Got a Minute?

An activity that gathers and analyzes student-generated data to extract the 5-Number Summary and use it to create a Box Plot both by hand and using the TI NSpire handheld.

NCTM Standards Addressed:

Grades 3 - 5
>   Collect data using observations, surveys and experiments;
>   Represent data using tables and graphs such as line plots, bar graphs and line graphs;
>   describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed;
>use measures of center, focusing on the median, and understand what each does and does not indicate about the data set.

Grades 6 - 8
>   select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots;
>   find, use, and interpret measures of center and spread, including mean and interquartile range;
>   discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots.

Set-Up and Running of Activity:

Instructor will need a watch or clock with a second hand and a class set of TI-NSpire handhelds.

Students will need the activity sheets, some paper and a pencil.

Instructor may do one or all of the activities, but use just one to generate the summary and box plot.

Depending on the activity used to generate the data; ensure students have room to move without injury to themselves or others.

Students are frequently confused about what numbers are used to find the Upper and Lower Quartiles. If the Median is an actual data point, it is 'removed' from the data string and the quartiles use the remaining data points on either side; but if the Median is derived, the two data elements used to derive it *remain* and become the upper and lower elements for the lower and upper quartiles, respectively.

Suggested Added Topics and Follow-On Questions

        Students should see the Box Plot as a tool and not a terminal depiction of the data. To that end, some questions about the arrangement of the plot should get the students thinking about how the data is grouped:

1.   Are the Quartiles (and Median) close together? widely separated? evenly spaced with regard to each other and/or the Minimum and maximum?
> **a.**   How many of the data elements fall on the left "whisker?" The right?
> **b.**   How much of the data falls inside the "box?"

2.   Regards the Interquartile Range:
> **a.**   Looking for Outliers:
>> **i.**   To find if (and where) outliers exist, multiply the IQR by $\frac{3}{2}$.
>>> **1.**   *Subtract* the result from the lower quartile to find low outliers; (Elements below this number are outliers)
>>> **2.**   *Add* the result to the upper quartile to find high outliers; (Elements above this number are outliers)
>>> **3.**   If outliers are found, adjust the minimum (or maximum) to the first element after (or last element before) the outlier.
>>> **4.**   Ideally this is done before the generation of the box plot.

3.   Students may wonder about very small, or very tightly packed data sets. It is possible that the lower or upper quartiles may coincide with the minimum or maximum values. Or for the median to be co-located with the lower or upper quartiles. Should any of these occur, the graph depiction is altered appropriately, but the "shared location" is labeled with both values.

4.   This activity can also used as an introduction of the distribution curve and the calculation of variance, standard deviation, and z-scores.