

2.MD: MEASUREMENT & DATA

Cluster Statement: A: Measure and estimate lengths in standard units.

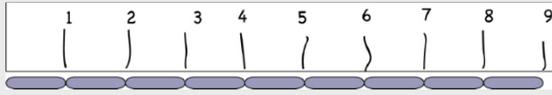
Major Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	Standard for Mathematical Practices	Students who demonstrate understanding can:
<p>2.MD.A.1: Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.</p>	<p>SMP 5: Students can use tools strategically by selecting an appropriate measurement tool (rulers, yardsticks, meter sticks, and measuring tapes) for various contexts.</p> <p>SMP 6: Students can attend to precision by measuring accurately to the designated unit.</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Identify the location of zero, not always at the end of the measuring tool, and explain the role of zero in measuring an object. • Recognize that the numbers on measurement tools are equally spaced. • Identify that the length of an object is the number of same size units the object spans with no gaps or overlaps. • Choose an appropriate tool to measure the length of objects. • Explain why a specific measurement tool is best for a given situation.
		Webb's Depth of Knowledge: 1-2
		Bloom's Taxonomy: Remember, Understand and Apply
<p>2.MD.A.2: Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.</p>	<p>SMP 3: Students can construct viable arguments by describing how the quantity of a measurement relates to the size of the unit chosen and critique the reasoning of others as they explain these ideas.</p> <p>SMP 5: Students can use tools strategically by selecting an appropriate measurement tool (rulers, yardsticks, meter sticks, and measuring tapes) for various contexts.</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Use the terms length and measure precisely. • Measure an object using two different tools. • Describe two different measurements of one object and the relationship between the measurement and the unit length.
		Webb's Depth of Knowledge: 2-3
		Bloom's Taxonomy: Remember, Understand and Apply

<p>Standard Text</p> <p>2.MD.A.3: Estimate lengths using units of inches, feet, centimeters, and meters.</p>	<p>Standard for Mathematical Practices</p> <p>SMP 2: Students can reason abstractly and quantitatively by using units to help reason about estimates.</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Use mental and visual information to determine a measurement without using a measurement tool. • Justify the reasonableness of an estimate. • Choose an appropriate unit of measurement to estimate. <p>Webb’s Depth of Knowledge: 2</p> <p>Bloom’s Taxonomy: Apply and Evaluate</p>
<p>Standard Text</p> <p>2.MD.A.4: Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard-length unit.</p>	<p>Standard for Mathematical Practices</p> <p>SMP 5: Students can use tools strategically by selecting an appropriate measurement tool (rulers, yardsticks, meter sticks, and measuring tapes) for various contexts.</p>	<p>Students who demonstrate understanding can:</p> <ul style="list-style-type: none"> • Choose an appropriate tool to measure the length of objects. • Compare two quantities by finding their difference in length. • Explain how many units longer one object is compared to another object. <p>Webb’s Depth of Knowledge: 1-2</p> <p>Bloom’s Taxonomy: Apply, Analyze and Evaluate</p>
<p>Previous Learning Connections</p> <ul style="list-style-type: none"> • Connect to the process of measuring objects using non-standard units, such as cubes or paperclips. (1.MD.1) • Connect to the concept of comparing objects, limited to comparative terms such as shorter, longer, shortest, and longest. (1.MD.2) 	<p>Current Learning Connections</p> <ul style="list-style-type: none"> • Connect to the transition from use of non-standard units to standard units of measure in this cluster. • Connect to the use addition and subtraction strategies as they compare the length of objects and determine the difference. (2.NBT.5) • Connect to the understanding of linear measurement to solve word problems. (2.MD.5) 	<p>Future Learning Connections</p> <ul style="list-style-type: none"> • Connect to generate measurement data by measuring objects and showing the measurements on a line plot (2.MD.9) • Connect to sub-divide lengths as they use rulers marked with halves and fourths of an inch. (3.MD.3) • Connect to applying linear measurement to measure perimeter and area. (3.MD.5-8)
<p>Clarification Statement:</p> <ul style="list-style-type: none"> • 2.MD.A.1: It is vital that students learn that “one” represents the space from the beginning of the ruler to the hash mark, not the hash mark itself. 		

- 2.MD.A.1: To learn measurement concepts and skills, students might use both simple rulers (e.g., having only whole units such as centimeters or inches) and physical units (e.g., manipulatives that are centimeter or inch lengths).

Using a unit to draw a ruler



Students use a standard unit (shown in below the ruler) to make rulers, helping them to understand the meaning of the markings on rulers.

- 2.MD.A.2: Students can learn that the larger the unit, the fewer number of units in a given measurement. That is, for measurements of a given length there is an **inverse relationship** between the size of the unit of measure and the number of those units. This is the time that measuring and reflecting on measuring the same object with different units, both **standard and nonstandard**, is likely to be most productive.
- 2.MD.A.2: Students can also use the concept of unit to make inferences about the relative sizes of objects; for example, if object A is 10 regular paperclips long and object B is 10 jumbo paperclips long, the number of units is the same, but the units have different sizes, so the lengths of A and B are different
- 2.MD.A.3: Although “**guess and check**” experiences can be useful, research suggests explicit teaching of **estimation** strategies (such as iteration of a mental image of the unit or comparison with a known measurement) and prompting students to learn **reference or benchmark lengths** (e.g., an inch-long piece of gum, a 6-inch dollar bill), order points along a continuum, and build up mental rulers.
- 2.MD.A.4: Second graders learn to combine and compare lengths using arithmetic operations. That is, they can add two lengths to obtain the length of the whole and subtract one length from another to find out the difference in lengths.

