



EnvironMentors© Data Analysis

Teacher and Mentor Summary

Students will conduct basic forms of analysis on their data in order to draw accurate conclusions. We ask that all students calculate the mean, median, and mode for their data and present this analysis in the form of charts or graphs. Calculation of median, mean, and mode is briefly described below, followed by a quick review of pie, line, and circle graphs. Of course, you are free to lead students in more advanced forms of data analysis and encourage them to produce more advanced graphs.

Students should be aware that an EnvironMentors board member provides a special scholarship targeted specifically to one student who does outstanding work in gathering, organizing, analyzing, and presenting his or her data. Use of Excel and other data organizing programs is permitted.

Objectives

- Calculate basic and appropriate statistics for his/her collected data
- Develop meaningful graphs and tables based on the statistics

Activities

- Organize the data in appropriate tables
- Calculate Mean, Median, Mode and any other valuable statistics
- Develop different graphs based on the data and statistics

Suggested Rubric

Total Value= 10 points To what extent does the student:

- Organize the data in a useful manner
- Properly Calculate mean, median, and mode in a way that helps illuminate the significance of the experimental results.
- Identify other important statistics for the data
- Create useful graphs that show important trends in the data

Background

Basic Statistics: Mean, Median, and Mode

- **Calculating the Mean**—Also known as the average. To calculate a Mean score, simply add the values of all the entries and divide by the number of entries.
- **Calculating the Mode**--The mode is the value that occurs most frequently in the data set. To compute the mode, add the number of times each value occurs in the data set to get the sum of total of each value. Then choose the highest sum.
- **Calculating the Median**--The Median is the central value of an ordered distribution. To obtain the median score, order the values from the smallest to the highest values. Then select the score that occurs in the middle of your distribution. If the data set has an even number of entries, add the two middle values and divide by two.

Basic Types of Graphs

- **Bar graphs** are used to show relationships between groups. The two items being compared do not need to affect each other. It is a fast and easy way to show big differences.
- **Line graphs** are used to show continuing data, how changes in one variable affect changes in another variable. Line graphs are also used to illustrate how the data changes over time. It's clear to see how things are going in students' experiments by the rises and falls shown by a line graph.
- **Circle or Pie Graph** are used to show how part of something relates to the whole. Pie graphs are needed to show percentages effectively.

→Talk with your students about which graph is most appropriate for showing the results of their data.

→Help student to gain access to Excel and work with them to learn the basics for working with the program.



Student Data Analysis Form

Now that you have collected observations and data in both your Control and Experimental sets, what does the data tell you? How does the data you collected help to answer your Research Question? Does the data you collected prove your hypothesis correct or incorrect?

The only way to be able to answer these questions is to analyze your data. In this stage of your project, you will perform simple forms of data analysis that will allow you to understand what your data is telling you. For your EnvironMentors Project, we first ask you to calculate the Mean, Medium, and Mode values of your data. You will then visually represent your data in charts and graphs so that the judges can better understand your data and the results of your experiment.

***Note:** It is best to find access to a computer with **Microsoft Excel** loaded on to it. Excel has functions that will make it easier for you to analyze your data and to make graphs and charts. Either visit your school's computer lab or talk with your mentor about finding access to Excel.

Calculating mean, median, and mode

You may already know how to calculate mean, median, and mode scores. If not, calculation of these values is described below. If you are having trouble, your mentor or teacher should be able to help.

Calculating the Mean--The Mean is often referred to as an average. To calculate a Mean score, simply add the values of all the entries and divide by the number of entries.

The Mean score for my data is: _____

Calculating the Mode--The mode is the value that occurs most frequently in the data set. To compute the mode, add the number of times each value occurs in the data set to get the sum of total of each value. Then choose the highest sum.

The Mode of my data is: _____

Calculating the Median--The Median is the central value of an ordered distribution. To obtain the median score, order the values from the smallest to the highest values. Then select the score that occurs in the middle of your distribution. If the data set has an even number of entries, add the two middle values and divide by two.

The Median of my data is: _____

***Things to keep in mind:**

- You may have more than one mean, median, or mode for your data. Talk to your mentor or teacher about the best method for calculating these values if you are confused.
- What do you think these statistics show or mean? Are they helpful for explaining your results? It is important to explain HOW the analysis you do informs your experimental results. And if the statistics don't seem to mean anything, try looking at the numbers a different way. **Work with your mentor.**
- Show your process. When you write up your results, explain how you went about calculating your results. **Do Not** just write mean=x, median=y, mode=z.



