**Measurement Competitions**

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| In this lesson, students rotate through five measurement stations to collect numerical data. Following the data collection, students create a frequency table and a line plot to organize and display the data. |

**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 pose questions and collect data from my classmates.
* I can create a frequency table and line plot to represent data.
* I can communicate with others about my data.

**Math Language:**

* data
* numerical data
* frequency table
* line plot
* question

**Materials:**

* graph to display (Speed Racers)
* poster paper, markers (1 per station)
* marbles
* straws (1 per student)
* rulers, meter sticks, tape measures
* stop watches, timers, or clocks
* recording sheet (1 per student)

**Advance Preparation**:

* Gather materials
* Prepare five measurement stations around the classroom. At each station, place the necessary materials and a large piece of poster paper and marker to collect the students’ measurements.
* Plan how to group students in groups of 3 – 4 students

**Launch:**

Introduce the Context (10 minutes)

Display the graph for the class to see. Ask: *What do you notice about the data?*  *What do you think the question was that students answered? What could be a possible title for this graph?* Give students time to discuss the questions as partners and then allow students to share their ideas with the whole class.

Tell students that the title of the graph is “Speed Racers”. Ask: *Based on the title, what do you think the line plot represents? What do the numbers mean?* Give students time to brainstorm possibilities with a partner and then have them share as a whole class.

Tell students that the data represents how fast children ran during a race at school. The numbers represent the number of seconds it took for the students to run a 100 meter race. Ask students questions about the data:

* What does the data at the bottom of the line plot represent?
* What do the X’s represent?
* How many students ran in the race?
* What was the fastest time that someone ran?
* What was the slowest time that someone ran?
* How many students ran the race in 24 seconds? How do you know?

Collecting Data (30 minutes)

Students will rotate through five measurement stations in order to collect numerical data. Once the data collection is complete, each group will select one set of data. The group will form a question and create both a frequency table and a line plot to represent the data.

Introduce students to the five measurement stations. At each station, each student will complete the activity and record their measurements on their individual recording sheet as well as the large poster hanging at the station. The large poster will be used to collect all of the data (students’ measurements).

Measurement Stations:

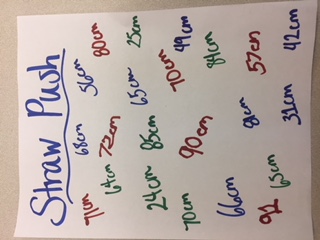
Marble Grab: Students grab as many marbles as they can with one hand. Do this 3 times. Record your highest number on your recording sheet and the poster.

How Much Wood: Students determine how many times they can say “how much wood could a wood chuck cut if a wood chuck could chuck wood?” in 20 seconds. Record your number on your recording sheet and the poster.

Straw Push: Students push a straw from one side of a long table across to the other side of the table. Students record in centimeters how far they pushed the straw. If the straw goes off the table, the number is the length of the table. Record your number on your recording sheet and the poster.

Jumping Jacks: Students do as many jumping jacks as they can do in 10 seconds. Record your number on your recording sheet and the poster.

Backwards Jump: Students record in centimeters how far they can jump backwards. Record your number on your recording sheet and the poster.

Example poster:

Once the data has been collected, assign (or allow students to select) one measurement station. Instruct students to form a question that could be answered using the collected data. Examples: How many jumping jacks can fourth graders jump in 10 seconds? How far can we jump backwards? How many marbles can our class grab with one hand? Students may record the question on their recording sheet.

Instruct students to create a frequency table and a line plot to organize the data from their assigned measurement station. Once students have completed both representations, have them compare their representations with their group members and write two sentences about the data. The recording sheet provides space for both the representations and sentences.

**Explore:**

3. 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 titles and labels on each representation?

Once students have completed both representations, have them compare their representations with their group members and write two sentences about the data.

**Discuss:**

1. Discussion of Solutions (15 – 20 minutes)

Bring students together to discuss the experience and the data displays. 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).

Possible discussion questions:

* How did the frequency table and line plot help you answer your question?
* How are frequency tables and line plots alike? How are they different?
* What challenges did you encounter as you created your data displays?

Conclude the discussion by reviewing numerical data. Ask students to explain why all of the questions yielded numerical data.

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Observe students and ask questions as they are collecting data and creating their graphs. Look for students who may need more support keeping track of their data or creating their graphs.

**Formal Evaluation:**

* As an exit ticket, you can redisplay the “Speed Racers” graph 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 have difficulty creating a frequency table, provide them with graph paper to help them organize the data. Pose questions such as: What does that data tell us?, What should our data labels be?, How can we represent how many of each number we have?, and How can we ensure that we have recorded all of the responses?
* For students who struggle creating a line plot, provide them with several models of line plots and lined or graph paper to help them organize the data. Also pose questions about the data that was collected: Which values should be the labels at the bottom of the line plot?, What does each X on the line plot mean?, and How would you determine how many X’s are needed for each value?

**Extensions:**

* Students can create questions about the representations they created and then trade with a partner to answer the questions.
* Students can select a different set of data (from a different measurement station) and create representations for that data.
* Students can create a different representation such as bar graph for the data.

**Special Notes:**

* This lesson may extend over two days. You may want to have students complete the measurement stations to collect data on the first day and then have students create the data representations on the second day.
* In this lesson, students individually create a line plot and frequency table on their recording sheet. An alternative is to have students work together in their small groups to collaboratively create the representations on a large piece of poster paper.

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| X |  |  | X | X |  | X |  |
| X |  | X | X | X |  | X |  |
| X | X | X | X | X |  | X | X |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |

**Part 1: Collecting the Data**

**Measurement Stations**

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| **Activity** | **Measurement** |
| Marble Grab:  Students grab as many marbles as they can with one hand. Do this 3 times. Record your highest number. |  |
| How Much Wood:  Students determine how many times they can say “how much wood could a wood chuck cut if a wood chuck could chuck wood?” in 20 seconds. Record your number. |  |
| Straw Push:  Students push a straw from one side of a long table across to the other side of the table. Students record in centimeters how far they pushed the straw. If the straw goes off the table, their number is the length of the table. Record your number. |  |
| Jumping Jacks:  Students do as many jumping jacks as they can do in 10 seconds. Record your number. |  |
| Backwards Jump:  Students record in centimeters how far they can jump backwards. Record your number. |  |

**Part II: Organizing and Representing the Data**

1. Select one of the measurement stations. Use the station to create a question that will yield numerical data.
2. Create a frequency table to organize the data for the measurement station.
3. Create a line plot to organize the data for the measurement station.
4. Write two sentences about the data you collected and represented.