Recipe for Data Interpretation
Science, High School

As a powerful science instructor, you want to teach this lesson because

- The lesson binds together two factors that make happy, successful students – autonomy and food – and uses them to drive science process.
- Students administer a survey and analyze data from it to help generate testable hypotheses.
- Students can manipulate data about their own lives and preferences.
- Even though the listed benchmarks are about science process and the scientific method, the lesson provides a springboard for numerous science topics: photosynthesis, respiration, nutrients, enzymes, minerals, fitness training, diet, diabetes, high blood pressure. And regardless of the topic, we know that this lesson is about students.
- Carl Rogers is right about self-discovered and self-appropriated learning.
Grade Level Expectation (s):
B1.1A Generate new questions that can be investigated in the laboratory or field.
B1.1B Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.
B1.1C Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
B1.1D Identify patterns in data and relate them to theoretical models.
B1.1E Describe a reason for a given conclusion using evidence from an investigation.
B1.2A Critique whether or not specific questions can be answered through scientific investigations.
B1.2D Evaluate scientific explanations in a peer review process or discussion format.

3 MNN Behavioral Outcome:
Eat fruits and vegetables, whole grains, and fat-free or low-fat milk products every day. Balance caloric intake from food and beverages with calories expended.

SNAP-Ed Core Nutrition Messages:
Eat fruits and vegetables at meals and snacks.

What type of garden setting? Seek vegetables from your local school garden.

Goal:
Part One: After administering a survey, students will utilize data collection and interpretation to analyze vegetable preferences amongst their peers, comparing and contrasting results. Part Two: Students will follow this activity with a science investigation that tests their actual patterns of vegetable consumption.

Learning Objectives:
The students will...
1. Collect data on student tastes and preferences for various vegetables.
2. Create accurate representations (graphs) of the taste preference data.
3. Students will generate measurable questions to be investigated.
4. Students will recognize the benefits of graphic representation of data.
Background

Nutritional Information for the following:  
http://www.fruitsandveggiesmorematters.org/?page_id=115

- Tomato
- Cucumbers
- Carrots
- Radishes
- Onions
- Cabbage
- Cauliflower
- Broccoli

Vocabulary
X-axis
Y-axis
Variables
Data table vs. Graphs

Advanced Preparation

- Create vegetable posters ahead of time
- Obtain the vegetables and cut them into bite-size amounts
- Sampling plates, napkins, or utensils, enough to supply a set of vegetable samples for each student in class

Supplies

- MyPyramid poster.  http://teamnutrition.usda.gov/educators.html  (Teacher note: MyPyramid for Kids is for children 6-11 years.  If the majority of your class is over 11 years of age use the adult MyPyramid.)
- 8 Poster boards labeled with each of the vegetables listed in the background information
- Sticky notes; enough for students to have 3 each.  Students check the appropriate rating for each vegetable.
- Set up data collection as a spread sheet and have students enter their data directly into it.
- Rulers, one per student
• Graph paper, one per student
• Paper and writing utensil, for each student
• For a class of 25 students you should have the following amounts:
  o Tomato – cut up 3 tomatoes and leave 1 whole (for display)
  o Cucumbers – cut up 2 cucumbers and leave 1 whole (for display)
  o Carrots – 1 large package of baby carrots (1 whole carrot)
  o Radishes – one bunch of radishes (leave 1 whole)
  o Onions – cut up 1 Vidalia onion and leave 1 whole
  o Cabbage – 1 head of cabbage, cut up only half
  o Cauliflower – 1 head, cut up only half
  o Broccoli – 2 stalks, cut up 1 and leave 1 whole
  o Remember to cut up small tasting sizes

Safety Notes
Check with students to make sure there aren’t any food allergies.
Ensure that proper food sanitation and safety issues are addressed prior to food preparation

PART ONE: A SURVEY OF PREFERENCES

Step 1
Review MyPyramid with students. Explain that the class will specifically be working with vegetables for this lesson. Ask the students what their favorites are. Discuss.

Step 2
Have students visit the school garden and harvest a variety of vegetables (enough to prepare a taste test for the class). Return to the class and hold up each vegetable. Ask students to predict which vegetables will be preferred by the class.

