**Numerical or Categorical?**

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| This lesson involves determining whether data is categorical or numerical. This lesson also addresses mathematical practice #1 and allows students to examine and correct errors. |

**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 determine whether a survey question will yield categorical or numerical data.
* I can communicate with others about data.
* I can find and correct errors.

**Math Language:**

* data
* categorical data
* numerical data

**Materials:**

* graph to display (Find the Goof Up)
* data cards (one set per group)
* sticky notes
* Working with Line Plot Data activity sheet
* Optional: anchor chart, poster of Math Practice #1 (<http://www.debbiewaggoner.com/math-practice-standards.html>)

**Advance Preparation**:

* Gather materials
* Copy and cut out data cards (one set per group)
* Plan how to group students into groups of 3-4 students

**Launch:**

Introduce the Context (10 – 15 minutes)

Display the graph “Find the Goof Up” for the class to see. Read or display the statements one at a time. Have students determine if each statement is correct or not. If a statement is correct, ask them to prove why it is. If a statement is not correct, ask students to prove why it is not correct, and then ask them to correct it. (Solutions included at the end of lesson.)

Statements:

1. The difference in the number of siblings between the person wth the most siblings and the least amount is 4. (incorrect)
2. The number of siblings with the most X’s is 1. (correct)
3. No one has 4 siblings. (incorrect)
4. There were 20 people who were surveyed. (incorrect)
5. The people surveyed have a total of 40 siblings. (incorrect)

After discussing each statement, introduce students to Mathematical Practice #1 – Make sense of problems and persevere in solving them. This can be done by displaying the practice on the board, adding it to an anchor chart, or presenting it as a poster <http://www.debbiewaggoner.com/math-practice-standards.html>). Discuss what it means to persevere and make sense of problems. Say, *“When persevering and making sense of problems, mathematicians check their work, identify mistakes, and find ways to correct them. Today you are going to do some more work with data and at times you will need to make sense of information and even revise your answers or correct mistakes.”*

1. Introduce the Task (10 minutes)

Provide each group with one set of data cards. Instruct students to sort the cards into categories. This is an open sort. Allow the students to sort the cards into any categories they like. Do not prompt or lead students to a specific type of sort. Give each group a set of sticky notes to label each category with a title.

**Explore:**

1. Sorting Data Cards (10 – 15 minutes)

Provide time for students to work in groups to sort the data cards. Observe students to see how they are discussing the cards and placing them into categories based on common characteristics.

Possible questions:

* + How are you sorting the cards? Why did you sort the cards in that way?
  + How are the cards alike? How are the cards different?
  + What would you call this category? How would you label this category?
  + Why did you decide to put this card in that category?

**Discuss:**

1. Discussion (20 – 30 minutes)

After students have had time to sort the cards, bring the group back together. Have groups share the different ways they sorted the cards and describe why they sorted them into those categories. Possible sorts may include types of activities, measurements, favorites, involve numbers, etc.

Point out that mathematicians sort data into two categories – Numerical Data and Categorical Data. Numerical data (also known as quantitative data) are measurable. They represent objects or individuals by numbers assigned to certain measureable properties such as their length or age. The data can be measurements such as time, height, temperature, and weight or numbers such as the number of teeth lost by first graders or ages of elementary students. Categorical data (or qualitative data) represent characteristics such as gender, eye color, types of movies, or genres of books. The data can be grouped into categories and represent individuals or objects that share one or more traits. Define each type of data and relate to the categories that students selected. For example, if students labeled one group as measurements (length, heart rate, height), connect this to numerical data. You may even want to record this information on an anchor chart.

Instruct students to return to their sorted data cards and decide which cards represent categorical data and which cards represent numerical data. Encourage students to explain their reasoning.

|  |  |
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| **Observation** | **Questions to Ask** |
| Students have difficulty determining if data is categorical or numerical. | * How was the data collected? * What type of data did we collect? * What is the best way to represent the data? * How would a person respond to this question? What are some possible responses? |

Discuss how students sorted the data cards. Have students identify and defend which cards represent numerical data and which cards represent categorical data.

|  |  |
| --- | --- |
| **Numerical Data** | **Categorical Data** |
| A – Length of leg | B – Favorite ice cream flavors |
| C – Measurements of race times | E – Favorite season |
| D – Height ball bounced | H – Types of books |
| F – Number of students | K – Types of pets |
| G – Length of pencils |  |
| I – Student ages |  |
| J – Heart rate |  |
| L – Number of pets |  |

Close the lesson by returning to today’s learning target: I can determine whether a survey question will yield categorical or numerical data. Have students define each type of data in their own words and provide a few examples.

