**Big Feet**

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| In this lesson, students will measure the length of their feet. They will use this set of numerical data to create a frequency table and a line plot.  |

**NC Mathematics Standards:**

**Measurement and Data**

**NC.4.MD.4** Represent and interpret data using whole numbers.

* Collect data by asking a question that yields numerical data.
* Make a representation of data and interpret data in a frequency table, scaled bar graph, and/or line plot.
* Determine whether a survey question will yield categorical or numerical data.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

4. Model with mathematics.

6. Attend to precision.

**Student Outcomes:**

* I can create a table and line plot to represent data.
* I can communicate with others about my data.

**Math Language:**

* data
* numerical data
* line plot
* frequency table

**Materials:**

* graph to display (Hand Sizes)
* rulers with centimeters
* data display materials such as blank paper, graph paper, poster paper, rulers, yard/meter sticks, and pencils/markers/colored pencils/crayons
* activity sheets

**Advance Preparation**:

* Gather materials
* Plan how to group students into pairs

**Launch:**

Introduce the Context (10 minutes)

Display the graph “Hand Sizes” for the class to see. Ask: *What type of data is on the graph?* Ask: *Why do think a line plot was used instead of a picture or bar graph?* Give students time to respond to the questions as partners and then share ideas with the whole class. Point out that the line plot is used to display numerical data. Define or review the definition of numerical data (Data that is measurable. The data can be measurements such as height and weight or counts such as the number of teeth or pages in a book.). Have students give several examples of numerical data and point out how it is different from categorical data.

Tell the class that the data represents the width of people’s hand from their thumb to their pinky measured in inches. Ask: *Based on the data, can we determine how many people answered the question? How many people had their hand measured?*

* After students respond, remind students that every X stands for a data point or in this case a person. The number of people surveyed is the same as the number of X’s on the line plot (23 people).

Ask several additional questions about the data such as:

* What was size of the largest hand?
* What was the size of the smallest hand?
* How does the smallest hand size compare to the largest hand size?
* Which measurement had the most people with that hand size?

If time allows, instruct students to work with a partner or small group to come up with two questions about the data in the line plot. Have a few groups share their questions with the class and discuss how the line plot could be used to help answer the questions.

Introduce the Task (10 minutes)

Tell students that today they are going to collect numerical data and create a table and a line plot to answer the question “What is the size of our feet?”. Pair students up and have them measure the length of each person’s foot in centimeters.

After students have had time to measure their feet, collect the data by having students share the measurements. Display the data as a list for the class to see. Instruct students to use the collected data to create both a frequency table and line plot. Provide students will materials such as blank paper, graph paper, poster paper, pencils, crayons, markers, colored pencils, rulers, or yard/meter sticks.

**Explore:**

Representing Our Data (20 – 30 minutes)

Allow time for students to create both a frequency table and a line plot for the data. Observe students as they create the frequency tables and line plots. Carefully select different graphs or aspects of the graphs that you would like to highlight during the discussion (labels, number line, organization, size or organization of Xs).

Observe:

* What challenges do students have as they create the line plot and frequency table?
* How do students organize the data? Do they include all of the data points?
* How do students draw the Xs on the line plot? Are they organized and approximately the same size?
* How do students label the numbers on the number line? Are any numbers skipped or not included?
* Do students include a title on the line plot?

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| **Observation** | **Questions to Ask** |
| Students have difficulty creating a frequency table. | * What does that data tell us?
* What should our data labels be?
* How can we represent how many of each number we have?
 |
| Students have difficulty creating a line plot. | * What information do we put on the bottom of the line plot?
* What does each X on the line plot mean?
* How can we be sure that we have included all of the data?
 |

 Example:

Length of Feet (centimeters)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Length of Foot (cm) | Number of Feet |  |  | X |  |  |  |  |
| 10 |  |  |  | X |  |  |  |  |
| 11 |  |  | X | X |  |  |  |  |
| 12 |  |  | X | X | X |  |  |  |
| 13 |  |  | X | X | X |  |  |  |
| 14 |  |  | X | X | X | X |  | X |
| 15 |  |  | X | X | X | X | X | X |
|  |  |  | 10 | 11 | 12 | 13 | 14 | 15 |

Once students have made a frequency table and line plot, have them answer the following questions:

* + What was the longest foot?
	+ What was the shortest foot?
	+ How many people measured the length of their foot?

If time allows, have students write two questions about the data or write observations about the data.

**Discuss:**

4. Discussion of Solutions (15 – 20 minutes)

Bring students together to discuss the experience and the data displays. Use the following questions to assist you with the discussion.

|  |  |
| --- | --- |
| **Sample Questions** | **Possible Responses or Talk Frames** |
| * What does your data tell you about the class?
 | * “I learned that my classmates’ feet measure \_\_\_. \_\_\_ is the smallest measurement and \_\_\_\_ is the largest measurement.”
 |
| * Who would like to share your question and tell us about the results?
 | * Responses will vary based on the question and data.
 |

Highlight aspects of the frequency tables and line plots (labels, number line, organization, size or organization of Xs) that need to be addressed and discuss any challenges students had as they were creating the graphs. You may want to compare some the displays, discussing how they are alike or different. Have students discuss common features of frequency tables and line plots (display counts or frequency of data, quick and easy ways to organize data, easy to visually compare data, can be used to collect and display numerical data).

Conclude the discussion by reviewing numerical data. Return to today’s question “What is the size of our feet?” and ask students if this question yielded categorical or numerical data. Ask: *How can you use the data we collected and data representations to answer this question?*

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe students and ask questions as they are making their graphs. Look for students who may need more support making their graphs.

**Formal Evaluation:**

* Students complete the Graphing Our Data activity sheet.
* As an exit ticket, you can redisplay the “Hand Sizes” line plot from the beginning of the lesson and ask a “how many more” or “how many fewer” question.

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* For students who struggle creating a line plot, provide them with models of different line plots. Ask questions about what a line plot looks like.
* For students who struggle with organizing a line plot, provide them with graph paper. Have them place one X in each box to keep the Xs organized and a consistent size.

**Extensions:**

* Students can create a different representation such as a bar graph with the collected data.
* Students select a question that will yield categorical data or numerical data and pose that question to either the class or a small group. Once the data is collected, they can create a line plot, bar graph, or frequency table with the data.

**Special Notes:**

* This lesson calls for students to measure the length of their feet in centimeters. You can have students measure using inches instead of centimeters.

**Hand Sizes (inches)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | X | X |  |  |  |
|  |  |  | X | X |  |  |  |
|  | X | X | X | X | X |  |  |
|  | X | X | X | X | X | X |  |
| X | X | X | X | X | X | X | X |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**Graphing Our Data**

For each set of data, determine if the data is numerical or categorical. Then make a frequency table, bar graph, or line plot with the data.

1. Favorite Math Topic

6 people chose multiplication

8 people chose fractions

**Numerical or Categorical?**

5 people chose addition

1 person chose subtraction

1. Hours of Sleep

1 people slept 6 hours

6 people slept 7 hours

**Numerical or Categorical?**

8 people slept 9 hours

6 people slept 10 hours

1. Time to Run 50 yards

It took 8 people 11 seconds

It took 4 people 12 seconds

**Numerical or Categorical?**

It took 3 people 14 seconds

It took 4 people 15 seconds

1. Length of Pinky

5 people have a pinky that is 2 cm long

**Numerical or Categorical?**

6 people have a pinky that is 4 cm long

2 people have a pinky that is 5 cm long

8 people have a pinky that is 6 cm long