Graphing Bayouside Classroom Data

Grade Level
6-12

Duration
1 or 2 class periods

Subject Area
Science and Math

Setting
Classroom

Extension Areas
Statistics

Vocabulary
none

BTNEP Connection
Water Quality

Focus/Overview

This activity allows students to answer questions about their environment using data collected during water sampling.

Learning Objective(s)

The learner will

- be able to use pictures to report water quality data
- be able to question, examine, and test hypotheses
- be able to evaluate the relationships between water quality parameters

Louisiana Grade Level Expectation(s)

5; GLE-28 Math	Use various types of charts and graphs, including double bar graphs, to organize, display, and interpret data and discuss patterns verbally and in writing (D-1-M) (D-2-M) (P-3-M) (A-4-M)
5; GLE-29 MATH	Compare and contrast different scales and labels for bar and line graphs (D-1-M)
5; GLE-30 MATH	Organize and display data using spreadsheets, with technology (D-1-M)
6; GLE-29 MATH	Collect, organize, label, display, and interpret data in frequency tables, stem and leaf plots, and scatter plots and discuss oatterns in data verbally and in writing (D-1-M)
6; GLE-30 MATH	Describe and analyze trends and patterns observed in graphic displays (D-2-M)
6; GLE-31 MATH	Demonstrate an understanding of precision, accuracy, and error in measurement (D-2-M) (M-2-M)
6; GLE-32 MATH	Calculate and discuss mean, median, mode, and range of a set of discrete data to solve real-life problems (D-2-M)
7; GLE-23 MATH	Demonstrate an intuitive sense of comparisons between degrees Fahrenheit and Celsius in real-life situations using common reference points (M-5-M)
7; GLE-31 MATH	Analyze and interpret circle graphs, and determine when a circle graph is the most appropriate type of graph to use (D-2-M)
7; GLE-32 MATH	Describe data in terms of patterns, clustered data, gaps, and outliers (D-2-M)
7; GLE-33 MATH	Analyze discrete and continuous data in real-life applications (D-2-M) (D-6-M)
7; GLE-35 MATH	Use informal thinking procedures of elementary logic involving if/then statements (D-3-M)

7; GLE-37 MATH	Determine probability from experiments and from data displayed in tables and graphs (D-5-M)
8; GLE-34 MATH	Determine what kind of data display is appropriate for a given situation (D-1-M)
8; GLE-35 MATH	Match a data set or graph to a described situation, and vice versa (D-1-M)
8; GLE -38 MATH	Sketch and interpret a trend line (i.e., line of best fit) on a scatterplot (D-2-M) (A-4-M)(A-5-M)
8; GLE -39 MATH	Analyze and make predictions from discovered data patterns (D-2-M)
9; GLE-29 MATH	Create a scatter plot from a set of data and determine if the relationship is linear or nonlinear (D-1-H)(D-6-H)(D-7-H)
10; GLE-22 MATH	Interpret and summerarize a set of experimental data presented in a table, bar graph, line graph scatter plot, matrix, or circle graph (D-7-H)
8; GLE- 9 Sci. Inq	Use computers and/or calculators to anaylize and interpret quantitative data (SI-M-A3)
8; GLE-13 Sci. Inq	Identify patterns in data to explain natural events (SI-M-A4)
8; GLE-17 Sci. Inq	Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)
9-12; GLE-Sci Inq	Write a testable question or hypothesis when given a topic (SI-H-A1)
9-12; GLE-Sci Inq	Utilize mathematics, organizational tools, and graphing shills to solve problems (SI-H-A3)
9-12; GLE-Sci Inq	Write and defend a conclusion based on logical analysis of experimental data (SI-H-A6) (SI-H-A2)

Materials List

- access to the internet
- computers with graphing software or
- graph paper and colored pencils

Background Information

Graphs are picture representations of data that has been collected. Graphs have become very important in business, the media, and science. People use graphs in everyday life to communicate ideas. Knowing how to make a graph and convey ideas and results visually has become just as essential as knowing how to read a graph. There are many reasons that graphs have become a popular method of presenting data to audiences. The following list is are just some of the reasons people use graphs.