Common Misconceptions

- Students beginning the measurement count at the “1” mark on a ruler rather than the “0” and not accounting for it.
- Students not iterating the unit accurately, leaving gaps or overlapping
- Students selecting the incorrect unit of measure (e.g., when asked for centimeters, learner measures in inches)
- Students believing the numbers on a ruler are counting the marks as opposed to the space between the marks.

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 provides additional time for confusion to happen with new mathematical ideas when studying measuring and estimating lengths in standard units (inches, feet, centimeters, and meters) by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes; describing how two measurements relate to the size of the unit chosen and measuring to determine how much longer one object is than another because students used non-standard units of measurement in prior grades. Students often misread measurement tools. When provided additional time for confusion to happen with new mathematical ideas, students could experience less stress.

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

- 1.MD.A.2: This standard provides a foundation for work with measuring and estimating lengths in standard units because students have the opportunity to use non-standard tools and practice lining objects up with no gaps or overlaps. This will help them when using standard tools. 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

Physical Action: How will the learning for students provide a variety of methods for navigation to support access?

- For example, learners engaging with measuring and estimating lengths in standard units benefit when learning experiences that ensure information is accessible to learners through a variety of methods for navigation, such as physically interacting with materials by hand, voice, single switch, joystick, keyboard, or adapted keyboard because as students engage with measuring and estimating lengths some may need alternatives measuring tools provide greater accessibility for students.

Build

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

- For example, learners engaging with measuring and estimating lengths in standard units benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as constructing communities of learners engaged in common interests or activities because as students work in a community of learners, they can discover measurement properties and engage in discussions relevant to the learning outcome.

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 measuring and estimating lengths in standard units benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as pre-teaching vocabulary and symbols, especially in ways that promote connection to the learners' experience and prior knowledge because key vocabulary, labels, icons, and symbols should be linked to, or associated with, alternate representations of their meaning to ensure accessibility for all. Students cultural and linguistic backgrounds may not include the units of measurement customarily used within the United States (e.g., inch, foot), and all students benefit from making all key information available in English as well as first languages.

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 measuring and estimating lengths in standard units benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as using physical manipulatives (e.g., blocks, 3D models, base-ten blocks) because allowing for multiple modalities for students to express their understanding allows for stronger formative assessment of what students are learning.

Internalize

Self-Regulation: *How will the design of the learning strategically support students to effectively cope and engage with the environment?*

- For example, learners engaging with measuring and estimating lengths in standard units benefit when learning experiences set personal goals that increase ownership of learning goals and support healthy responses and interactions (e.g., learning from mistakes), such as supporting students with metacognitive approaches to frustration when working on mathematics because the measurement standards for length provide a critical stepping stone to future learning for all types of measurement in later grades, helping students to set goals and learn from their mistakes will lead to stronger long term learning.

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 measuring and estimating lengths in standard units by providing specific and immediate feedback to students on their work through a short mini lesson because standard units and estimation require practice and precision.

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 measuring and estimating lengths in standard units by addressing conceptual understanding because measurement involves spatial reasoning. Some learners may need additional guidance and practice in measurement and estimating measurement.

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 open ended tasks linking multiple disciplines when studying measuring and estimating lengths in standard units (inches, feet, centimeters, and meters) by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes; describing how two measurements relate to the size of the unit chosen and measuring to determine how much longer one object is than another. This is helpful in the instruction of science and social studies mapping for students to be proficient in estimating lengths for possible projects and for distances on a map.

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 (Goal Setting): Setting challenging but attainable goals with students can communicate the belief and expectation that all students can engage with interesting and rigorous mathematical content and achieve in mathematics. Unfortunately, the reverse is also true, when students encounter low expectations through their interactions with adults and the media, they may see little reason to persist in mathematics, which

can create a vicious cycle of low expectations and low achievement. For example, when studying measuring and estimating lengths in standard units (inches, feet, centimeters, and meters) by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes; describing how two measurements relate to the size of the unit chosen and measuring to determine how much longer one object is than another goal setting is critical because society and cultures often negatively portray students' ability to measure and estimate lengths. For example, the media belittles and creates jokes regarding the fast food employee who doesn't comprehend that a "foot long" menu item and a "twelve-inch" menu item are the same length. As learners set challenging, but attainable goals, they can engage with interesting and rigorous mathematical content of measurement and estimating lengths to achieve in mathematics.

Standards Aligned Instructionally Embedded Formative Assessment Resources:

Source: <http://tasks.illustrativemathematics.org/content-standards/2/MD/A/tasks/1313>

The linked assessment question addresses 2.MD.A.2, specifically describing two different measurements of one object and the relationship between the measurement and the unit length. Students can demonstrate their understanding of the idea of a standard unit of measure and why we use them. The tasks also reinforce the idea that we measure lengths by placing units end-to-end. Teachers can use this formative assessment task early in a unit on measurement to assess if students understand the importance of measurement and common units.

Relevance to families and communities:

During a unit focused on measuring and estimating lengths in standard units (inches, feet, centimeters, and meters) by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes; describing how two measurements relate to the size of the unit chosen and measuring to determine how much longer one object is than another, 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, learning about the different ways measurement and estimating lengths is used in the home and community can be a great way to connect schools tasks with home tasks. Students may have different non-standard units of measurement that are used in the home and community. Learners may also have examples of how measurement and estimation of measurements is used in the home and the community (e.g., the length of a garden, the linear length of material for fencing or sewing).

Cross-Curricular Connections:

Science: In second grade the NGSS states students should "plan and conduct an investigation to determine if plants need sunlight and water to grow." Consider providing a connection for students to measure plant growth.

Language Arts: Literature can offer connections about measurement such as: *How Big is a Foot* by Rolf Myller and *How Short, How Far Away?* by David A. Adler.