Step 3
Have students get into groups and select a specific vegetable to work with. Provide them time to research the nutritional value of their vegetable at http://www.fruitsandveggiesmorematters.org/?page_id=115  Have the students prepare a small presentation (or poster) with their nutritional information. While students are researching, prepare a taste-test sample for all students to try each of the vegetables.

Step 4
Have students add each vegetable to a spreadsheet (use Excel, or other preferred visual aid). Write the name of each vegetable on the board. Provide students with 3 sticky notes and have them write their initials on each. Instruct them to place their colored sticky notes on the board under the name(s) of their vegetables of preference.

**Step 5**
Have the students collect the data about preferences by counting the number of sticky notes on the posters where students placed their sticky notes. Have the students construct a data table of their findings. Assign them to chart the data by putting the names of vegetables on the X-axis and the number of votes on the Y-axis, creating a bar graph. Using a spreadsheet, students will review different graph types and select an appropriate one to use in their presentation. At some point, discuss the strengths and weaknesses of the different graph types. Why do you like one versus another?

**Step 6**
As a class, discuss the analysis of your data:
What is the most popular vegetable?
What is the least popular vegetable?
Did everyone try every vegetable before voting?
Does this factor weigh into the overall results? Why?
Why do you think ____ was the most popular vegetable?
Why do you think ______ was the least popular vegetable?

**Step 7**
Instruct students to examine the data collected, comparing and contrasting vegetable preferences in the class. Do their findings match their predictions? Why or why not?

**Step 8**
Once students have analyzed class preferences, have them work in groups and use the data to formulate a preliminary classroom garden plan.

**Part One Assessment**

Students will be assessed based on their creation of the class data table and graph. Student may also be given participation points in the class discussion.
Students will be scored based on accuracy of data and graph. Points should be given for labeling and titles for both the x-axis and y-axis, main title of the graph, and appropriate scale used for plotting data points.

Student Page

SAMPLE Data Chart

Name: ___________________________________

<table>
<thead>
<tr>
<th>Tomato</th>
<th>Broccoli</th>
<th>Cauliflower</th>
<th>Cabbage</th>
<th>Onions</th>
<th>Radishes</th>
<th>Carrots</th>
<th>Cucumbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>11</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>1</td>
<td>12</td>
<td>17</td>
</tr>
</tbody>
</table>
SAMPLE GRAPH:

- Tomato
- Cabbage
- Carrot

Frequency
PART TWO: TESTING DIETARY HABITS

Step 1
In the first part of this lesson, you administered a survey, compiled the results, and analyzed the data to determine what vegetables to plant in a school garden. Although conducting a survey is not the same thing as using the scientific method, surveying can help scientists formulate questions for study. Take a moment and create a list of two or more science questions prompted by the survey results. After a brief period, share ideas for scientific study.

Step 2
Your class may wish to formulate its own question, hypothesis, and experiment to pursue. One interesting question, however, that is inspired by the preference study is this: Do people really eat the types and amounts of vegetables they say they do? From this point on, students will employ many of the skills used during the preference study as they work their way through the scientific method. One major difference is that this study will go on for an extended period of time – at least a month – to collect a larger ______ of data. Secondly, the data will reflect measurement rather than subjective _______. Finally, the collected data can be used to support or refute the hypothesis. (See student scientific method worksheet.)

Step 3
Regardless of whether you use the question stated in Step 2 or use one formulated by your class, be sure that you keep this in mind: Your active pursuit of developing healthy dietary habit is essential. Use the space below to write about new things you’ve learned about vegetables, your attitudes, and your diet.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
MYPYRAMID NOTES ON VEGETABLES

What foods are in the vegetable group?

Any vegetable or 100% vegetable juice counts as a member of the vegetable group. Vegetables may be raw or cooked; fresh, frozen, canned, or dried/dehydrated; and may be whole, cut-up, or mashed.