- They are quick and direct while providing the same amount of information as a table of numbers.
- They can easily highlight really important information.
- They promote better understanding of data.
- They can be more convincing than a list of numbers.
- They leave a lasting impression.

Creating a graph that conveys the message we want it to well can be difficult. By keeping the following rules in mind while making a graph will help to ensure that the graph will accurately represent its message. A graph that is made well will . . .

- be easy to read.
- have a title and a label.
- be relevant to the information presented in the text.
- be uncluttered and simple to read.
- represent the data accurately.
- be done so any trends or differences in the data are clear.

There are many types of graphs that can be used to represent data. Some of the most popular types include line graphs, bar graph, scatter plot graphs, pie charts, and pictographs. Each type of graph has different properties that make them better suited to some applications than others. Deciding which type of graph to use is critical to the success of the graph in conveying a message to the audience. Below is a table to help select the most appropriate type of graph. Blackline Master #1 is a chart that can be used to help make the decision about which graph is the best to use in different situations.

Advance Preparation

Review

Procedure

Graphing With Computers

- Discuss with students how often they see graphs in their daily lives. Have them name a few places where they often see graphs (e.g. newspapers, television, etc.) and what purpose are the graphs are serving.
- Have the students describe different types of graphs and how they are used (e.g. line graphs are used to show changes over time)
- Discuss with the students how scientists use graphs and how they use them. Do they make reporting the results of their research easier?
- Ask the students if they know what things are important to include on graph (labels, title, legend, etc).
- Explain to the students they will be using water quality data to make graphs. Tell them that the purpose of their graphs will be to educate other people about water quality parameters.
- Go to the Bayouside Classroom Website (www.lumcon.edu/bayousideclassroom) and explain what parameters are being measured by students in Louisiana.
- Tell the students that they will be graphing some of this data.
- Give each student or student group a copy of the “graphing data” worksheet and the “Types of Graphs” hand out (Blackline Master #1 & #2)
- Have them follow the steps in the worksheet so they know which data they need to make their graphs.
- Have each student or groups follow the step by step instructions for retrieving data from the Bayouside Classroom website.
- Once the students have retrieved their data have them follow the instructions for getting data into Excel (Blackline Master # 3).
- Have the students look through their data and correct or delete the data they do not need. When they are done with this step they should have a data set that is clear and easy to use.
- Have the students identify replicates and do some mathematical analysis (e.g. mean, mode, etc).
- Students should then be able to make their graphs. Instructions on how to graph using Excel are provided in Blackline Master # 4
- Once the students are done with their graphs have them write a short summery about their graphs.

Each student summery should contain:

- A brief explanation of the graph.
- Why they used a certain graph type to represent their data.
- If the student observe patterns in their graphs.
- If the students see relationships among parameters.

Graphing without Computers

- Discuss with students how often they see graphs in their daily lives. Have them name a few places where they often see graphs (e.g. newspapers, television, etc.) and what purpose are the graphs are serving.
- Have the students describe different types of graphs and how they are used (e.g. line graphs are used to show changes over time)
- Discuss with the students how scientists use graphs and how they use them. Do they make reporting the results of their research easier?
- Ask the students if they know what things are important to include on graph (labels, title, legend, etc).
- Explain to the students they will be using water quality data to make graphs. Tell them that the purpose of their graphs will be to educate other people about water quality parameters.
- Go to the Bayouside Classroom Website (www.lumcon.edu/bayousideclassroom) and explain what parameters are being measured by students in Louisiana.
- Tell the students that they will be graphing some of this data.
- Give each student or student group a copy of the "graphing data" worksheet, the "Types of Graphs" handout, and a copy of the data set retrieved from the website (Blackline Master #1 & #2).
- Have them follow the steps in the worksheet so they know which data they need to make their graphs.
- Have the students look through their data and correct or cross out the data they do not need.
- Have the students identify replicates and do some mathematical analysis (e.g. mean, mode, etc).
- Students should then be able to make their graphs. Handout graph paper and colored pencils.
- Once the students are done with their graphs have them write a short summery about their graphs.

Each student summery should contain:

- A brief explanation of the graph.
- Why they used a certain graph type to represent their data.
- If the student observe patterns in their graphs.
- If the students see relationships among parameters.

