

Elaborate: How do you construct a box and whisker plot to compare data sets?

Name _____ Class _____ Date _____

Background: Once data has been collected as part of a scientific investigation, how does a researcher determine if that data supports or does not support the proposed hypothesis? When comparing two or more data sets, researchers will generally go beyond generating a simple scatter plot to determine if there is a difference between data sets. The purpose of this activity is to use an example air quality research data set to demonstrate how to perform some basic statistical analysis and use the construction of a box and whisker plot to graphically represent the results of that statistical analysis.

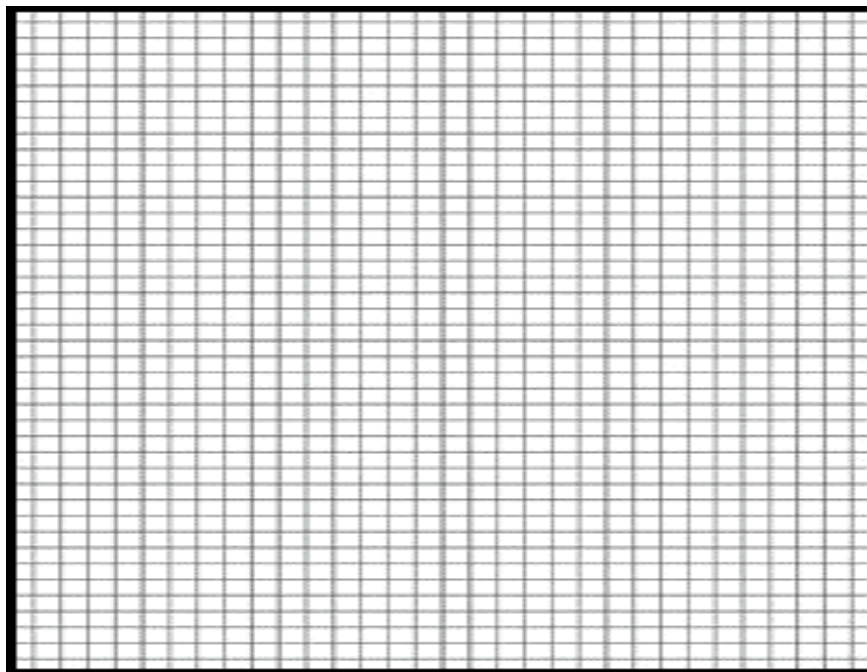
1. Student researchers want to investigate the research question, will there be a difference in $PM_{2.5}$ levels between the bacon cooking methods of frying and broiling? After doing some background research, the students devised the following hypothesis: *if the bacon preparation methods of frying and broiling are compared, then $PM_{2.5}$ levels will increase more during frying than with broiling.* The students design and conduct an experiment comparing $PM_{2.5}$ levels between frying and broiling bacon. The following $PM_{2.5}$, $\mu g/m^3$, data was collected:

Time(min)	Fry ($PM_{2.5}$)	Broil ($PM_{2.5}$)
1	135	108
2	143	110
3	112	115
4	135	125
5	137	130
6	191	145
7	190	149
8	141	150
9	192	161
10	160	185
11	106	190
12	125	195
13	107	190
14	138	187
15	159	175
16	193	150
17	185	135
18	147	130
19	133	120
20	182	111
21	119	110

2. Does this data set support or refute the students' hypothesis? Explain.

3. Use the data on the previous page to construct a scatter plot graph comparing the $PM_{2.5}$ levels over time for frying bacon and broiling bacon. Be sure your graph has all of the properties of a properly constructed graph.

Graphs that are to be submitted digitally on this pdf must be constructed on another platform—Microsoft Word or Excel or Google docs or sheets. It is easiest to insert these constructed objects into a pdf when the pdf is opened in **Adobe Acrobat Reader**. To insert a graph in this pdf, copy the constructed object from the original platform using the Copy function or the snipping tool. In Adobe Acrobat Reader, open the *Stamp* tool from the right side tool bar. The *Stamp* commands will now appear on the upper tool bar. Click on *Stamp*, then click on *Paste Clipboard Image as Stamp Tool* from the bottom of the opened menu. The cursor will now appear as a stamper. Move the stamper to the center of the coordinate system below and left click. The pasted object can be moved or re-sized by left clicking on the object.



Does this graph support or refute the students' hypothesis? Explain.

4. Is your response to question 3 similar to your response to question 2? Why or why not?

5. Use Microsoft Excel or Google Sheets to perform basic descriptive statistics on your data set (your instructor will provide resources to assist you with this task). For the purpose of this activity, focus on the **mean**, **median**, **mode**, and sample **variance**. Copy the values for the mean, median, mode and sample variance into the data table below then research the terms and define them in the last column of the data table.

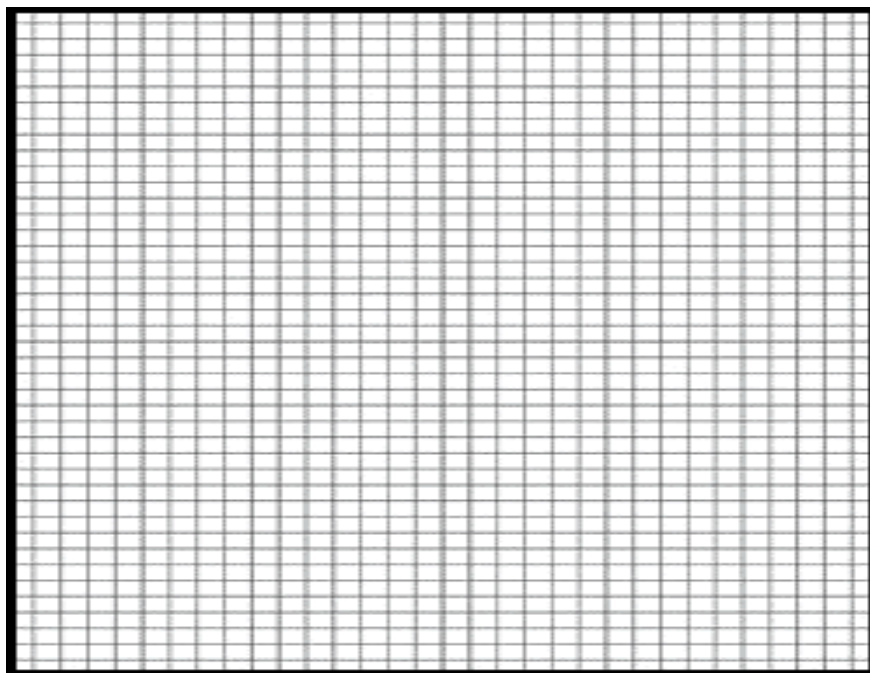


Data Table: descriptive statistics values for bacon cooking method example

Statistical Parameter	Value for Frying	Value for Broiling	Definition
Mean			
Median			
Mode			
Variance			

6. Based on the values of these variables, is the students' hypothesis supported or refuted? Explain.

7. A graphical method used to represent several of the statistical values mentioned in step 5 is to construct a box and whisker plot. Your instructor will provide resources that will help you construct a box and whisker plot using either Microsoft Excel or Google Sheets. Construct a box and whisker plot using the bacon cooking method data from step 1. Examine the resulting box and whisker plot and research to explain how the box and whisker plot is related to the descriptive statistics you defined in step 5.



8. Does the box and whisker plot support or refute the students' hypothesis? Explain.

Teacher Comments: