Lesson Plan 2:
Box plot

Subject: Mathematics

Course/Grade: 6-8

Objectives/Outcomes:
- Research data from their favorite NFL player, current or historical. Wide receivers, running backs, and quarterbacks with more than 5 seasons of play will qualify for this project.
- Create box-and-whisker plots for the statistics of their favorite NFL players, correctly identifying scales, labels, and a title.
- Describe in words the trends of the graph. What are the shape, center, and spread of the box-plots? Calculate the mean, median, and mode of the distribution.
- Using the box-plots created, compare players of the same position by year and career. Which players performed at the highest level in one season? Which players performed at the highest level over the course of a career?

Curriculum Framework Standard(s):
- MCAS (Standard 8.D.2, 8.D.3)
  - Select, create, interpret, and utilize various tabular and graphical representations of data; e.g., circle graphs, Venn diagrams, scatter-plots, step-and-leaf plots, box-and-whisker plots, histograms, tables, and charts. Differentiate between continuous and discrete data and ways to represent them·
  - Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.

Procedure:
1. **"Frontloading" (Before)**
   a. Preparation & Planning
      i. For either homework or a class opener, have the students research their favorite NFL player. For those unfamiliar with the NFL, a list of players may be provided and/or assigned.
      ii. Explain to students that they will be discussing how statistics of NFL players can be analyzed.
      iii. Students could find the following (all of which can be accessed via www.nfl.com)
         1. Name
         2. Position
         3. Number of years playing in the NFL
         4. Write down the number of rushing yards (running backs), receiving yards (wide receivers) or passing yards (quarterbacks) for each season during which the player competed. Make sure students only fill out one statistic, as opposed to mixing the combinations of rushing and receiving yards.

2. **Assistance and Associations (During)**
    a. Have the students find the mean, median, mode, minimum, maximum, and range for the data set.
    b. Explain the idea of an outlier and have students point out if there are any outliers in their data and possible explanations for why they exist.
    c. Create a box-plot, with accurate scaling and labeling. A quarterback scale could go from 0 to 5,000, while the running backs and wide receivers should go from 0 to 2,500.
    d. After one box-plot and calculations have correctly been made, the student could research up to 3 more players at the same position (they do not have to be Patriots players). Calculations should be made for the mean, median, mode, minimum, maximum, and range for the data set. The box-plot should be made and placed directly above or below previous box-plots.

3. **Reflection & Readiness for Application (After)**
    a. To conclude, each student could write one paragraph summarizing his or her results. Here are some questions to consider – of the players researched, which gained the most yards, and how do you know? Which player had the highest median? The highest maximum? Which player had the greatest range?
    b. Split the students into virtual groups by the position of the player they picked. In other words, have all the students that chose a quarterback meet virtually, etc. Within the groups, have the students pick which player is the best, not based on the name of the player, but on yards produced by the respective positional statistic.
    c. To extend the lesson:
        i. Some further ideas for analysis
            1. Students could research information about several more players, creating a paper as a potential extra credit assignment.
            2. Students could complete similar box-plot reports for other statistics in football
            3. Similar exercises would be useful for other sports: basketball and baseball would provide several statistics useful for analysis.