Is There A Home Team Advantage?

Angie Herron

Lab Partner: Chris Khedouri

South Carolina State Standards for Data Analysis:

II. Select and use appropriate statistical methods to analyze data.

A. **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.**
    1. **Describe the features of a data set, including measures of center, range, and outliers.**
B. **Use measures of center, focusing on the median, understand what each does and does not indicate about the data set.**
C. **Compare different representations of the same data and evaluate how well each representation shows important aspects of the data.**
    1. **Compare the different types of graphs (bar graph, line plot, line graph, and pictograph) to represent a given data set and explain the benefits of each.**

III. Develop and evaluate inferences and predictions that are based on data.

A. **Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions of predictions.**
    1. **Make and justify predictions based on data from a variety of applied situation.**
    2. **Consider alternative explanations to the conjectures formed on the basis of presentations of data and then design further studies to test the conjectures.**

Concepts:

Mean, Median, Mode, Range, Outliers, Measuring with the metric system, graphing

Background Information:

<u>Measures of Central Tendency</u>

(Suppose we have a sample with 4 observations: 4,1,4,3)

Mean – The sum of a set of numbers divided by the number of observations.

Example: 4+1+4+3= 12/4= 3

Median – The middle point of a set of numbers (for odd numbered samples).

The mean of the middle two points (for even samples).

Example: 1,3, 4, 4= 3+4=7/2= 3.5

Mode – The most frequently occurring number.

Example: Mode= 4 (4 occurs the most).

Measures of Variation

Range – The maximum value minus the minimum value in a set of numbers.

Example: 4-1=3

Standard Deviation – The average distance a data point is away from the mean.

Hints for calculation:

1. Standard Deviation: compute the difference between each data point and the mean. Take the absolute value of each difference. Sum the absolute values. Divide this sum by the number of data points.
2. Median: first arrange the data points in increasing order.

Materials needed: chart paper, graph paper, wastebaskets, paper, soccer balls, and footballs

Engage

Have students think back to the first unit we did on statistics when the students discussed what their favorite sports are. Ask them to tell you everything they know about how data is collected about sports. They may need help with this so you can get them started by talking about batting averages in baseball, percentage of free-throw shots made in basketball, number of games won on the road compared to the number of the games won at home in almost any sport, etc.

After this discussion has taken place and the students ideas about how we record statistics in sporting events have been written down on chart paper, let the students know that we are going to take some statistics of our class during sporting events. The sporting events the students will be involved in are paper basketball, soccer, and football. All of the students will participate in each event.

Exploration

Have the students begin with the paper basketball event. Students will be placed in groups of 4. Each basket will be placed 8-9 ft from the marked foul line for each group. Students will measure this distance with their group. Students will get three practice shots each with throwing the paper ball at the basket. Once their practice shots are through students will each throw the paper ball at the basket 10 times per person. Students will record the number of shots made per person within the group.

Explanation

After each group has completed the task of completing the 10 shots and recording the data, meet back as a class to discuss the group's findings. List the student's names and the number of shots each student makes in each group. Introduce the students to how to find the mean of a set of data. Calculate the mean for each group. Introduce the students to how to find the range of the data. Find the range for each group. Introduce the students to how to find the median. Find the median for each group. Introduce the students to how to find the mode. Find the mode for each group. Have the students repeat the basketball event this time having each person within the group taking 8 shots. Make sure each student records the amount of times they make the shot out of the eight possible shots. After each member of the group has taken eight shots have the groups figure out the mean, median, mode, and range for the data. Meet back as a class and have the students explain their findings. Make sure the groups use the new vocabulary: mean, median, mode, and range.

Exploration

Tell the students that their next challenge will be to see how far they can kick a soccer ball. Each student will get two practice kicks and then will record data for their following five kicks. This experiment will be done on the football field so their kicks will be measured in yards. (Depending on your students you could introduce how to convert yards into feet and feet into yards.) Have the students meet in their groups to devise a plan on the design for this experiment and how they can record their information. Have each group member predict how long he or she will be able to kick the soccer ball.

Before you take the students outside to execute their experiments, meet as a class to go over the procedures they have come up with in their groups. Explain to the students that each group member must participate and record how far they kicked the soccer ball each time. Each student will have to calculate the mean, median, mode, and range of their collected data. After each student has calculated this information, the group must also calculate the mean, median, mode, and range for their group's data.

Explanation

After the students have had enough time to finish collecting their data and calculating their individual statistics, as well as their group's statistics, take the students back into the classroom to discuss their findings. Have the students report all of their group's statistical findings: the mean, median, mode, and range. During this discussion you can have the students explain in their own words how to find the mean, median, mode, and range.

Ask the students to take a few moments and think about what might have affected the outcomes of the mean, median, mode, and range. This is a great opportunity to discuss outliers, as well as other variables that may have affected their outcomes. You may also want to talk about which one of these statistical distributions best represents their data.

You can also talk to your students about how they would be able to graph this information. What type of graph would be the most appropriate and why?

Elaboration

Discuss the theory that athletic teams do better when they play at home. Talk about what some of the advantages of playing at home might be.

- Number of points scored
- Number of fouls called against their team
- Number of games won at home

After the discussion ask the students if they believe in the theory of the home team advantage. Have them commit to an outcome. Have the students work in pairs in order to research a professional athletic team on whether or not the theory of the home team advantage exists. Give the students ample time to research the team of their choice. In order to figure out if the home team advantage exists for each athletic team that is being researched the students will look at the mean, median, mode, and range for the number of points scored during home games versus the number of points scored during away games, the number of fouls called against them during home games versus the number of fouls called against them during away games, and the number of games won at home versus the number of games won on the road. If the mean, median, mode, and range are of greater value during the home games than during the away games the theory of the home team advantage will be proven for those specific teams. If the mean, median, mode, and range are of a lesser value during the home games than the away games than this disproves the theory of the home team advantage for those specific teams.

Evaluation

The students will be expected to present the research and statistics that they have found on their specific athletic team to the class. They will have to discuss how they found the mean, median, mode, and range. They will also have to explain if their information supports or disproves the theory of the home team advantage. During this explanation they will have to use data to support their findings. You can also have the students talk about what variables might affect whether there is or is not a home team advantage.

The students will also participate in a football-throwing contest. This will again take place on the football field so the distance will be measured in yards. Tell the students to work in their groups in order to design an investigation to see if they can find a mean, median, mode, and range for how far they can throw a football. Each group must discuss their design for the experiment with the teacher before carrying out their experiment.

The students will carry out their experimental design in order to find the mean, median, mode, and range of how far their group can throw a football. Students will be expected to display their statistics, as well as explain how they found the statistics. The students will also be required to display their information in a graph and explain any variables that could have affected their outcomes. The students will present their projects to the class.