4-1 (Rev.) Building a Math Community through Data (Grade 4 Unit 1)
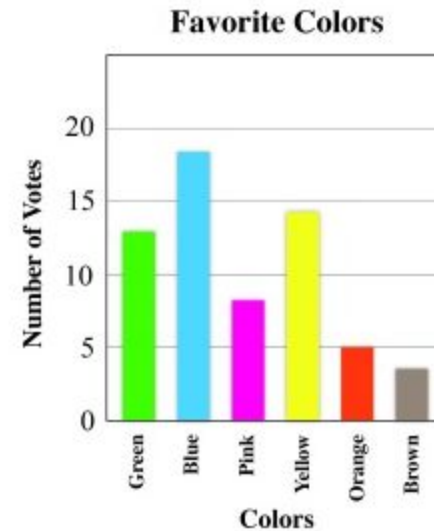**Common Misconceptions / Intervention Strategies**
NC.4.NBT.4, NC.4.MD.4

Common Misconceptions	Intervention Strategies
Students may have difficulty distinguishing between categorical data and numerical data.	● Focus on using data collection for a purpose and to answer questions in the real world. When students generate the questions they want to ask, the data they collect will be more meaningful. With students, brainstorm questions that interest them. Begin with questions that involve categorical data and have 4 to 5 answer choices and later move to up to a maximum of 10 answer choices. For example, *"Which type of weather do you predict for today? Sunny, Cloudy, Rainy, Snowy"* or *"Which snack is your favorite? Chips, Fruit, Cheese/Yogurt, Candy, Cookies, Vegetables."* Categorical data can be sorted into groups or categories, such as colors, animals, games, and types of movies. ● After students can graph and analyze categorical data successfully, then students can begin working with numerical data. Numerical data is data that is measurable such as amount, height, weight, and time. Some examples include *"How many siblings do you have? 0, 1, 2, 3, 4, 5 or more"* or *"How many hours do you spend on homework in one week? 0, 1, 2, 3, 4 or more."* ● Have students generate and record possible survey questions (categorical and numerical). Then have students exchange questions with each other. They will create a list of 4-8 possible responses to that survey question. In a whole group, all students will sort the survey questions with the possible responses into two groups: ***categorical data or numerical data***. Discuss what they notice about the types of responses that are in each group.
Students may have difficulty interpreting the scale of a graph and determining the best scale to use.	● First, make and answer questions about bar graphs with a scale of single units (i.e., counts by ones). Point out the number sequence (0, 1, 2, etc.). Then collect data about a question in which the values of the responses will be larger numbers which will require you to use a different scale than counting by ones. Discuss with students the purpose of using a scale of 2, 5, or 10.

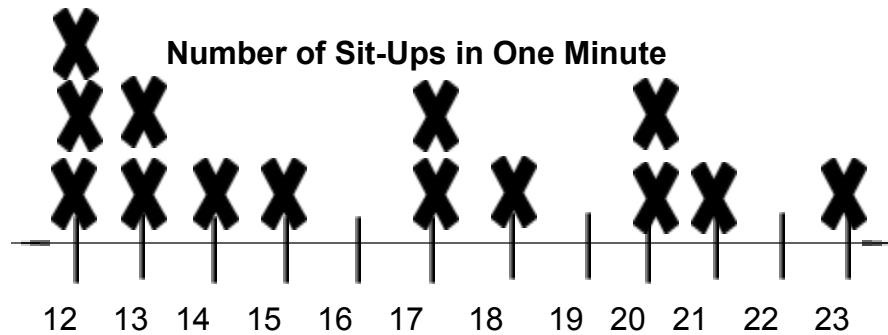|	
	● Show students graphs using different scales. Guide the students to figure out the scale that was used in each graph. In addition, discuss the reason for using that particular scale. **Favorite Colors** ● Analyze different sets of number data to determine the best scale to use. Encourage students to use 2, 5 or 10 if possible because they are more familiar with those multiples. 　▪ Lengths of reptiles (in feet): 6, 3, 12, 6, 14, 4, 9, 12, 18 　▪ Number of hours spent reading per month: 10, 5, 20, 25, 7, 35, 21, 10, 15, 36 　▪ Low temperatures in September (degrees Fahrenheit): 45, 49, 70, 55, 61, 58, 60, 65, 69, 48, 50, 67, 74
Students may have difficulty accurately collecting and recording data in a frequency table with tally marks.	● Have students make a table with three columns labeled Data, Tally, and Frequency. In the first column, write down all of the categorical choices or numerical values. In the second column, place one tally mark at the appropriate place for every piece of data collected. When the fifth tally is reached, draw a line across the first four tally marks to make one group of five tally marks. Count the number of tally marks for each category/data value and write the number in the third column.

