There is a Difference: Histograms vs. Bar Graphs

STANDARDS:

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GRADE: 3-5,6-8
PERIODS: 1

Using data from the Internet, students summarize information about party affiliation and ages at inauguration of Presidents of the United States in frequency tables and graphs. This leads to a discussion about categorical data (party affiliations) vs. numerical data (inauguration ages) and histograms vs bar graphs.

Instructional Plan	Objectives + Standards	Materials	Assessments + Extensions	Questions + Reflection	Related Resources	Print All

Prior to the beginning of this lesson, you will want to find a website listing all of the presidents and their party affiliation. A simple search on the internet should provide viable options. You may also choose to bookmark this site such that students have easy access to the chosen resource.

Start the lesson by engaging students in a discussion about the Presidents of the United States. You might ask: What factors influenced our last presidential race? Are there typical characteristics of a person running in any Presidential race? There are many answers to these questions. If no students suggest party affiliation and age at the time the person enters office, bring these characteristics into the discussion.

Discuss the data provided for each president with the class. Use questions to structure the discussion. What is the difference between raw data and summarized data? [Raw data is the individual values while summarized data is presented in a way for analyzing the data.] If I wanted to find the number of Presidents in each party, how could I summarize the data? [frequency table, bar chart, line chart, histogram] What would be the title for the columns of the frequency table? [Political Party, Frequency]

While distributing the Charting the Difference Activity Sheet, divide students into pairs a computer for each pair to share. If fewer computers are available, groups of 3 can be used with assign roles, such as announcer, recorder, and checker. However, avoid groups with more than 3, as there will be students with nothing to do.

[Charting the Difference Activity Sheet](#)

Remind students on how to record data in frequency tables. Have them record the frequencies in groups of five tally marks.

As students begin their bar graphs for the political party data, check the graphs being created for correctness. Ask questions to help struggling students. How is the frequency scaling determined? [by the range of the frequency column] What should the frequency scaling be based on the lowest and highest frequency? [0-20 with marks at 5, 10, 15, 20] Since the political parties are separate categories, makes sure students' bars do not touch each other but are of the same width.

Circulate through the room as students work on the inauguration ages frequency table, asking questions like the following examples to help students.

- What is different about the data being collected in this frequency table?

    [The data is numerical, not categorical like the previous table.]

- Are we going to list every age at inauguration to summarize the data?

    [No, there would be too many rows.]

- What intervals of numbers might work better? How many intervals will there be?

    [Decades might work, but there would only be 3 intervals, which would not make the graph very informative. Intervals of 5 years would be better because then there would be 6 categories.]

- Did the order of the political parties matter in the previous table? Does it matter in this table?

    [The categories in the first table are not related so they can be in any order. In this table, it makes sense for the categories to be in ascending or descending order since the categories are intervals of numbers.]

After all groups have finished, have the groups compare answers in a class discussion. Call on students to give their answers to the questions. As they do this, point out in ages at inauguration frequency table that the categories are numeric intervals in an increasing order with no gaps between the numbers. The graph also has no gaps between the bars. This is because there is no gap between the numbers for the ages. For example, one bar ends at 44 and then next starts at 45. This is a difference between the two frequency tables and this affects the graphs. To check for understanding, ask students: Why is it the bars in bar graphs do not touch and the bars in histograms do touch? [Bar graph bars do not touch because the data is categorical; histogram bars do touch because the categories intervals of continuous numbers.]

While students share their generalizations from Question 5, use questions such as those in *Questions for Students* to show that some answers cannot be determined by the graphs but may have to be researched using the raw data or using other sources.