Charts and Graphs

To get a better understanding of your data and to assist other people in understanding your project, you need to present the data in graphical form. Developing charts and graphs of your data will also help you to understand it better and hence draw better conclusions.

There are three basic types of graphs—bar graphs, line graphs, and circle or pie graphs. The more ways you have to visually represent your project, the better able others, including judges, will be able to understand it. In selecting which type(s) of graphs to use, look at examples in newspapers, magazines and on the internet.

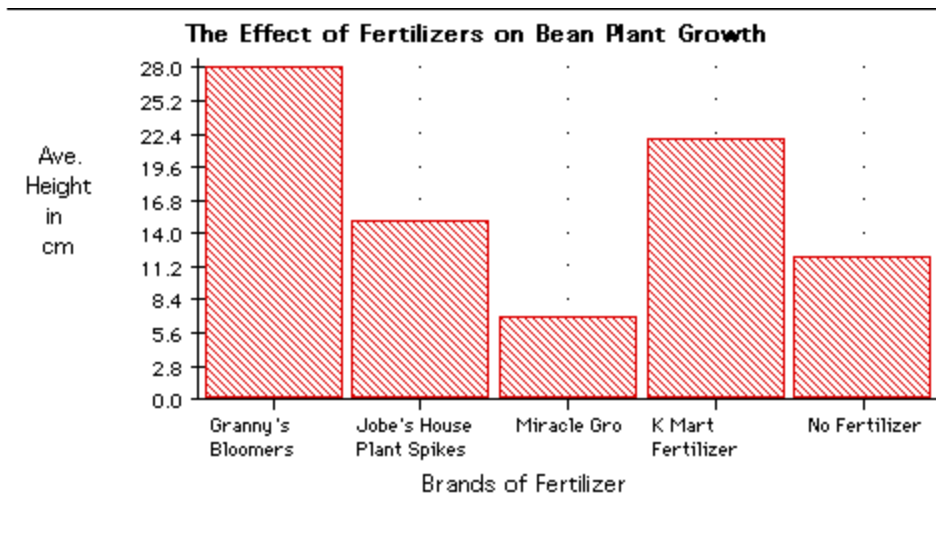
The examples of Charts and Graphs are courtesy of: Twin Groves Middle School, Buffalo Grove, IL

Source: <http://www.twingroves.district96.k12.il.us/ScienceInternet/ChartsGraphs.html>

Bar Graphs

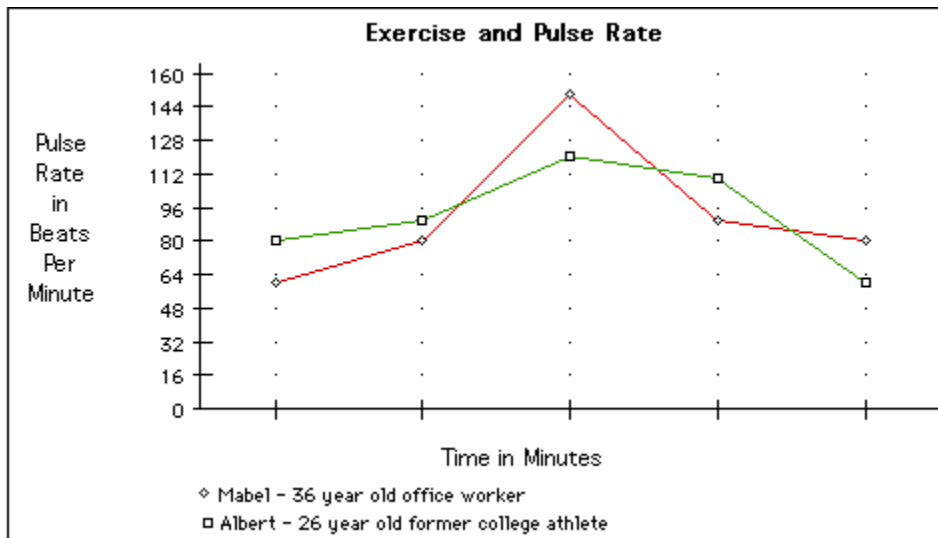
A bar graph shows relationships among groups. The two items being compared do not need to affect each other. It's a fast way to show big differences. Notice how easy it is to see what was done in the experiment below with bean plant growth and different brands of fertilizer.

