Statistics: Learning About Data

Strand: Probability and Statistics

Topic: Representing, interpreting, and comparing data displayed in line plots (dot plots) and stem-and-leaf plots

Primary SOL: **5.PS.1 The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on line plots (dot plots) and stem-and-leaf plots. Students will demonstrate the following Knowledge and Skills:**

a) Formulate questions that require the collection or acquisition of data.

b) Determine the data needed to answer a formulated question and collect or acquire existing data (limited to 30 or fewer data points) using various methods (e.g., polls, observations, measurements, experiments).

c) Organize and represent a data set using a line plot (dot plot) with a title, labeled axes, and a key, with and without the use of technology tools. Lines plots (dot plots) may contain whole numbers, fractions, or decimals.

d) Organize and represent numerical data using a stem-and-leaf plot with a title and key, where the stems are listed in ascending order and the leaves are in ascending order, with or without commas between the leaves.

e) Analyze data represented in line plots (dot plots) and stem-and-leaf plots and communicate results orally and in writing:

   i.   describe the characteristics of the data represented in a line plot (dot plot) and stem-and-leaf plot as a whole (e.g., the shape and spread of the data);

   ii. make inferences about data represented in line plots (dot plots) and stem-and-leaf plots (e.g., based on a line plot (dot plot) of the number of books students in a bus line have in their backpack, every student will have from two to four books in their backpack);

   iii. identify parts of the data that have special characteristics and explain the meaning of the greatest, the least, or the same (e.g., the stem-and-leaf plot shows that the same number of students scored in the 90s as scored in the 70s);

   iv. draw conclusions about the data and make predictions based on the data to answer questions; and

     v.   solve single-step and multistep addition and subtraction problems using data from line plots (dot plots) and stem-and-leaf plots.

Materials
- Paper
- Construction paper
- Pencils
- Markers

Vocabulary

data, compare data, interpret data, line plot, dot plot, stem, leaf, stem-and-leaf plot

Student/Teacher Actions: What should students be doing? What should teachers be doing?

Note: If students have not been introduced to stem-and-leaf plots and/or line plots (dot plots) yet, this activity can be used as an introductory learning experience. If stem-and-leaf plots and line plots (dot plots) have been introduced, this activity can be used as a review.

1. Engage students in a discussion about the difference between categorical data (data that can be put into categories and may not have a specific order, e.g., favorite color, food types, etc.) versus what types of questions can be answered using numerical data. Possible questions-
   - What is a multiple of 5 starting at 10 and ending at 50?
   - On what day of the month (number) is your birthday?
   - What is the total number of letters in your whole name—first, middle, and last?
   - What is the age, or approximate age, of one adult that lives in your home?
   - What is your favorite two-digit number?
2. Have students form cooperative learning groups and formulate a question to ask to collect numerical data.
3. After the groups have created their question, tell them to decide on what method they would like to use to collect and organize the data (survey, tally chart, table, etc.).
4. After each group has collected and organized the data, give each group a large sheet of construction paper and tell them to use the data and markers to create a stem-and-leaf plot and a line plot (dot plot) for their data. Advise them to create the graph in pencil first and then, when all group members agree on the graphs, trace the graph with a marker so it is easy to see. Make sure students do the following:
   - **To create a stem-and-leaf plot:**
     - Organize the data from least to greatest.
     - List the stems vertically from least to greatest with a line to their right. (No stem can be skipped.)
     - List leaves horizontally, from least to greatest, and can be separated by spaces or commas.
     - Record every value, regardless of the number of repeats.
     - Include a key to explain how to read the stem-and-leaf plot.

- Provide a title for the plot that communicates the context from which the data was collected.
- **To create a line plot:**
  - First, create a part of a number line that includes all the values in the data set and the value one less than the smallest value in the data set and one more than the largest value in the data set.
  - Provide a title for the graph that communicates the context from which the data was collected.
  - Next, place an X (or dot) on the number line above each value in the data set. If a value occurs more than once in a data set, place an X over that number for each time it occurs.
  - Provide a key for the graph.

5. When students have posted their graphs, have students go on a gallery walk around the room to look at the graphs.

6. Have students compare the similarities and differences between the data displayed for each plot. Ask, *"Was it easier to represent data in one type of plot than the other?"* Listen for responses, such as, "Line plots (dot plots) are easier to create when the range of the data is smaller." Discuss whether one graph is easier to find the mode, the median, the mean and have students justify their responses. Continue to compare and contrast the two plots.

7. Have students return to their groups and prepare a presentation interpreting the data for a new student. The task: "A new student is coming to class tomorrow. Based on what we have learned, what will your group predict the new student's response would be to your group's question and describe how you reached your decision." Have each group share their predictions and how they arrived at them.

8. Have students answer questions about the data presented in the stem-and-leaf plots and line plots (dot plots).
   - How many more _____ than _____ are there?
   - How many fewer _____ than _____ are there?
   - How many more _____ and _____ are there than _____?

Assessment

- **Questions**
  - What is the difference between a line plot (dot plot) and stem-and-leaf plot? What are the similarities?
  - What are some other types of data that can be displayed in a stem-and-leaf plot?
  - What are some other types of data that can be displayed in a line plot (dot plot)?

- **Journal/writing prompts**
  - Explain how a stem-and-leaf plot and line plot (dot plot) can be used to organize data.
  - Explain why the key and title are important for graphs.

- **Other Assessments**
  - Create a survey question that can be displayed in stem-and-leaf and line plot (dot plot). Collect data from the class and present it in stem-and-leaf and line plot (dot plot).
  - What type of data would be difficult to display on a stem-and-leaf plot? Line plot (dot plot)?

Extensions and Connections (for all students)

- Remove the titles from some stem-and-leaf plots and line plots (dot plots). Have students work with a partner to match titles to the plots. Have them write an explanation of how they matched them.
- Have students throw cotton balls and measure the distance in inches. Record the data in a stem-and-leaf plot or line plot (dot plot) and explain why you chose that plot to represent the data.
- Give students a chance to create a survey question and collect data from another grade. Students create a line plot (dot plot) or stem-and-leaf plot on a poster with interpretations of the data below it.
- Have students create single-step and multistep addition and subtraction problems using data from line plots (dot plots) and stem-and-leaf plots for classmates to solve.

Strategies for Differentiation

- Some students may need to display a smaller amount of data.
- Some students may need the support of a diagram to organize their data.
- Some students may benefit from using graph or grid paper to create their stem-and-leaf plot or line plot (dot plot).