For each graph:

- Remind students of what makes a good graph and ask them whether each graph meets those basic guidelines.
- Ask the students if each graph accurately represent the data.
- Ask the students whether another type of graph would have changed the "message" of the graph or the way they perceive the data.

Blackline Master(s)

- Types of Graphs handout – Blackline Master #1
- Graphing Data worksheet – Blackline Master #2
- Getting Data into Excel – Blackine Master #3
- Graphing Data in Excel – Blackline Master# 4
- Provided Data Set – Blackline Master #Retrieving Data from the Bayouside Classroom database – Blackline Master # 5

Assessment(s)

- Use the graph produced by the students and the commits of other student to assess student understanding of graphing.
- Have the students explain what the R2 value means for their data.

Resource(s)

LUMCON's Bayouside Classroom Website and Student Database – www.lumcon.edu/bayousideclassroom

Type of Graph	Description	Uses	Advantages	Disadvantages	Variations	Notes
Line Graph	Have 2 axes. The x-axis (independent variable) often measures units of time. The y-axis (dependent variable) indicates quantity or percentage. The line created shows how the 2 variables are related.	1. It is used to show a change in direction of a relationship as the independent variable changes.	1. Simple to read/understand. 2. Shows specific data well. 3. Reveals trends and relationships 4. Compares trends in different groups.	1. Inconsistent scales can reveal trends or relationships that are not true. 2. Multiple lines on a graph can become confusing. 3. Difficult to determine exact values on the graph.	1. Area line graphs 2. Surface graphs	1. Shares the same purpose as bar graphs, however, they show a change in direction and not magnitude.
Vertical Bar Graph	Have 2 axes. The x-axis is labeled with the categories or numbers. The y-axis is labeled with the scale. The height of the bar represents the number of units or observations of a category or value.	1. It is used to show a difference in magnitude of categories or through time. 2. Describes the relationship of several variables all at once.	1. Great for comparing data. 2. Simple to read/understand.	1. Very hard to read if too many things are compared. 2. Inadequate room to label categories.	1. 3-D bar graphs 2. 3-axis bar graphs 3. Stacked bar graphs 4. Line/Bar graphs 5. Histograms 6. Pictograms	n/a
Horizontal Bar Graph	Have 2 axes. The x-axis is labeled with the categories or numbers. The y-axis is labeled with the scale. The length of the bar represents the number of units/observations of a category or value.	1. It is used to compare quantities in different categories or through time. 2. Describes the relationship of several variables all at once.	1. Great for comparing data. 2. Simple to read/understand. 3. More room to label categories.	1. It is easy to compare to many things (can get very hard to read).	1. 3-D bar graphs 2. 3-axis bar graphs 3. Stacked bar graphs 4. Line/Bar graphs 5. Histograms 6. Pictograms	When comparing more than 9-10 variables, consider using a line graph instead.
Scatter Plot	Have 2 axes. Both axes (x and y) represent a range of values. Data points are plotted according to x/y values and are not joined. The resulting pattern is used to establish the type and strength of relationships. Can be used to predict the reactions of one variable if the other were to change.	Will illustrate various patterns and relationships: 1. Data correlation (types and strength of inner relationships) 2. Positive or direct relationships 3. Negative or inverse relationships 4. Scattered data points 5. Non-linear patterns 7. Spread of data 8. Outliers	1. Clearly shows data correlations (positive, negative, strong, or weak relationships). 2. Illustrates non-linear patterns. 3. Shows spread of the data and outliers. 4. Can show atypical relationships. 5. Used for data extrapolation and interpolation.	1. Too few points can lead to skewed extrapolation and interpolation. 2. Hard to determine exact values for data points. 3. Error bars can make graph hard to read. 4. Cannot show the relationship between more than two variables at once.	None	n/a
Pie Chart	Circles divided into different slices to represent various categories. The size of each slice represents the proportion of each category for the whole dataset.	1. Summarize categories or percentile data from the “whole”	1. Excellent visual concept of the “whole”. 2. Easy to compare different components to each other. 3. Easy to label, with lots of space.	1. Difficult to compare one pie chart with another since the “wholes” may be different. 2. Too many segments can make the chart impossible to read. 3. Difficult to understand without labels. 4. Hard to show error values.	1. 3-D Pie chart 2. Doughnut graph	Bar graphs communicate the same message and can be easier to read.

