Breakfast Cereal – How Nutritious Is Yours?

A stem-and-leaf plot activity for middle school students.

Goals/Objectives:

Data Analysis and Probability Standard

Benchmarks grade 5-7

A. Read, create and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate.

E. Collect, organize, display and interpret data for a specific purpose or need.

F. Determine and use the range, mean, median and mode to analyze and compare data, and explain what each indicates about the data.

Indicators grade 7

1. Read, create and interpret box-and-whisker plots, stem-and-leaf plots, and other types of graphs when appropriate.

3. Analyze a set of data by using and comparing combinations of measures of center (mean, mode, median) and measures of spread (range, quartile, interquartile range), and describe how the inclusion or exclusion of outliers affects those measures.

Benchmarks grade level 8-10

A. Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.

C. Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data.
D. Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.

Indicators grade 8

1. Use, create and interpret scatterplots and other types of graphs as appropriate.

4. Compare two sets of data using measures of center (mean, mode, median) and measures of spread (range, quartiles, interquartile range, percentiles).

5. Explain the mean’s sensitivity to extremes and its use in comparison with the median and mode.

Rationale:

A stem-and-leaf plot is used to organize data into a table by showing each item in order. This makes it easy to recognize the median, mode, range, and any outliers. In a stem-and-leaf plot, you begin by separating the last digit (leaves) of each data value from the previous digits (stems) of each value. These two separate lists of values are then placed in order in a table. A back-to-back stem-and-leaf plot can also be created to compare two sets of data. In this type of plot, the same stems are used but two columns of leaves, one to the left and one to the right of the stem column are created. Each stem-and-leaf plot also contains a key for clarification.

Materials/Resources:

Student worksheets     calculator (optional)     chalkboard or overhead projector

10-15 boxes of assorted cereal or copies of nutrition panels from cereal boxes

Resources: Show-Me Center (http://www.showmecenter.missouri.edu/)

Trashketball video (http://www.mmmproject.org/data.htm)
Procedures:

Part I

1. Ask students for the name of their favorite breakfast cereal and have one student record the responses on the board.

2. Tell students that today they’re going to compare different breakfast cereals (theirs might be one of them) to find the most nutritious one for them. Ask them if anyone has seen the Total commercial (it compares how many bowls of other cereals you’d have to eat to equal the nutrition in their cereal).

3. Divide students into groups of 2-3. Have one person from each group get a box of cereal or nutrition panel sheet and take it back to the group. Have them discuss what they see. Point out that the facts are for one serving only. Ask them what would happen if they ate more than one serving.

4. Pass out the student worksheets to each student. Read through the directions with the students and ask if they have any questions before they begin.

5. The students will begin by collecting three different types of data from 10-15 different cereals. First they will look for calories per serving. Then they will choose two other measurable values, such as carbohydrates, sodium, protein or one of the vitamins. They will place these values in the table on their worksheet.

6. Discuss the data with the students. What did they find? Can we make any inferences about the data as written? Do you think we could rearrange it somehow to better interpret the data? How could we do that?

7. Explain that they’re going to construct a stem-and-leaf plot that will put their data
into a much more organized table that will allow them to compare data values.

Begin by having students place the calories per serving data in order from least to greatest. Next, have them separate the last digit of each data value from the other digits(s) with a vertical line. Explain that the last digit is the leaf and the first digit(s) is the stem. Demonstrate how to organize the data in column form with the stems on the left and the leaves on the right, making sure the leaves are in ascending order with space between each digit.

8. Monitor student work and encourage them to ask other students in their group for help as needed.

9. Once students have organized their data into a stem-and-leaf plot table, ask them what else needs to be included (they should say things like title, headers and key-if not, lead them in that direction). Monitor their progress as they include these items.

10. Discuss with students how they might find the mean, median, mode, range and outliers from their stem-and-leaf plot. Have students answer the questions on their worksheet.

**Part II**

11. The students will now use the data they collected on the other two measurable values to create a back-to-back stem-and-leaf plot. Explain to the students that this type of plot is very similar to the one they created previously. The only difference is that instead of placing leaves on only the right side of the stem, we can compare two sets of data by placing leaves on the left side of the stem as well. Ask students for suggestions on how that might look. Pose questions such as:
Can you put the leaves on whichever side you choose? and, What about the key?

12. Monitor progress as students complete this new plot. Again, encourage them to ask for help from their group as needed. When they have completed that task, have students answer the questions on the worksheet.

**Assessment:**

As a final assessment, students will write a letter to one of the cereal manufacturers explaining either why they would buy their cereal or why they wouldn’t buy their cereal based on their findings. Students should include facts they discovered about the product in comparison to other products in this lesson. The decision on whether to buy the cereal or not shouldn’t rely on taste or packaging alone. Remember, as consumers we want to get the best value for our money and stay healthy in the process!
## Breakfast Cereal - How Nutritious Is Yours?

### Student Worksheet

<table>
<thead>
<tr>
<th>Name of Cereal</th>
<th>Calories/Serving</th>
<th>Value #1</th>
<th>Value #2</th>
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</thead>
<tbody>
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<td>10.</td>
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</tbody>
</table>
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Student Worksheet

Ascending order of Calories/Serving:

Draw a Stem-and-Leaf Plot for the data collection.

Questions:

1. What does a stem-and-leaf plot tell you about the data that a single number like the range does not?

2. Does your data cluster around one data area, and if so, what would that be?
3. Which measure of central tendency (mean, median, or mode) best describes the data?
Explain your reasoning.

4. If you had found a data point far away from the “typical” data points, would that have changed your answer to #3, and if so, how? What would this “non-typical” point mean?

Ascending orders of value #1 and value #2:

Draw a back-to-back stem-and-leaf plot for value #1 and value #2.
Questions:

1. What does a back-to-back stem-and-leaf plot tell you that a regular stem-and-leaf plot can’t?

2. What conclusions about the data can you come to? Is there a correlation between value #1 and value #2? In other words, do both values seem to center around the same data area or does one stay high and the other low? What does this say about the nutritional value of cereal?

3. What could this type of plot be used for? Give specific examples.
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Student assessment

As a final assessment, you will write a one-page letter to one of the cereal manufacturers explaining either why you would buy their cereal or why you wouldn’t buy their cereal. This is to be based on your findings from the stem-and-leaf plots you created. Make sure you include some of the mathematical terms we discussed in this lesson. You should also include facts you discovered when comparing the different brands, and not base your decision on taste or packaging. Remember, as consumers you want to get the best value for your money and stay healthy in the process!