Title of investigation:

Science and language skills/concepts:

Materials needed:

Elaborate

For our purposes, elaborate is the part of the science lesson where students come to know and understand the steps to an investigation. It starts with a question. In this experimental investigation, students use the question frame, What is the relationship between _____ and _____?

First, the word relationship should be discussed and defined, and examples provided and placed on the science word/phrase wall. A graphic organizer is constructed with the word relationship in the center, with lines radiating from the word to demonstrate what the students think the “relationship” means.

Using this frame—What is the relationship between _____ and _____?—opens the door to understanding variables (dependent and independent). For example, What is the relationship between the brand of popcorn and the number of kernels popped? The brand of popcorn is the independent variable, and the number of kernels popped is the dependent variable.

1. After coming up with a class question (using the what is the relationship between _____ and _____? question frame), take a minute to analyze the question for cause-and-effect phrases. For example, in the popcorn question, the brand of popcorn is the cause, and the number of kernels popped is the effect.

2. Students then formulate a hypothesis. It is an idea that can be tested.

3. Students design and conduct an experiment, make observations, and collect data and record them on the “t” data table.

<table>
<thead>
<tr>
<th>Brand of popcorn is the cause (independent variable)</th>
<th>Number of kernels popped is the effect (dependent variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand A</td>
<td></td>
</tr>
<tr>
<td>Brand B</td>
<td></td>
</tr>
<tr>
<td>Brand C</td>
<td></td>
</tr>
</tbody>
</table>
4. They plot the data from the data table to a graph (bar, line, circle), labeling each axis with the names of the variables.

![Bar Graph]

5. Now, students are ready to analyze the data they have collected. One place to begin is to review the information plotted—which brand has the most kernels that popped, the least that popped, and somewhere in between.

Looking at the graph, decide which brand is the best to buy, based on the evidence they uncovered in this experiment. Ask, Why do you think so?

If they need some support in coming up with answers, why do you think the Claims and Evidence Scaffold that follows may prove helpful?

Students go back to the “t” table and the graph to fill in the Claims and Evidence Scaffold. They think about their “claims” or conclusions made about the popcorn brand—best, worst, in between. Once a claim has been identified, it must be supported with evidence. The key question is: Is there evidence to support your claim of best, worst, in between? If the answer is “yes,” students go on to the second claim, finding evidence in the data collected and plotted on a graph.

**Claims and Evidence Scaffold**

<table>
<thead>
<tr>
<th>Claims</th>
<th>Evidence</th>
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<tbody>
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</table>

Taylor and Villanueva (2014) provide the following series of questions that teachers can ask to assist students in completing the Claims and Evidence Scaffold. The following question and sentence frames provide a template for student responses.

a. What do you claim to be true from your investigation?

b. How can you prove your claim? (How can you back up your claim?)

   *I claim that when I did __________, then __________ happened.*

   *I know this is true because I observed __________.*

(Continued)
c. With the whole class, ask, *Who agrees with each group’s claim?*
   
   *How many agree with ______ group’s claim and evidence?*
   
   *How many disagree with ______ group’s claim and evidence?*
   
   Student response sentence frames might include:
   
   *I agree with_______ claim because ______.*
   
   *I disagree with ______ claim because ______.*
   
   d. Finally, ask, *Which of the following claims is most like yours [state the claim]? My claim is ...*
   
   *similar to ________.*
   
   *somewhat similar to ________.*
   
   *completely different from my classmates.* (Taylor & Villanueva, 2014, p. 64)

6. Students in the upper grades will identify and then describe the variables in their investigation based on the question they posed and the data they collected.

7. In their science notebooks, students will do the following:
   
   *Write the question and make a hypothesis, which is an idea that can be tested by an experiment or observation (Sciencesaurus, 2006).*
   
   *Sketch a “t” data table using the question and the variables they identified. Taking the popcorn question, *What is the relationship between the brand of the popcorn and the number of kernels popped?*
   
   *Summarize the findings, looking at the information in the “t” table and drawing conclusions by using sentences following these frames: In this investigation, I did ______ or I learned that ______. They use the information from their Claims and Evidence Scaffold to respond. Emphasize that every claim must be supported by evidence.*