Vegetables are organized into 5 subgroups, based on their nutrient content. Some commonly eaten vegetables in each subgroup are:

**Dark green vegetables**
bok choy  
broccoli  
collard greens  
dark green leafy lettuce  
kale  
mesclun  
mustard greens  
romaine lettuce  
spinach  
turnip greens  
watercress

**Orange vegetables**
acorn squash  
butternut squash  
carrots  
hubbard squash  
pumpkin  
sweet potatoes

**Starchy vegetables**
corn  
green peas  
lima beans (green)  
potatoes

**Other vegetables**
atichokes  
asparagus  
bean sprouts  
beets  
Brussels sprouts  
cabbage  
cauliflower  
celery  
cucumbers  
egoplant  
green beans  
green or red peppers  
iceberg (head) lettuce  
mushrooms  
okra  
onions  
parsnips  
tomatoes  
tomato juice  
vegetable juice  
turnips  
wax beans  
zucchini

**Dry beans and peas**
black beans  
black-eyed peas  
garbanzo beans (chickpeas)  
kidney beans  
lentils  
lima beans (mature)  
navy beans  
pinto beans  
soy beans  
split peas  
tofu (bean curd made from soybeans)  
white beans
MYPYRAMID NOTES ON VEGETABLES

How many vegetables are needed daily or weekly?

Vegetable choices should be selected from among the vegetable subgroups. It is not necessary to eat vegetables from each subgroup daily. However, over a week, try to consume the amounts listed from each subgroup as a way to reach your daily intake recommendation.

The amount of vegetables you need to eat depends on your age, sex, and level of physical activity. Recommended total daily amounts are shown in the first chart. Recommended weekly amounts from each vegetable subgroup are shown in the second chart.

### Daily Recommendations*

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age Group</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>9-13 years old</td>
<td>2 cups</td>
</tr>
<tr>
<td></td>
<td>14-18 years old</td>
<td>2 ½ cups</td>
</tr>
<tr>
<td>Males</td>
<td>9-13 years old</td>
<td>2 ½ cups</td>
</tr>
<tr>
<td></td>
<td>14-18 years old</td>
<td>3 cups</td>
</tr>
</tbody>
</table>

*These amounts are appropriate for individuals who get less than 30 minutes per day of moderate physical activity, beyond normal daily activities. Those who are more physically active may be able to consume more while staying within calorie needs.
ASK A QUESTION:

Do people really eat the types and amounts of vegetables they say they do?

RESEARCH/PREVIOUS KNOWLEDGE:

a. Vegetables are sometimes mixed with other foods
b. Diet may vary from day to day or season to season
c. Vegetables used will be as set forth in

d.

HYPOTHESIS:

➢ Record the types and amounts of vegetables you eat, along with how frequency you eat them.

<table>
<thead>
<tr>
<th>Vegetables in diet</th>
<th>Amount eaten/setting</th>
<th>Number of times eaten/month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

DESIGN AN EXPERIMENT:

a. Students will document the types and amount of vegetables s/he consumes over a period of _____________________ (time frame.)
b. Students will use the same unit of measurement (cups) for all vegetables.
c. Students will identify vegetables as set forth in MyPyramid. (See MyPyramid Notes.)
d.
COLLECT DATA:

Design a chart that will allow you to record for the period of time defined in your experiment. Once you have completed your study, use the chart below to summarize your data.

Data Summary Table

<table>
<thead>
<tr>
<th>Diet</th>
<th>Average Amount eaten/setting</th>
<th>Number of times eaten/month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted</td>
<td>Actual</td>
</tr>
<tr>
<td></td>
<td>Predicted</td>
<td>Actual</td>
</tr>
</tbody>
</table>

CONCLUSION:

a. Does your data support, fail to support, or refute your hypothesis (the predictions you made prior to the start of the experiment.) Explain your answer using data from your chart to illustrate your point.

- Because your prediction had several parts, you may wish to pick parts of it to discuss. You might even discuss a prediction the data supports and one it refutes. You could also discuss the percent of correct or incorrect predictions.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

NEW QUESTIONS:

What new questions do you have?
Extension Ideas

- Create a classroom garden that reflects the preferences evidenced in the survey.
- Create a school-wide survey and compile information to make recommendations to the school’s food service department.
- Have students develop their own home gardens, planting more of the items they preferred in the survey.
- Compare local data with wide-scale research driven data from credible sources - http://docs.schoolnutrition.org/newsroom/jcgm/02fall/morris/
- Have students monitor their intake of vegetables, aiming to put more emphasis on that portion of MyPyramid.