Blackline Master #2

Graphing Data Worksheet

What parameter or parameters are you going to graph?

Are you going to compare parameters over time (temporal comparison), by location (spatial comparison), or compare 2 parameters together?

What data are you going to need to make your graph?

Is there enough data supplied in the data set for you to make a graph?

Do you have too much data to put on one graph? Is there any way for you limit the amount of data without losing your message?

What kind of graph will most accurately represent the data?

Do you have to do any math calculations to complete your graph?

What title and labels will help your audience to understand your graph?
Title:

X axis label:

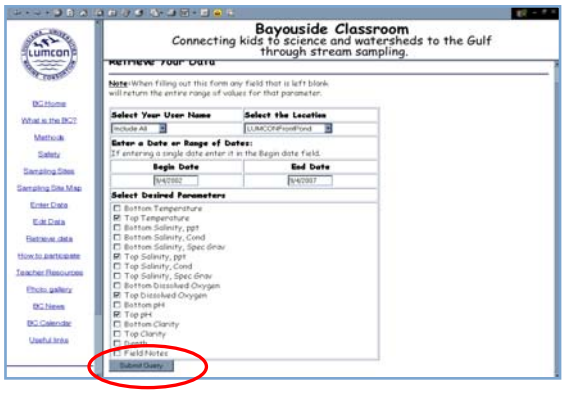
Y axis label:

Do you need a legend to help people read your graph?

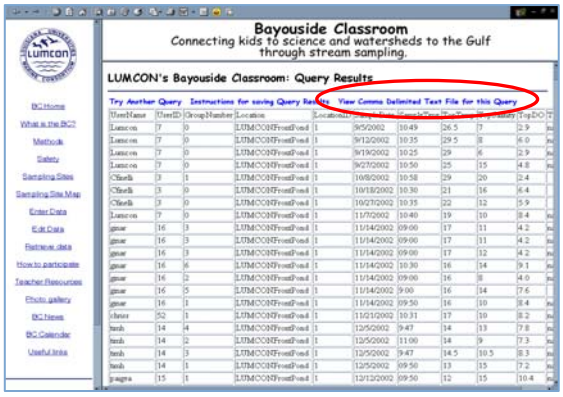
Retrieving Data From the Bayouside Classroom Website and Importing Data into Excel

Step 1: Go to the Bayouside Classroom Website (www.lumcon.edu/bayousideclassroom) and select "**Retrieve Data**" from the menu on the left side of the page.

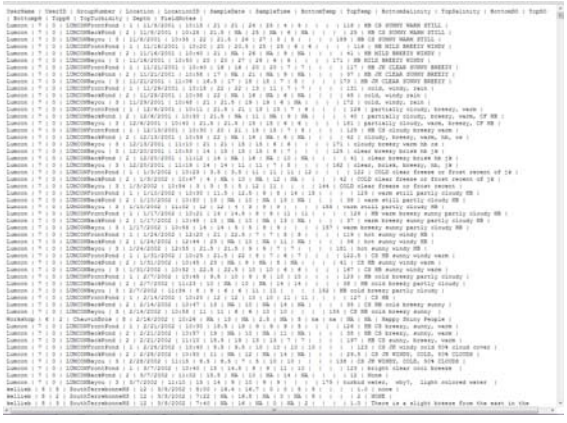
Step 2: Select the data that you are interested in from the "**Retrieve Data**" page. Click the "**Submit Query**" button to get the data.



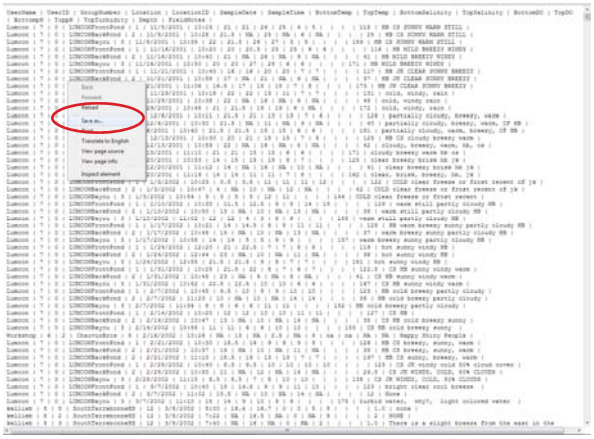
Step 3: Next click on the "**view delimited text file for this query**" link near the top of the page.