A typical chart or table for this graph might look like this:



Line Graphs

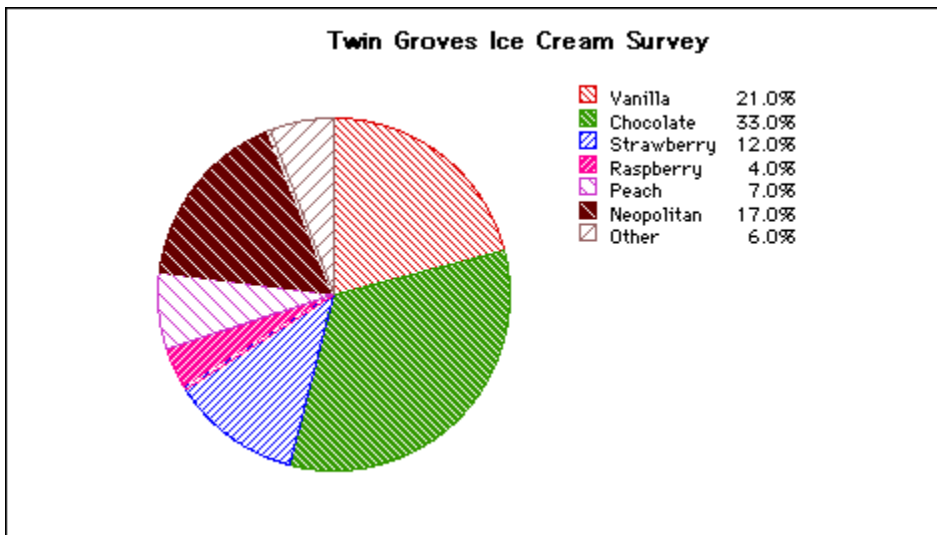
A line graph shows continuing data, how one thing is affected by another. It's clear to see what is happening by the rises and falls a line graph shows. This kind of graph is needed to show the effect of an independent variable on a dependent variable. In the sample below, the pulse rate of a person (dependent variable) is shown to change over time based on the impact of the exercise (independent variable). Over time, the pulse rate changes. A typical graph might look like this:



Pie or Circle Graphs

A circle graph is used to show how a part of something relates to the whole. This kind of graph is needed to show percentages effectively. Remember, whatever you are comparing, the total must add up to 100%!

A typical pie graph might look like this:

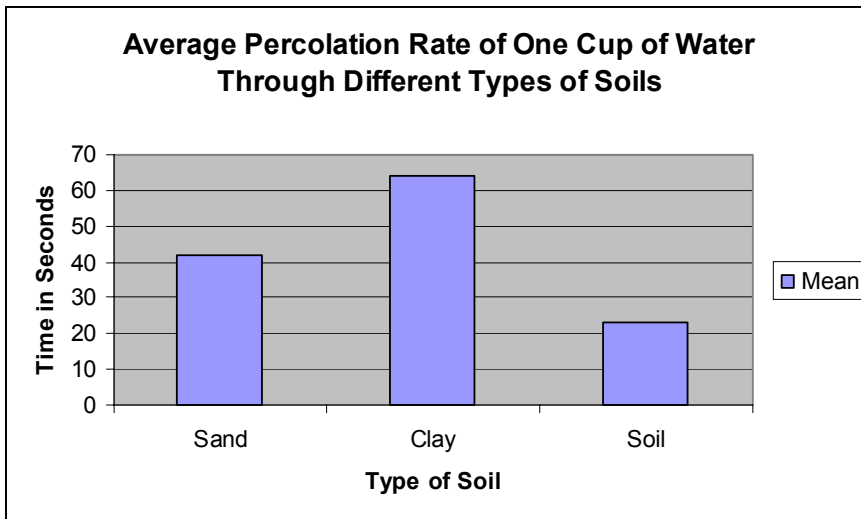


***Note: Use your mentors as resources!!!** Most of them have lots of experience from school and work working with data analysis and using Excel.

