Exploring How Shape Affects Measures of Center

Using several graphical representations, you will explore how changing a data value can affect the graph.

Claire has nine quiz grades for the first nine weeks in AP Statistics. Mrs. Overstreet has just announced that the class will have one more quiz. Claire wants to see how the grade of this quiz could affect her quiz average. She also wants to examine a histogram and boxplot and see how this grade would change the graph of her grades. So far she has the following grades: 95, 88, 85, 71, 84, 89, 90, 88, and 81.

1. Enter the data into a list and name it **qzgrades**.

2. Insert a *Data & Statistics* page and select **qzgrades** for the horizontal axis. Then change the window to X_{min}: 68, X_{max}: 102.

3. Change the layout of this page to a top/bottom layout and add another *Data & Statistics* page. On this page select **qzgrades** for the horizontal axis and change the graph to a box plot. Change the window settings to match the horizontal axis of the dot plot.

Using the boxplot, list the five number summary. Describe the boxplot. Are there any outliers? Verify this.

4. Increase the size of the dot plot section by arrowing over the line between the two sections until ⇕ appears. Click and hold then press the down arrow to change the size of the dotplot section.

5. While in the dotplot section, use the *PlotValue* function and type **mean(qzgrades)**.

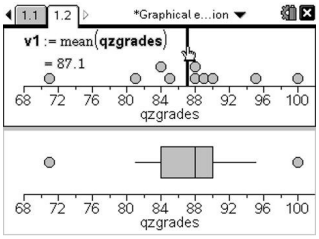
Compare the mean to the median.

6. In the *List & Spreadsheet*, add the value **100** to **qzgrades**.

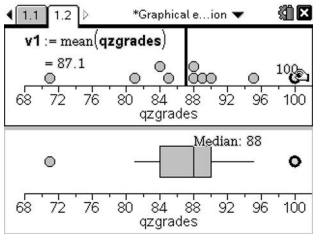
Describe what happened to the graphs and the measures of center when this value was added.

Now we want to explore what happens to these plots and their measures of center when extreme values are manipulated.

7. Go to the graphs page.



- Use the touchpad to move the cursor to the line in the dotplot that represents the mean. The ➘ should become ☝. Click [touchpad] and the value of the mean will be displayed.



- Arrow over to the point that represents 100. Click and hold [touchpad] until the hand closes, ✊, and the point should become highlighted. Drag this point toward the other quiz grades.

Describe what happens to the mean as you move the point. Does the mean stop changing? Explain.

Describe the changes (if any) in the dotplot and boxplot.

When does the median change?

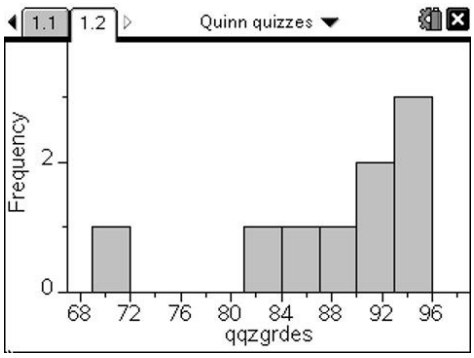
8. Press (ctrl) (esc) and the point will return to its original position. To "unhighlight" the point, arrow to a blank region in the graph and press [touchpad]. Now move the data point representing the 72 quiz grade to the right.

Describe the changes to the mean, median, and graphs.

How would you compare the mean and median in the presence of extreme values?

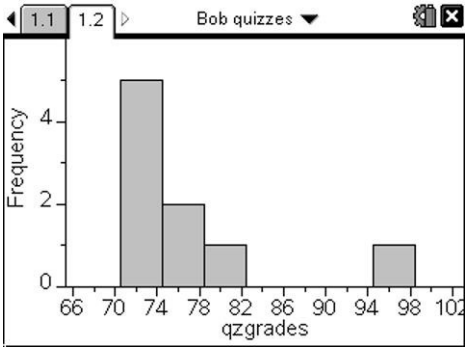
Now we will look at how the shape of the distribution affects measures of center. Two more students' quiz grades are given in the table below. The histograms of the grades are displayed for you on either side of the table.

Quinn's quiz grades



Quinn	Bob
95	72
92	72
93	73
88	72
91	71
95	76
86	78
82	80
70	97

Bob's quiz grades

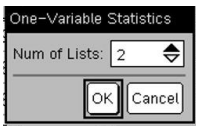


Describe the shapes of the distributions of Quinn's and Bob's quiz grades.

9. Put the quiz grades into your *Lists & Spreadsheet* page. Name them **quinnqz** and **bobqz**.

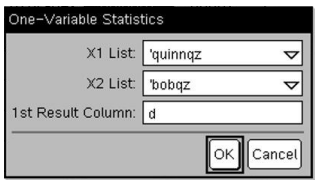
10. Calculate the summary statistics for both data sets. Both sets of summary statistics can be calculated at the same time.

    - Press (menu), *Statistics, Stat Calculations, One-Variable Statistics.*



    - In the first dialogue box, type 2 or press the up arrow. (tab) to [OK] and press (enter).

    - Select the options shown at the right, (tab) to [OK], and press (enter).



The one variable statistics should now be listed for both data sets.

How does the mean compare to the median in Quinn's distribution of quiz grades? Bob's distribution? Claire's distribution (with the 100)?

Mrs. Overstreet tells the students on their 2nd progress report she is only going to list a measure of center for their quiz grades. However, she will let the students choose the measure of center to represent their quiz grades.

Which measure would accurately represent the boys' quiz grades? Explain.

Bob wants to show his parents that he has improved since the 1st progress report which contained the first 5 quiz grades. Which measure should he choose? Explain.