Step 4: This will display the data in a text file with all the data separated by vertical bars.



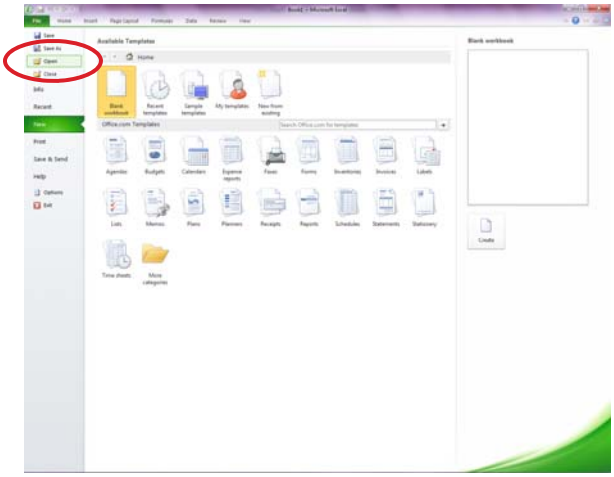
Step 5: Right click on the newly created text file and select "**Save as. . .**". Save the text file under a name and location that you will remember.



You are now ready to put these data into Excel.

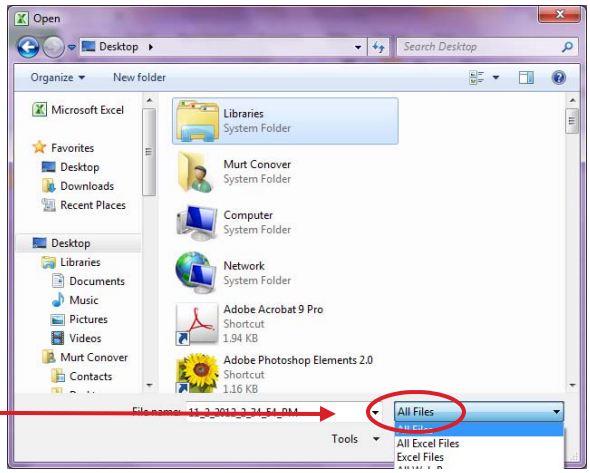
Getting Data Into Excel

Step 1: After opening Excel click on "**File**" and then select the "**Open**" option.

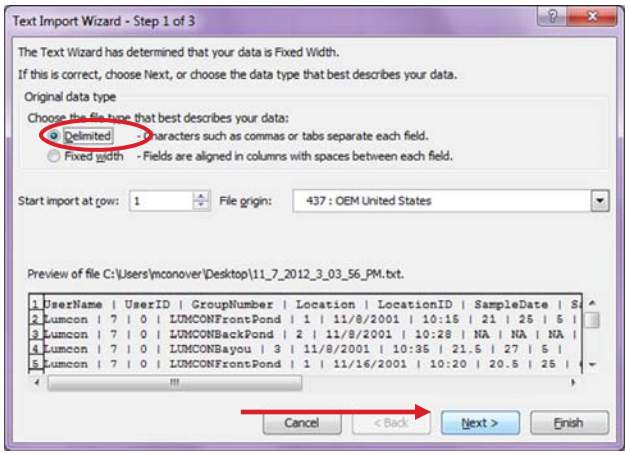


To find your text file, you'll have to choose the option to view "**All Files**".

If you do not do this then you will not be able to see your file.



