

## Lesson Plan: iSense Final Project

**Teacher:** Ms. Brady

**Subject:** Math/Science

**Lesson Title:** Applying the Scientific Method in the Context of a Controlled Experiment

**Content Objective:** Students will be able to identify and apply the steps of the scientific method to identify a question, formulate a hypothesis, design and conduct a controlled experiment, analyze data, modify the experiment if necessary and finally draw conclusions and communicate their results.

**Language Objective:** Students will be able to explain the relationship that exists between variables using the terms “direct correlation”, “inverse correlation”, “no relationship”, “independent variable” and “dependent variable”. Students will also be able to discuss the limitations of an experiment, and how that might affect the reliability and validity of the results.

**Content Standard: (6.EE.9)** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. **(6.RP.3b)** Solve unit rate problems, including those involving unit pricing and constant speed.

**Language Standard: (6.LS.6)** Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression. **(6.SL.1)** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others’ ideas and expressing their own clearly.

### Procedure:

#### ***Periods 1 and 2***

- **Do Now:** Students should review the scientific method with their table group.
- **Objectives:** Review content and language objectives with the class. Have these posted at the front of the room.
- **Lesson Introduction:** Tell students that during today’s lesson we will be conducting an experiment, but that it will be different from the experiments they have conducted in the past. In the past, students most likely will have played the role of the experimenter, however today, students will be the participants, or the test subjects of the experiment. Tell students that the topic we will be investigating is the effect of technology on student achievement.
- **Step 1 of the Scientific Method:** Ask students to name step 1 of the scientific method (Identify a problem or question). Ask them to turn and talk about what the question we might be

investigating today could be. Guide students to form a question similar to “Does the use of technology improve student performance?”

- **Step 2 of the Scientific Method:** Ask students to name step 2 of the scientific method (Formulate a hypothesis). Give students 5-10 minutes to independently develop a hypothesis regarding whether or not technology will improve student performance.
- **Step 3 of the Scientific Method:** Ask students to name step 3 of the scientific method (design a controlled experiment). Discuss what steps would need to be taken in order to test the hypotheses created. Facilitate a discussion regarding experimenter bias, control group vs. experimental group, and random assignment. The steps to the controlled experiment should resemble the following:
  - Students should be divided into two groups: an experimental group, and a control group.
  - The groups will be chosen at random by drawing names one at a time and alternating the group each student is placed in.
  - Both groups will be given the exact same performance task (please see attached), however the experimental group will be allowed to use technology (chromebooks) and the control group will not.
  - The experimental group will be given privacy shields, so the control group is not accidentally exposed to the technology.
  - Participants from both groups will be told to begin at the same time, and the amount of time it takes them to complete the assessment will be recorded.
  - As soon as a participant has completed the performance assessment, he or she is to bring the assessment to the experimenter who will record the amount of time passed, rounding to the half minute, as well as what “place” they have finished in (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>).
- **Step 4 of the Scientific Method:** Ask students to name step 4 of the scientific method (conduct the controlled experiment). Follow the steps created during step 3. Hand out the performance assessments to students; make sure that those in the experimental group get ones labeled “tech” and those in the control group do not. Instruct students to put their name at the top of the paper but not to read anything before they are able to start. Instruct the experimental group to get a chromebook, log in, and go to [www.isense.org](http://www.isense.org) and search for project 1667. Tell them to click on the project and scroll down to the blue button that says “visualize” and then wait for my signal to begin. Once all students are ready, tell students they may begin and start timing. If students do not finish the performance assessment within the period, record the time that has passed and continue the next period.

**\*On Your Own:** Score the student performance assessments. Give a score of “zero” for no attempt, a score of “one” for an attempt but a wrong answer demonstrating little to no understanding, give a score of “two” for a partially correct answer that demonstrates mixed evidence of understanding (in some ways the student shows he or she understands, but in other ways demonstrates misconceptions or misunderstandings of how to solve the problem), give a score of “three” for a correct answer that demonstrates understanding, but is flawed in some way (i.e. use of incorrect units, minor computation error, etc.), and give a score of “four” for an exemplary answer where the student demonstrates he/she

understands the concepts at hand, completes all computations correctly, utilizes appropriate units, etc. Score each item independent of the rest.

\* Then organize all of the student data into a spreadsheet that will be accessible to show to the class.

### ***Period 3***

- **Do Now:** Ask students to review the experiment we have conducted thus far with their table groups. Discuss what we have done so far in whole group format.
- **Content and Language Objectives:** Review the content and language objectives with the class. They should still be posted at the front of the room.
- **Step 5 of the Scientific Method:** Ask students to name step 5 of the scientific method (analyze data). Have students discuss with their table groups what this means and what should happen at this step. Facilitate a class discussion regarding how to go about organizing the data. Discuss the need to “quantify” data. Decide upon an appropriate scale in which to score student data (steer students towards the scale mentioned above through the use of questioning). Ask students to discuss what to do with the data once it is scored. Ask what statistical calculations might need to be done to make the data easier to work with (average scores for experimental group, scores for control group and times for each).
- **Step 6 of the Scientific Method:** Ask students to name step 6 of the scientific method (modify the experiment if necessary). Use this opportunity to discuss limitations – what could have altered the outcome of the experiment? This discussion should hit on variables such as the population (6<sup>th</sup> grade CGS students is a very specific part of the US population), students might not have followed directions (this would affect the time averages, if control group looked at technology, if any participant read the assessment before they were supposed to), the assessment itself (too difficult, too easy, no matter how much technology a person is given if they didn’t know how to do the math they wouldn’t succeed). Ask students to discuss potential solutions to these limitations, and how these might affect the conclusions we are able to draw.
- **Step 7 of the Scientific Method:** Ask students to name step 7 of the scientific method (communicate results). Ask students to work with their table groups to determine what the outcome of the experiment is, what conclusions they are able to draw, and what they can confidently report out on as fact.
- **Reporting Out:** Give each group an opportunity to report their conclusions to the class. End with a class discussion regarding valid vs. invalid claims, and what, if any real conclusions can be drawn from this one experiment.