DC Example Graphs

Bar Graph

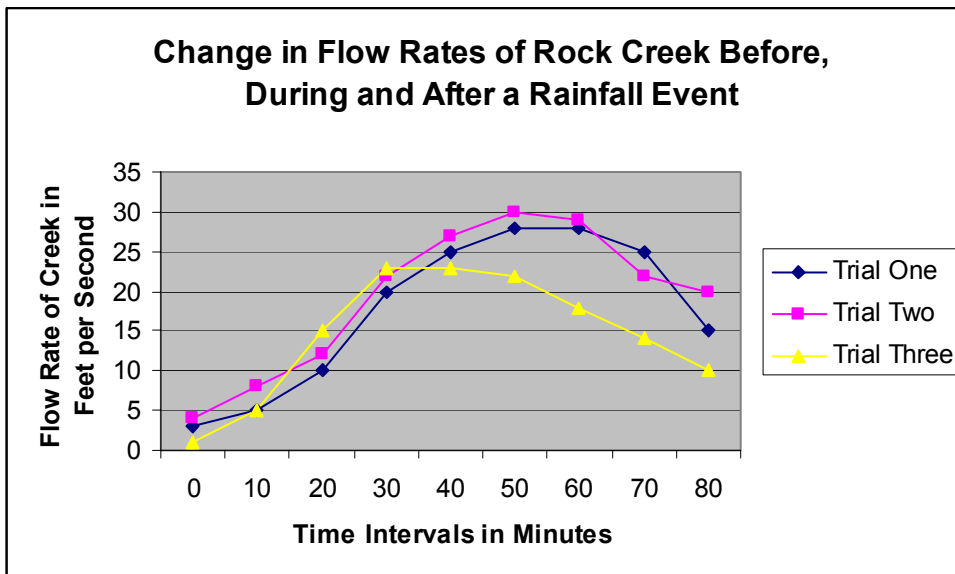
Percolation Rates of Water Through Different Soils in Seconds			
	Sand	Clay	Soil
Trial One	40	55	23
Trial Two	41	60	24
Trial Three	43	65	23
Trial Four	45	65	21
Mean/Average	42.25	61.25	22.75
Median	42	62.5	23
Mode	n/a	65	23



Line Graph

Change in Flow Rates in Feet Per Second of Rock Creek Before, During and After a Storm

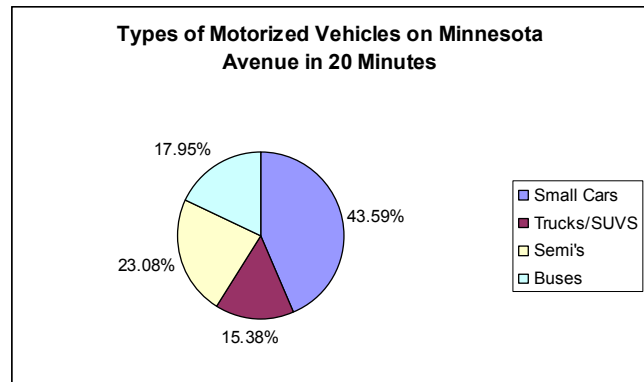
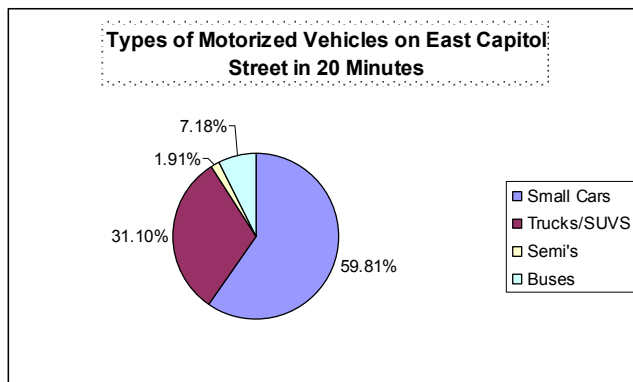
	0	10	20	30	40	50	60	70	80
Trial One	3	5	10	20	25	28	28	25	15
Trial Two	4	8	12	22	27	30	29	22	20
Trial Three	1	5	15	23	23	22	18	14	10



Pie Graphs

Capitol Hill- East Capitol Street		
	Amount	Percent
Small Cars	125	59.81%
Trucks/SUVS	65	31.10%
Semi's	4	1.91%
Buses	15	7.18%
Total	209	

Anacostia- Minnesota Avenue		
	Amount	Percent
Small Cars	85	43.59%
Trucks/SUVS	30	15.38%
Semi's	45	23.08%
Buses	35	17.95%
Total	195	



*Notes

- Don't get discouraged! Try different ways of graphing to find the most effective way of illustrating your results.
- Type up your process. Show how different calculations resulted in different charts and graphs. Make sure to include the graphs and charts in your write-up.

Save your results to your disk and print a copy for your teacher or student coordinator. You will want to have access to this later when it is time to finish your research paper and create your Display Board.

Congratulations you have completed your Data Analysis!

Due: _____