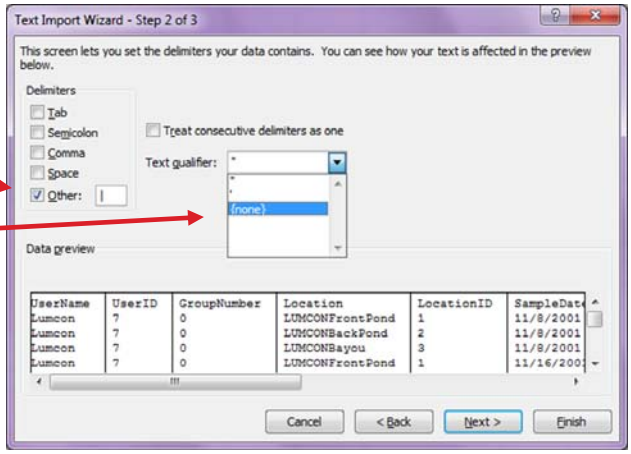
Step 2: Import Wizard - Step 1 of 3: When the wizard opens, select "**Delimited**" for the file type. Click on "**Next**".



Step 3: Import Wizard - Step 2 of 3: Select the "**Other**" delimiter option. In the box please inset a vertical bar symbol. The key for this symbol is located above the enter key on your keyboard.

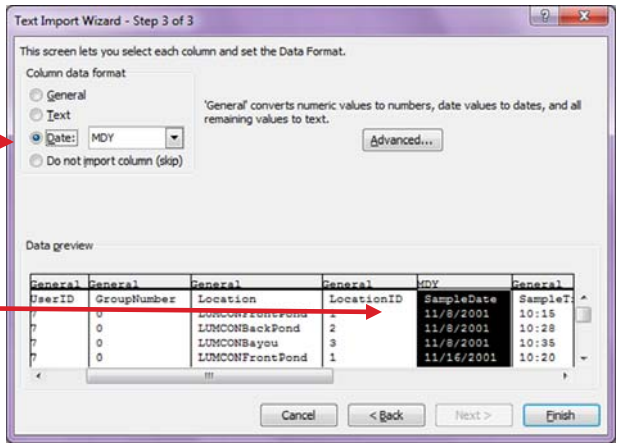
Select "**None**" as the text qualifier.

Click on "**Next**".

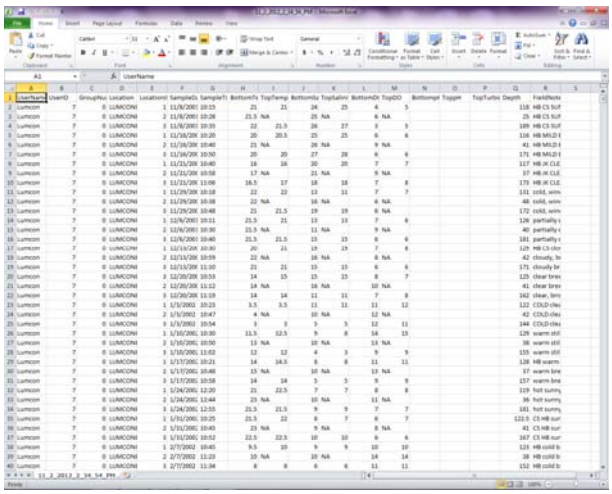


Step 4: Import Wizard - Step 3 of 3: Highlight the sample date column in the window and select "**Date**" from the column data format box and select "MDY" . Leave the rest of the columns as general format.

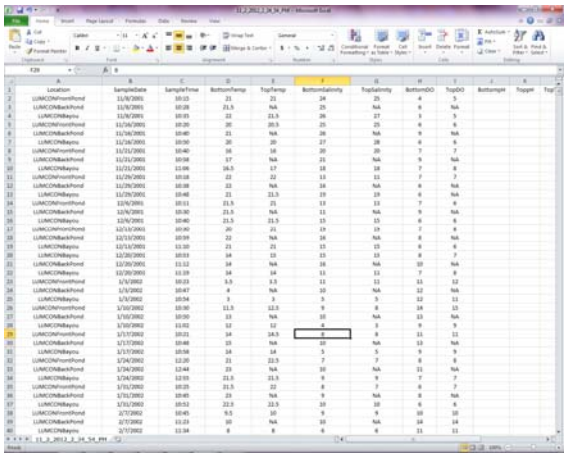
Click on "**Finish**".



Step 5: All the data should appear in the Excel spreadsheet.

