

## **Science Experimentation: Encouraging Play in the Classroom**

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Grade Level: 8th  
Subject: Science

Project Summary: In our experimental methods unit we tap into each student's inner curiosity and provide structure for their exploration of the world around them. This unit provides an experience from which students can conduct organized science experiments and present their findings in an articulate manner that parallels posters created by scientists in the world of academia. Students are taught scientific report writing skills through the use of scaffolded assignments. These assignments benefit students of all language levels and allow them access to a rigorous and relevant science curriculum.

### Introduction:

*Project Description:* This project is part of a larger unit exploring experimental methods in our 8<sup>th</sup> grade curriculum. It is, however, a transferable piece focusing on the nature of scientific writing and exploration that can be implemented and established in any science curriculum from kindergarten to grade twelve. The project was inspired by poster sessions presented at UCSB science and engineering students during conferences. The posters presented by the graduate students presented the main elements of their experiments in a simple and visually pleasing format. They were easy to understand and gave viewers a great opportunity to peruse many experiments in a relatively short time and yet could be used by the students to verbally present their experiments in detail.

With the posters in mind, we designed simple one-page posters on which students could easily display their experimental results. We encourage neatness and creativity in presentation, resulting in many artistic and scientific examples of experiments to display around the classroom. These displays serve to remind the students that they are capable of conducting scientific investigations. Recently, a student reported excitedly back to me that on a field trip through the engineering department of UCSB he saw scientific posters of experiments that looked very much like the ones we made in class.

Realizing that often learning science also requires learning the language and writing style of science, we explored different ways to teach writing and vocabulary that are effective for English learners and native English speakers alike.

*Educational Value:* The value of the project is that it gives provides a template that gives structure to inquiry based activities, allows students to emulate actual presentation styles of scientists in academia, and provides a strong foundation in the language of science.

### Student Impact:

Students will learn how to set up a simple experiment, isolate one variable and then communicate the results in a logical and articulate fashion. The poster template will serve as a springboard to more detailed lab reports and scientific papers. A critical component is the organization of the lab assignment conducted before the first poster. In this first phase students are lead through a scaffolded written analysis of their experimental results. This analysis is then transferred to the poster template to further help students reflect upon their results and practice drawing conclusions from their data. The poster template has the flexibility to accommodate a variety of activities from structured experiments, to homework assignments, to in-class engineering design activities.

### Assessment:

In the Pepper and the Fortune Fish Labs students are evaluated on their ability to conduct an experiment by changing and testing only one variable at a time. Students' final posters are graded on their ability to write: testable hypotheses, observations of their experiment, conclusions that accept or reject their hypotheses, and a discussion of the overall meaning of their results. Students are assessed by the quality and accuracy of work displayed on their posters, as well as traditional written summative assessments.

Standards:

**Grade 8: Science**

9. Investigation and Experimentation

- a. Plan and conduct a scientific investigation to test a hypothesis.
- b. Distinguish between variable and controlled parameters in a test.

Materials/Budget:

**Lab Supplies:** Cups, pepper, various stir sticks and toothpicks, oil, honey, pencil shavings, dried herbs (like oregano), soap (hand soap, dish soap, biodegradable soap), Chinese Fortune Fish, M&Ms, small paper soufflé cups, small plastic soufflé cups, aluminum foil wax paper.

Lesson Plans:

**Hypothesis, Control, & Variable: Vocabulary, Writing, and Controlled Experiment Lesson**

**Time:** 1 day + Homework & follow up in subsequent labs and homework

**Objective:** Given a problem or question, students should be able to write a testable hypothesis, and then identify the control and variable for a corresponding experiment.

**Context:** Prior to this lesson students have learned about the steps to the scientific method and have completed activities relating to the overall process. Students have previously learned about making factual observations during an experiment. This specific lesson practices these steps and builds further skills needed to write a testable hypothesis for an activity involving melting M&Ms and future, more complex experiments (Pepper Lab, Fortune Fish, Science Fair Projects).

**Activity 1:** Kinsella Inspired Vocabulary Cards: Hypothesis and Control

- Teacher says word and taps out syllables, then repeats with students also speaking work and tapping out syllables.
- Teacher defines word and reads definition out loud with students.
- Teacher reads 2 example sentences containing the vocabulary with students. Each example sentence has blanks that the teacher fills in with the students.
- Using a sentence frame, students write their own sentence using the vocabulary word. Students take turns reading their sentences to their table partners, and then are called on by teacher to share out. 2 volunteers are taken to share sentences only after teacher has used other methods to call on non-volunteer students.

**Activity 2:** Testable Hypothesis Practice

- Students are guided through the process of writing a hypothesis in the “If..., then...” format. The worksheet used is scaffolded with sentence frames to help guide students into writing with the correct language style (scientific, 3<sup>rd</sup> person) and vocabulary.
- Teacher follows the “I – We – You” format to teach writing a testable hypothesis. The first problem is done and explained by the teacher. The second problem is done with student input. And the 3 problem is done by students and checked as a class. The remaining problems are done individually by the students and checked as a class.