Summarize Question 6, draw a table on the board with a column for characteristics of bar graphs and a second column for characteristics of histograms. A representative from each group can then add an observation to either or both columns, comparing and contrasting the attributes of the different graphs. Allow students to add statements one group at a time without repeat a prior statement. This will become more difficult as more groups go, so try to choose groups with longer answers to Question 6 after groups with shorter answers. A partially complete table may look like this:

BAR GRAPHS	HISTOGRAMS
graph title and labeled axes	graph title and labeled axes
Bars do not touch.	Bars do touch.
Vertical scale is frequency.	Vertical scale is frequency.
categorical data	numerical data

Charting the Difference Answer Key

- Computer with Internet connection
- Charting the Difference Activity Sheet
- Charting the Difference Answer Key
- The Life Cycle Activity Sheet and Answer Key (optional)

Assessments

1. To reflect on the process of data collection using frequency tables for histograms, have students answer general questions for the next class discussion. Some possible questions include:
   - How do we determine the intervals of numbers in a numeric category?
   - Do the intervals need to be the same size?
   - Does the first interval always start at 0?
2. Have students use other raw data to make more frequency tables, bar graphs, and histograms. The Life Cycle Activity Sheet provides the format for this assessment.

    The Life Cycle Activity Sheet and Answer Key

Extensions

1. Since the range of ages helps to determine the number of categories and their widths, other statistical data can be collected such as mean, median, and mode. These statistics of central tendencies can be gathered from many categories, such as age at inauguration and death. Students could complete the following table to lead into an introduction of statistics:

Categories	Range	Mean	Median	Mode
Inauguration Ages				
Ages at Death				
Length of Term in Office				

2. There are many other types of graphs students can explore. Software such as Excel can facilitate exploring several types in a short period of time.

3. Put a map of the United States on the board. Create cards with photos and names of each President. Have the students research the Presidents' birth places and place the cards in the correct locations on the map. As a cross-curricular writing activity, have the students research responses to these questions:
   - Why are most Presidents from the East Coast? Why are they mostly from the Northeastern States?
   - Considering the history of the United States, why would we not expect to see many presidents from Alaska?
   - What is unique about President Ford's climb to presidency?
   - Who was in office the longest? Why has no other President surpassed this number?
   - Who had the shortest term in office? Why?

Questions for Students

1. Why are there more Democratic and Republican Presidents than Presidents from other parties?

   [These have been the dominant parties in the United States for most of the country's history. The other parties are older. For example, the Whig party eventually became the current Republican party.]

2. When you are old enough to vote, do you think there will be the same 2 major parties?

   [Answers will vary.]

3. Were there any other parties on the ballot during the last election?

   [Yes. This changes with each election. Encourage students interested in the political parties to continue their research after the lesson.]

4. What age range were most presidents' ages on their Inauguration Day?

   [50-54.]

5. Who was the youngest president when inaugurated? Where did you find your answer?

   [Theodore Roosevelt; the raw data.]

6. Who was the oldest president when he took the Oath of Office and where did you get this information?

   [Ronald Reagan; the raw data.]

7. How many Presidents died in office?

   [8: Garfield, Harding, Harrison, Kennedy, Lincoln, McKinley, F. Roosevelt, and Taylor.]

8. How many Presidents are still living?

   [Answers will vary depending on when this lesson is used.]

Teacher Reflection

- Did the students remember how to make proper Frequency Tables?
- Were the students comfortable using the internet to gather the data?
- Do the students remember to include titles, scales, etc. in their Bar Charts and Histograms?
- Did students use the data from the web site to make additional conclusions?
- Did all students participate in the group activity?

Learning Objectives

The students will:

- Summarize raw data in a frequency table
- Determine the category of the data as categorical or numerical

- Create the appropriate chart (histogram or bar chart)
- Analyze data using histograms and bar charts

Common Core State Standards – Mathematics

Grade 3, Measurement & Data

- CCSS.Math.Content.3.MD.B.3
  Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

Grade 7, Stats & Probability

- CCSS.Math.Content.7.SP.C.6
  Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.

Grade 8, Stats & Probability

- CCSS.Math.Content.8.SP.A.1
  Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Common Core State Standards – Practice

- CCSS.Math.Practice.MP1
  Make sense of problems and persevere in solving them.
- CCSS.Math.Practice.MP4
  Model with mathematics.
- CCSS.Math.Practice.MP5
  Use appropriate tools strategically.
- CCSS.Math.Practice.MP7
  Look for and make use of structure.