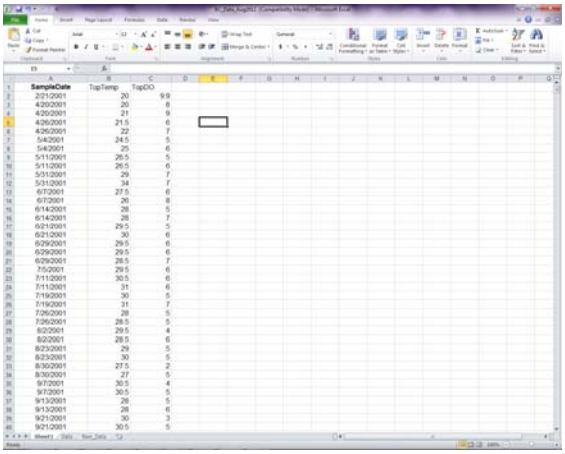


Working with Bayouside Classroom Data in Excel

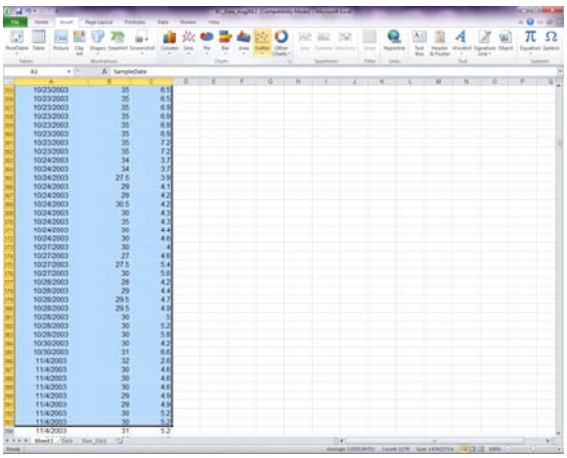


Step 1: Now that the data have been imported you can start organize the data and get rid of those that you do not need.

The data may need to be "cleaned-up" by getting rid of all data points with NA in the cells, taking out units when they are included, etc.

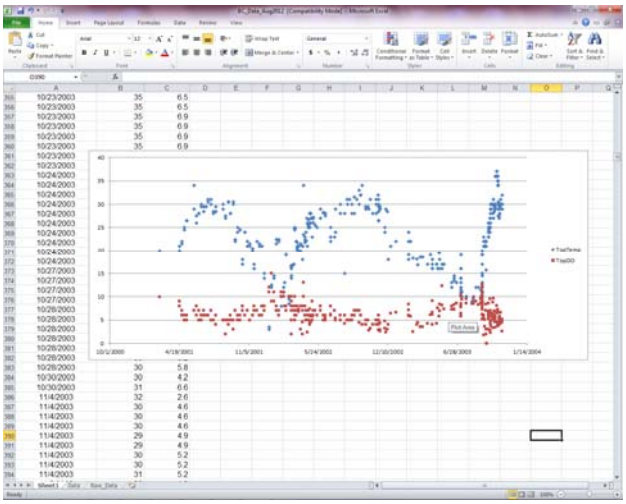


Step 2: Once you have the data set you need you can start to graph data.



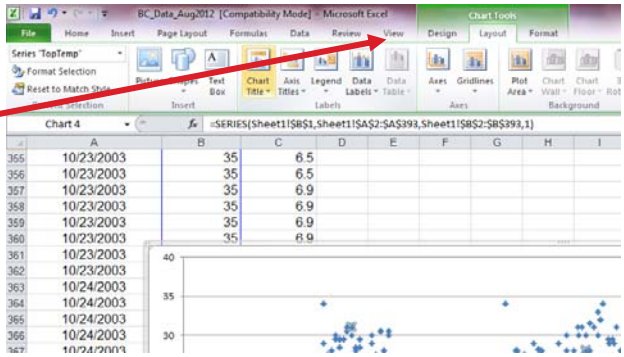
Step 3: To graph data highlight the data you want on your graph. Click on the "**Insert**" tab at the top of the page. Select the type of graph you want to make.

Step 4. A graph should appear within your work-sheet. Make sure that graph is type that you have chosen is a good representation of the data.



Step 5: Use the “Chart Tools” tabs at the top of the page to format your graph, add titles, and add trend lines.

Be sure while you are formatting that you keep in the elements required to insure you have a “good” graph.



ALL DONE!