NEW MEXICO
Public Education Department

4.MD: MEASUREMENT & DATA

Cluster Statement: B: Represent and interpret data.

Supporting Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
4.MD.B.4: Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.*	SMP 1: Students can make sense of problems and persevere in solving them by interpreting and making sense of word problems involving information presented in line plots. SMP 2: Students can reason abstractly and quantitatively by attending to the meaning of the measured objects and plots on the number line by using addition and subtraction involving fractions. SMP 5: Students can use tools by measuring objects to the nearest 1/8, 1/4, and 1/2 inch using a ruler.	• Identify benchmark fractions. • Make a line plot to display a data set of measurements in fractions of a unit. • Solve problems involving information presented in line plots which use fractions of a unit by adding and subtracting fractions. **Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Remember and Apply

Previous Learning Connections	**Current Learning Connections**	**Future Learning Connections**
• Connect to generating measurement data and making line plots using whole number units. **(2.MD.9)** • Connect to generating measurement data by measuring lengths using rulers marked with halves and fourths of an inch and showing the data by making a line plot where the horizontal scale is marked off in appropriate units-whole numbers, halves, or quarters. **(3.MD.4)** • Connect to understanding line plots represent measurement data, not categorical data. **(3.MD.3-4)**	• Connect to using the four operations to solve word problems, including simple fractions and representing measurement quantities using diagrams. **(4.MD.2)** • Connect to explaining why fractions are equivalent and generating equivalent fractions. **(4.NF.1)** • Connect to adding and subtracting mixed numbers with like denominators. **(4.NF.3c)**	• Connect to making line plots with measurements to the half, quarter, and eighth of a unit and solving problems involving operations of fractions. **(5.MD.2)** • Connect to solving real world problems involving the addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. **(5.NF.2)**

Clarification Statement:
4.MD.B.4: Grade 4 students learn elements of **fraction equivalence** and arithmetic, including **multiplying** a **fraction** by a **whole numbe**r and **adding** and **subtracting** fractions with **like denominators**. Students can use these skills to solve problems, including problems that arise from analyzing **line plots**. For example, with reference to the line plot above, students might find the **difference** between the **greatest** and **least** values in the **data.** (In solving such problems, students may need to label the **measurement scale** in **eighths** so as to produce like denominators. **Decimal data** can also be used in this grade.)

Common Misconceptions
● Students may not understand that it is possible to graph with fractions.

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying, representing and interpreting data because students will have created line plots representing whole, halves, and fourths.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 3.MD.B.4: This standard provides a foundation for work with representing and interpreting data because students will have previous work with measuring to halves and fourths then creating line plot with this information. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Core Instruction

Access
Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with representing and interpreting data benefit when learning experiences include ways to recruit interest such as creating socially relevant tasks because students are more engaged when topics are about them. For example, data can be gathered on height, shoe size, number of siblings, etc. Whole class data charts can be created to serve as anchor charts for other tasks.

Build
Effort and Persistence: *How will the learning for students provide options for sustaining effort and persistence?*

- For example, learners engaging with representing and interpreting data benefit when learning experiences attend to students' attention and affect to support sustained effort and concentration such as encouraging and supporting opportunities for peer interactions and supports (e.g., peer-tutors) because students need to understand the data to be able to interpret it. Giving students opportunities to work with peers or allow them for support gives students encouragement to persist longer in math work.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or*

puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds)

- For example, learners engaging with representing and interpreting data benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as highlighting how complex terms, expressions, or equations are composed of simpler words or symbols by attending to the structure because students will have to interpret data based on a table or create a table based on data therefore students might need to highlight certain pieces for understanding. For example, highlighting x and y labels to help understanding.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*

- For example, learners engaging with representing and interpreting data benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing sentence starters or sentence strips because students need a way to organize data into verbal or written form for the data they are creating or interpreting. For example, _____ represents _____. might be a sentence starter/strip for interpreting a data chart. This gives students a place to start when speaking with a partner or writing about a data table.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*

- For example, learners engaging with representing and interpreting data benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as providing explicit, supported opportunities to generalize learning to new situations (e.g., different types of problems that can be solved with linear equations) because students need to understand the purpose for representing and interpreting data. For example, students can gather data and create tables. Students can generate questions to represent in a data table. These types of activities will help students understand data and how to represent it.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on representing and interpreting data by providing specific feedback to students on their work through a short mini-lesson because students will need feedback for mistakes they are making with creating or interpreting line plots. Attending to precision with setting up line plots.

Re-teach (intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit representing and interpreting data by confronting student misconceptions because if students can set up line plots, it is important to look at the misconceptions that still have students. This will allow the teacher to isolate issues and work with the student in that area.

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?
For example, some learners may benefit from an extension such as in-depth, self-directed exploration of self-selected topics when studying representing and interpreting data because students can explore where these types of data tables would be used or generate them from given information.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?
Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Equity Based Practice (Building Procedural Fluency from Conceptual Understanding): Instruction should build from conceptual understanding to allow students opportunities to make meaning of mathematics before focusing on procedures. When new learning begins with procedures it privileges those with strong prior familiarity with school mathematics procedures for solving problems and does not allow learning to build for more methods for solving tasks that occur outside of school mathematics. For example, when studying representing and interpreting data the types of mathematical tasks are critical because this cluster deals with collection of data, creating line plots based on fractions, and interpreting data from a data table. These mathematical concepts need procedural and conceptual understanding. Students need to understand how to set up a number line that will represent their data, this includes fractional measurements. Students need understanding in fractions and fraction measurements to be able to properly step up number lines in creating the line plot. Conceptual understanding comes through concrete work with these mathematical concepts.

Standards Aligned Instructionally Embedded Formative Assessment Resources:

Source: http://tasks.illustrativemathematics.org/content-standards/4/MD/B/4/tasks/1039

Standard: 4.MD.B4

Task: Button Diameters

a. With a partner or group, gather a handful of round buttons from a diverse collection, and use a rule to measure the diameter of each button to the nearest eighth-inch.
b. Make a line plot of buttons diameters, marking your scale in eighth-inch increments.
c. What is the most common diameter in your collections? How does that compare with the collection from another group?
d. Now measure the diameters of these same buttons to the nearest quarter-inch.
e. Make a line plot of button diameters, marking your scale in quarter-inch increments.
f. Describe the difference between the two line plots you created. Which one gives you more information? Which one is easier to read?

This type of assessment question requires students to use SMP 1 to reason about the task they are asked to do. This task allows students to relate information they gather to a word problem they may experience later. Using SMP5, students will use measurement to gather data to create their line plot. Students will have experience with mathematical tools for measurement, but also for creating a line plot that represents their data with two different increments of measurements and the use of measurement tool. This task will help with identifying misconceptions or reteaching about fraction ordering, measurement, plotting data on line plot, and interpretation of data on the line plot.

Relevance to families and communities: During a unit focused on representing and interpreting data, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, students can gather data at home, discuss data tables with parents, or discuss other topics that can be used to gather information for data tables.	**Cross-Curricular Connections:** Science: In fourth grade the NGSS recommends students "develop a model of waves to describe patterns in terms of amplitude and wavelength". Consider providing a connection for students to determine the length of various waves that measure in fractional units. Then have students graph and analyze that data. Social Studies: In fourth grade the New Mexico Social Studies Standards state students should "understand how visual data (e.g., maps, graphs, diagrams, tables, charts) organizes and presents geographic information." Consider having students gather, graph and analyze geographic data that contains measurements in fractions of a unit and can be displayed using a line plot. Consider providing opportunities to consider what type of data suits a line plot best.