	● Provide students opportunities to practice collecting data with tally marks in a frequency table. For example, students can roll a die multiple times and record a tally mark for the value they roll each time.

Students may have difficulty constructing and interpreting a line plot with whole numbers. Students may confuse the number data with the frequency when answering questions about the line plot.	● Create a survey question or task that will yield whole number data. For example, "*How many sit-ups can students do in 1 minute?*" Collect the numerical data in a frequency table. Then construct a number line with each whole number represented. Use an X to represent the number of occurrences. Explain that a line plot is used to represent numerical data, not categorical data, because it is created from a horizontal number line.
	
	Number of Sit-Ups in One Minute
	
	X X X X X X X X X X X
	X X X X X X X X X X X
	12 13 14 15 16 17 18 19 20 21 22 23
	
	● Discuss questions that require students to interpret the data on the line plot:
	    ○ How many students did more than 20 sit-ups?
	    ○ Which number of sit-ups occurred most often?
	    ○ According to the line plot, how many students did sit-ups?

Students may have difficulty finding the difference between two values in a graph. They may not understand that the *difference* is the actual distance between two numbers.	● Students can look at a graph and tell the value that is the most or least, but they may have difficulty figuring out the difference between two values displayed in the graph. The difference must be determined when students have to answer questions such as *"How many fewer students voted for orange than yellow?"*

	- Have children make the two amounts being compared with bars of connecting cubes. Discuss the difference between the two bars of cubes to generate the third number. Make equations with the three numbers (the numbers being compared and the difference). - Explore more questions which focus on the difference between two numbers. For example, *"Using the data in the graph, decide how many more students have brown eyes than green eyes?"* You can have the students in each category line up to make a human graph. Then students can match up in a one-to-one correspondence manner to determine how many more students are in the brown eye group than the green eye group. - Have students use a number line to locate and compare the two values by finding the distance between the numbers on the number line. For example, "*How far apart are 49 and 73?*"

Students may have difficulty answering questions about multiplicative comparisons when analyzing data in a graph. In addition, they may confuse additive comparisons and multiplicative comparisons. *(In third grade, students solved one and two step "how many more and how many less problems" using the information from graphs, but making multiplicative comparisons is a new concept in fourth grade.)*	- Have students practice using the language of times as much or times as many. Create sentence stems that students can refer to when making comparisons about data:
	  ▪ _____ is _____ times more than _____ .
	  ▪ _____ is _____ times less than _____.
	  ▪ _____ is _____ times fewer than _____.
	  ▪ _____ is _____ times as many as _____.
	
	- Use bar models to help students see the relationship between the two values being compared. The bar model will help connect the understanding that the comparison is based on one set of data being a multiplier of the other value. *For example, chocolate ice cream had three times more votes than vanilla ice cream. 3 x 6 = 18*

Resources:

- John A. Van de Walle. *Teaching Student-Centered Mathematics: Grades K-3* (2006); Chapter 11.

- "Fourth Grade Instructional Framework" – North Carolina Collaborative for Mathematics Learning (nc2ml.org)

- Tools4NCTeachers Website