**Activity 3:** Developing a Testable Hypothesis

- Students read about the difference between a testable and non-testable hypothesis. Students are given the following problem for this activity, “*An M&M candy begins to melt in your hand when held for 2 minutes.*”
- Using the skills practiced in the previous activity, students write a hypothesis that they will test in class using M&Ms. They are guided with the following sentence frame, “*If M&Ms are \_\_\_\_\_, then they will not melt within 2 minutes.*”

- Students are given M&Ms and other materials needed to conduct their anti-melting experiment. Typical choices include: wrapping an M&M in foil, Kleenex, or wax paper, or holding the M&M in an open palm. Students are taught to only change one variable for their test. The control trial involves holding the M&M in a tightly closed palm for 2 minutes.

**Homework:** Students complete the back of the Developing a Testable Hypothesis paper, which contains 4 more practice problems on writing testable hypotheses.

**\*See Hypothesis, Control, & Variable attachments**

### **The Pepper Lab**

**Objective:** The Pepper Lab is an inquiry lab in which the students are exposed to a phenomenon and then allowed to conduct mini experiments by varying factors in order to try to explain why the phenomenon occurs. This lab reinforces and brings together the concepts of a testable hypothesis, control and variable in an exploratory manner which the students enjoy. The main point of the activity is not to arrive at the actual scientific answer, but to be able to isolate the contributing factors to the phenomenon.

**Time:** 1 day + Homework

**Context:** Prior to this lesson students have learned about the steps to the scientific method and have completed activities relating to the overall process. Students have previously learned about making factual observations during an experiment. This lab is highly engaging and really taps into each student's innate curiosity. It guides the students to be methodical and structured about their investigation and allows them to share their results in a non-threatening way. It also allows teachers to assess student understanding of control and variable.

**Lesson Outline:** Student groups are given a plastic cup half filled with water, a soufflé cup of pepper and another of liquid dish soap and a wooden toothpick. As a class, the teacher leads the student groups to sprinkle pepper on top of the water and make observations, by writing a sentence and drawing what they see. The pepper flakes float along the surface of the water and are generally evenly spread out. The student groups then simultaneously place an end of their toothpick into the dish soap then gently touch that end to the center of the surface of the cup of water. The pepper should then immediately spread to the sides of the cup and then start sinking. One usually hears a collective gasp as the students observe the phenomenon. After discussing what they saw as a class, students then write and draw their observations on their paper. Their task is to then try to explain what causes the phenomenon by narrowing down the contributing factors. As a class, students brainstorm and write down the various factors such as the plastic cup, toothpick, water, dish soap and pepper. Students also volunteer variables to try in place of each factor such as a paper cup instead of the plastic cup or a plastic straw instead of the wooden toothpick.

The teacher then reveals what items she has been able to gather and the students plan out two experiments. In each experiment, the students identify the control, variable and their testable hypothesis. After conducting each experiment, the students then record their observations and their conclusions.

**Homework:** After sharing results and conclusions in class, the students complete a poster that gathers and presents their data in a simple format. Students are heavily encouraged to color their posters and make them presentable.

Another homework assignment is the **Water Strider Assignment**. This allows the students to apply what they learned in the classroom to real world experiences. It also asks the students to support their ideas with actual data or observations gathered from their experiments. This link from classroom experience to real world application is important in any content area.

**\*See Pepper Lab attachments**

### **Fortune Fish Assignment**

**Objective:** Students are each given Fortune Fish and are given the task to find out why it moves when placed in one's hand. Students are to conduct at least two experiments that will help them isolate the cause of the movement. No research is required, just lots of experimentation, recording of data and drawing conclusions from observations. A poster presentation similar to that of the Pepper Lab is completed to record and present their findings.

**Time:** This assignment is usually given in the form of over the weekend homework.

**Context:** Students have completed the Pepper Lab and several activities to help them form testable hypothesis, establish control and variable, record observations and draw conclusions.

**Comments:** Some sample student work is attached. This assignment is engaging because the Fortune Fish is tactile and it is given to the students to keep. It is also great to have students conduct simple and easy experiments at home so that the family can be involved. Since this is a reinforcement activity, the students can explain concepts and vocabulary to their families thereby giving the students a chance to be the "teacher". It is also an assignment in which students of all levels can be successful. Teachers can assess students by correct usage of vocabulary, articulation of ideas and presentation style. Students are usually eager to show their work and share their findings in class discussions when the assignment is due.

We have utilized the poster template in other units as well. There are two templates attached, one for designing **LandSail boats** in which students measured the speed of their boat and the other is a **Parachute lab** in which students design parachutes and measure hang time. These posters were created for engineering projects in which iterations of tests yield (hopefully) improved results.

**\*See Fortune Fish attachments**