Box and Whisker Plots

Summary
Students will construct and analyze box and whisker plots

Main Core Tie
Mathematics Grade 6
Strand: STATISTICS AND PROBABILITY (6.SP) Standard 6.SP.4

Additional Core Ties
Mathematics Grade 6
Strand: STATISTICS AND PROBABILITY (6.SP) Standard 6.SP.5
Secondary Mathematics I
Strand: STATISTICS AND PROBABILITY - Interpreting Categorical and Quantitative Data (S.ID) Standard S.ID.1

Materials
- Linking Cubes
- Printed card with each term of analysis (minimum, maximum, quartile 1, median, quartile)
- Post it note for each student
- 2 pieces of colored paper and a dark marker for each team
- 8 envelopes
- rulers
- Survey
- scissors for each student

Background for Teachers
Enduring Understanding (Big Ideas):
Representing and analyzing data
Essential Questions:
How can we construct a box and whisker plot? What five terms of analysis are displayed on a box and whisker plot?
Why is a box and whisker plot useful in analyzing data?
Skill Focus:
Construct and interpret box and whisker plots
Vocabulary Focus:
Box and whisker plot, minimum, maximum, lower (first) quartile, upper (third quartile), outlier
Ways to Gain/Maintain Attention (Primacy):
Manipulatives, movement, visualizing, technology

Instructional Procedures
Starter:
How can we construct a box and whisker plot? What five terms of analysis are
What is the minimum? The maximum? The range?
About what would the median be for the data represented?
Lesson Segment 1: How can we construct a box and whisker plot? What five terms of analysis are shown on a box and whisker plot?
Do the Grab-A-Handful activity following the steps below:
Grab a Handful

Objective:
Students will explore mean, median, mode, and range through the use of Linking Cubes, Post-it Notes, physical movement, and will use the data to generate a box plot.

Skills Developed:
Students will develop an understanding of mean, median, mode, and range. Calculator skills: using a LIST and box plots.

Materials Needed:
Linking Cubes
Post-it Notes
Pencils
Graphing calculators

Activity:

Have each of the students grab a handful of linking cubes from a bag.

Give each student a Post-it Note to write down the number of blocks they could hold in their grab.

Have the students stack their blocks together in a tower.

Do some questioning to discover the least amount of blocks grabbed in the whole class. Have the student or students with that least amount stand on one end of the whiteboard with their block towers. Have the student hold the word, Min.

Work with the class to discover what the greatest amount grabbed was and have that student hold the word, Max.

Select 7 other students to come to stand with their towers where they fit between the least and greatest students. Have them in a single file line. (More learning can occur if 2 students with the same number and if a student whose number of cubes might be an outlier are selected.)

Have students discuss how they could find the median. Finding the median could be done by counting in from both ends of the line simultaneously. When you reach the center participant, the number of cubes they have is the median. If there are two participants in the center you must take the average of their cube amounts. Give the median student the word, Median, to hold up.

Now repeat the process using the minimum and the median. The center is the 1st quartile or lower quartile. Do the same with the median and the maximum to find the 3rd quartile or upper quartile. Give the student who is close to each a word sign to hold up.

Draw a number line horizontally on the bottom of the board. Write the minimum number of cubes on the left side of the number line, and number consecutively across the line. Build a line plot by having each standing student you selected place their Post-it Note above the number corresponding to the number of Linking cubes they had grabbed.

Using this line plot as a visual aid, the class can review median, 1st and 3rd quartiles, mode, and range. Draw a box plot above the Post-it note line plot.

When you have completed this, help students put the numbers from the Post-it notes in L1 on the TI-73 to make a box plot.

Turn the STAT Plot on and choose the box plot graph. Also, identify the list to be used.

Discuss with the students what the WINDOW should be set at for the data. An example setting for your WINDOW could be as follows:

Xmin = 0

Xmax = larger than your largest number

Ymin = 0

Ymax = 5

Graph the box and whisker plot and select TRACE to see the five terms of analysis . Compare this to the predictions the students made.

You may also want to go to STAT, CALC, 1-Var Stats, and the name of the list being used to show students how the calculator will generate the statistics for data entered into a list.

Box plots are excellent for comparing two sets of data. Have all the class members now bring their Post-It notes to the number line. Enter all the data into LIST and construct a second box plot to compare with the class sample done previously.

Have students discuss how they could find the mean number of cubes grabbed by their team members. This can be done by having them compare towers either giving or taking cubes so they have the same height of tower. Hold extra cubes aside and discuss what to do with them, i.e. divide them up among all participants. Now you can discuss the mean of the group by looking at their evened-out towers.

Lesson Segment 2: Why is a box and whisker plot useful in representing and analyzing data?

Remind students that a box and whisker plot shows five important terms of analysis. Though the mean or mode are NOT easily seen, the median can give us very useful information. A box plot is an excellent way to compare two similar data sets.

Complete the Mystery Plots activity steps below.

Mystery Plots

(Contextualized data line plots, box and whisker plots and measures of central tendency)

Materials needed: A survey for each student, scissors, 8 envelopes, 16 pieces of colored paper (8 different colors), 8 black markers, graphing calculators, rulers.

Directions:

Gathering data: Divide the class into 8 teams, # 1-8). Give each student the survey. Discuss the items on the survey. Have the students complete the survey *without sharing their answers with anyone*. Have students cut one box at a time. Ask a person from each group to collect and bring to you one little box (item response) at a time. Put the responses for the items in separate envelopes so that all the responses for # 1 are in an envelope (Write the item number lightly under the flap where no one can see it but you), the responses for #2 are in another envelope, etc. Once all the responses have been put into the envelopes shuffle the envelopes. Hand each team one envelope. Have a speaker on each team quietly read off the numbers for the group members to record. Ask them to make sure no one outside their team sees the numbers or hears their discussion.

Making line plots: Each group constructs a line plot on one piece of colored paper. They should NOT title the plot. Assign roles to help each person in the group to contribute. Examples of roles might be scribe, reader to look at the small papers and read off the numbers, and one or two organizers who will decide what how the table and plots should look. When completed, have the scribe and coach tape the two papers side by side on the wall.

Box and whisker plots Have each group construct a box and whisker plot using a graphing calculator and sketch it on the other piece of colored paper. The line plot can help students in seeing the minimum, maximum, median, and quartiles for the box plot.

The papers should be numbered with the team's number to identify which team created them. Have each team tape their two papers on the wall. All teams then do a Gallery Walk where they walk around and try to guess what data each of the teams was actually displaying. Students should write down the team's number from the graph they are looking at, what data they think is being represented, and why they think so.

Once the teams have had time to look and write their guesses, they return to seats and each team tells what data they were, in fact, representing.

Discuss the median, any outliers, and how they affected the median of the data, which plot represented which survey item and why they think so. Ideas about range, distribution, etc will evolve. This is a good time to compare the plots to see if any were somewhat similar in any way.

You may want the scribe from each group to bring the data list to the overhead to allow students an

opportunity to practice construction box and whisker plots. Have the scribe show the box and whisker plot his/her team constructed after the class has constructed their own.
Practice working with Box and Whisker plots: Look at p 591/10 McDougal Littell or other appropriate text practice for constructing box and whisker plots.

Assessment Plan

performance, questions, observation, examples

Bibliography

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