Return to Mathematical Practice #1 – Make sense of problems and persevere in solving them. Have students describe times during today’s lesson that they had to persevere or make sense of challenging problems.

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe students and ask questions as they sorting the data cards. Use the observations to continue to plan and adapt your lessons.

**Formal Evaluation:**

* Play “Name That Data Type!” Have students identify whether the data is numerical or categorical. Examples: lengths of students’ arm spans (N), students’ eye color (C), zoo animals (C), ways students like to travel (C), favorite sport (C), number of siblings (N), crayon colors (C), bean-plant growth (N), daily moon phase (C), type of apple (C), Height of tallest animals (N), age of parents (N). Have students create their own questions and use to quiz the class. (Source: Navigating through Data Analysis and Probability in Grades 3-5 by NCTM)
* Students can complete the “Working with Line Plot Data” sheet.

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

**Interventions:**

* For students who struggle determining if the data is categorical or numerical, use the questions in this lesson. Have students refer to the anchor chart that was created.

**Extensions:**

* Students can create their own questions and determine if they will yield numerical or categorical data.

**Solutions:**

Find the Goof Up:

1. The difference in the number of siblings between the person wth the most siblings and the least amount is 4. (Incorrect - The correct answer is 5.)
2. The number of siblings with the most X’s is 1. (Correct)
3. No one has 4 siblings. (Incorrect - 1 person has 4 siblings.)
4. There were 20 people who were surveyed. (Incorrect - There is data from 21 people.)
5. The people surveyed have a total of 42 siblings. (Incorrect - There are a total of 39 siblings represented in the line plot.)

Working with Line Plot Data:

1a) There are data from 12 people in the graph. (Incorrect - There are data from 13 people.)

1b ) The difference in the number of pencils between the person with the most pencils and the person with the fewest number of pencils is 8. (Incorrect- the difference is 5.)

1c) Two times as many people had 5 pencils than the number of people that had 4 pencils. (Correct)

1d) There are a total of 72 pencils in the data on the graph. (Incorrect - There are 71 pencils.)

1e) Two times as many people had 3 pencils than the number of people that had 7 pencils. (Correct)

**Find the Goof Up**

Number of Siblings

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | X |  |  |  |  |
|  | X |  |  |  |  |
|  | X |  | X |  |  |
|  | X | X | X |  |  |
| X | X | X | X |  |  |
| X | X | X | X |  |  |
| X | X | X | X | X | X |
| 0 | 1 | 2 | 3 | 4 | 5 |

Statements:

1. The difference in the number of siblings between the person wth the most siblings and the least amount is 4.
2. The number of siblings with the most X’s is 1.
3. No one has 4 siblings.
4. There were 20 people who were surveyed.
5. The people surveyed have a total of 40 siblings.

**Data Cards**

|  |  |
| --- | --- |
| A  Students measure the length from their knee to their ankle in centimeters. | B  Students are asked to name their favorite flavor of ice cream out of 4 possible options. |
| C  Students run a race in PE and a graph is made out of the times it took each student to finish the race. | D  Students drop a ball and record data about how high the ball bounces after it hits the ground. |
| E  Students respond to a survey where they identify their favorite season. | F  At school, every class reports the number of students in attendance each day. |
| G  Students measure the length of their pencils and record the data. | H  Students tell whether or not they prefer fiction, non-fiction, poetry, or fables. |
| I  Students tell how old they are. Each student’s age is recorded and a graph is created to display the data. | J  A class collects data on their resting heart rate and then graphs the data. |
| K  Students name the types of pets they have at their house. | L  Students identify the number of pets that live at their house. |

**Working With Line Plot Data**

Part I: Determine if each statement below is correct or not. If it is incorrect, provide the correct answer.

Number of Pencils

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

1. There is data from 12 people in the graph.
2. The difference in the number of pencils between the person with the most pencils and the person with the fewest number of pencils is 8.
3. Two times as many people had 5 pencils than the number of people that had 4 pencils.
4. There are a total of 72 pencils in the data on the graph.
5. Two times as many people had 3 pencils than the number of people that had 7 pencils.

Part II: Create a frequency table and a line plot for each set of data.

1. Hours practicing soccer

6 people practiced 9 hours

8 people practiced 8 hours

7 people practiced 7 hours

4 people practiced 4 hours

1. Number of Pets

7 said 0 pets

5 said 1 pet

9 said 2 pets

4 said 3 pets

1. Length from wrist to thumb in centimeters

5 people measured 7 cm

9 people measured 8 cm

6 people measured 9 cm

4 people measured 10 cm

1. Temperatures at noon during July

4 days at 90 degrees

7 days 93 degrees

9 days 88 degrees

3 days at 95 degrees