits of the explanations produced by others.

The student learning outcomes will be achieved throughout the learning of the unit of Nature of Science.

Students data will be collected using TBL and after reading of the article .

- Students will take a test on Scientific Method done as a warm-up individually, as a team along with discussion.

Teaching Style:

- The teaching style of how I originally would teach this lesson will be alternated by getting the students to preview the lesson before it is discussed in class with a video. By using the TBL strategy it will hold the students accountable for preparing themselves before class discussion. The students will then test themselves on the knowledge to show their understanding

References:

- <http://datanuggets.org/2018/08/tree-killing-beetles/>
- <https://www.youtube.com/watch?v=H21xs1p0VTc>
- <https://www.youtube.com/watch?v=P30QlwSsUic&t=174s>
- <http://www.cpalms.org/Public/>
- Michaelsen LK, Watson WE, and Black RH. A realistic test of individual versus group consensus decision making. Journal of Applied Psychology 74(5): 834-839, 1989.
- Birmingham C, McCord M, Team-Based Learning, Sterling: Stylus Publishing, pp 73-90, 2004.
- Eisenstat RA, Cohen SG. Groups that work (and those that don't). San Francisco: Jossey-Bass, 1990

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Lesson Plan: Busy Beetles

Key Questions:

- Why is it important to have a control group in an experiment?
- Why do scientists make a hypothesis before beginning a scientific investigation?
- How do scientists ensure their work is valid?
- Why do scientists draw and defend conclusions?
- Why do scientists interpret data?

Science Subject/ grade and Ability Level:

- Standard Biology classes, 10 graders, reading level 1 and 2.

Science Concepts:

- Scientific Method and concepts

Overall Time Estimate:

- 2 class period (54 minutes each day) maximum depending on students

Learning Styles:

- Auditory, linguistic, spatial and kinesthetic

Vocabulary:

- Hypothesis
- Scientific Method

Lesson Summary:

Students will watch a video the night before class for homework. Students will do warm-up on answering questions about scientific method independently and again with group partners and discuss. Teacher will give a brief recap on Scientific method with whole group and students will be given an article to read and identify the steps of scientific method using the article.

Student Learning Objective:

Students will be able to:

- Pose questions about the natural world, (Articulate the purpose of the investigation and identify the relevant scientific concepts).
- Conduct systematic observations, (Write procedures that are clear and replicable. Identify observables and examine relationships between test (independent) variable and outcome (dependent) variable. Employ

appropriate methods for accurate and consistent observations; conduct and record measurements at

appropriate levels of precision. Follow safety guidelines).

- Examine books and other sources of information to see what is already known.
- Review what is known in light of empirical evidence, (Examine whether available empirical evidence can be interpreted in terms of existing knowledge and models, and if not, modify or develop new models).
- Plan investigations, (Design and evaluate a scientific investigation).
- Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs), (Collect data or evidence in an organized way. Properly use instruments, equipment, and materials (e.g., scales, probe ware, meter sticks, microscopes, and computers) including set-up, calibration, technique, maintenance, and storage).
- Pose answers, explanations, or descriptions of events.
- Generate explanations that explicate or describe natural phenomena (inferences).
- Use appropriate evidence and reasoning to justify these explanations to others.
- Communicate results of scientific investigations, and evaluate the merits of the explanations produced by others.

Materials:

- IF-AT (scratch and win style testing)
- Students pre-test score sheet
- [Article for reading](#)
- [Teacher article](#)
- Highlighters
- Projector and computer

Background Information:

- Students will watch videos at home on Scientific Method ([videos 1](#) and [2](#) will be uploaded on google classroom). Students will first do an individual Readiness Assurance Test individually on the videos.

- After they finish the test independently, students will then work together with their group members and retest together and discussing why they came up with the answer they did.
- Next, a mini lesson will be given on Scientific Method to clear up any misconceptions.
- Students will next read an article independently, and identify the scientific question, along with the hypothesis, independent variable and dependent variable, use the scientific data from the article and make a scatter plot.

Advance Preparation:

- Post videos 1 and 2 on the google classroom for students to watch
- Have the test preparation material ready when students arrive to utilize all of the class time.
- Project the timer to give all groups the same amount of time to collaborate with group members.
- Whole group discussion materials to discuss with students and clear up and misconceptions and discuss key questions.

Procedure and Discussion Questions with Time Estimates:

Assessment Suggestions:

Extensions:

Students will use IF-AT (scratch and win style testing) throughout the year to help check for understanding. Students will also use different scenarios to recognize scientific method.

Resources:

<https://www.youtube.com/watch?v=P30QlwSsUic&t=174s>

<https://www.youtube.com/watch?v=H21xs1p0VTc>

Michaelsen LK, Watson WE, and Black RH. A realistic test of individual versus group consensus decision making. Journal of Applied Psychology 74(5): 834-839, 1989.

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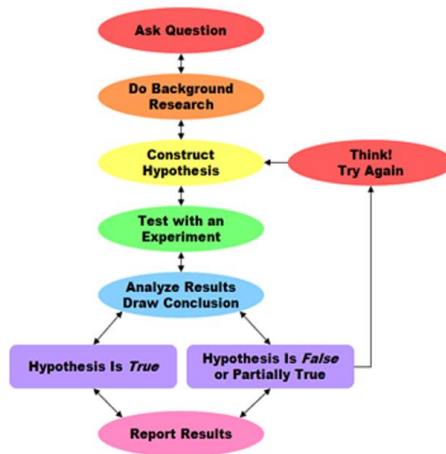
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Orange Park, Florida

- Standard Biology Class 10 grade
 - videos
 - TBL
- Scientific Method
 - Data Nugget

Scientific Method





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Team-Based
Learning™
Collaborative

Videos

https://www.youtube.com/watch?v=H21xs1p0VTc&disable_polymer=true

Ricochet Science

<https://www.youtube.com/watch?v=P30QlwSsUic&t=174s>

Amoeba Sisters





References



- <http://datanuggets.org/2018/08/tree-killing-beetles/>
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- <https://www.youtube.com/watch?v=P30QlwSsUic&t=174s>
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- Birmingham C, McCord M, *Team-Based Learning*, Sterling: Stylus Publishing, pp 73-90, 2004.
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