

► Grade 2 Topic 12: Measuring Length

Big Conceptual Idea: [K-5 Progression on Measurement and Data \(Measurement Part\)](#) (pp. 12-15)

Prior to instruction, view the [Topic 12 Professional Development Video](#) located in Pearson Realize online. Read the Teacher's Edition (TE): Cluster Overview/Math Background (pp. 687A-687E), the Topic Planner pp.687I-687K), the Topic Performance Assessments (pp. 757-758A), and all 9 lessons

<p>Mathematical Background: Read Cluster Overview (TE, pp. 687A-687E)</p>	<p>Topic Essential Question: What are ways to measure length?</p> <p><i>Reference Answering the Topic Essential Question (TE, pp. 753-754) for key elements of answers to the Essential Question.</i></p>
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The lesson map for this topic is as follows:

12-1	12-2	12-3	12-4	12-5	12-6	12-7	12-8	12-9	Assessment
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5 A/D/E days used strategically throughout the topic.

Instructional note:

The big idea of Topic 12 focuses on measurement. Focus instruction on Nevada Academic Content Standards (NVACS, 2010) cluster 2.MD.A.

2.MD.A Measure and estimate lengths in standard units.

1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
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.
3. Estimate lengths using units of inches, feet, centimeters, and meters.
4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Students construct understanding of length as a measurable attribute along an object from end-to-end, expressed in a number of same-sized units. In second grade, students will measure length with both customary (inches, feet, yards) and metric units (centimeters, meters).

*Only after children understand and can use single units of measurement should they move to working with common measuring tools. On the 2003 NAEP exam (Blume, Galindo, & Walcott, 2007), only 20 percent of fourth graders could give the correct measure of an object not aligned with the end of a ruler... Even at the middle school level, only 56 percent of eighth graders answered the same situation correctly (Kloosterman, Rutledge, & Kenney, 2009). Students on the same exam also experienced difficulty when the increments on a measuring tool were not one unit. **These results point to the difference between using a measuring tool and understanding how it works** (Van de Walle, Karp, Lovin, & Bay-Williams, 2014, p. 280).*

In first grade, students constructed measurement concepts of length as a number of same-size units that span the object being measured with no gaps or overlaps. They iterated (lay end to end) non-standard units of measurement, ordered up to three objects by length and compared the lengths of two objects using a third object as a reference. In second grade, students build an understanding of the need for standard units (e.g., inches and centimeters) of measurement. They use tools of measurement (e.g., rulers, yardsticks, meter sticks, and measuring tapes) to reinforce their understanding of the iteration of units (NVACS, 2010, 2.MD.A.1). In addition, students connect the size of the unit to the amount of iterations needed to measure a given length by measuring objects twice (NVACS, 2010, 2.MD.A.2). For example, a smaller unit such as centimeters requires more iterations than a larger unit, such as inches, to measure the same length. Thus, there is an inverse relationship between unit size and number of units needed for a given length. This understanding helps students choose appropriate measurement tools given the context and item to be measured (NVACS, 2010, 2.MD.A.1). Finally, students estimate lengths using inches, feet, centimeters, and meters and measure to compare the length difference of two objects (NVACS, 2010, 2.MD.A.3 and 2.MD.A.4).

As you child-watch, look for evidence of student understanding of *how* a measuring tool works. It is helpful to have an awareness of these understandings and common misconceptions, listed below. (Van de Walle, et al., 2014, p.280).

Topic 12
Measuring Length

Number of lessons: **9**

A/D/E: 5 days

NVACS Focus:
MD.A

Total Days: ~14

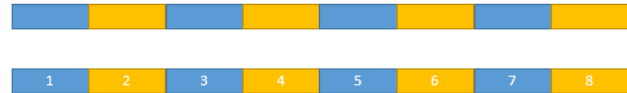
[2nd Grade Curriculum](#)
[Pacing Framework:](#)
[Balanced Calendar](#)

- Leaving gaps between units
- Overlapping units
- Using units that are not of equal size
- When using a ruler, beginning at "1" rather than "0"
- Measuring from the wrong end of the ruler
- Counting the marks on a ruler rather than the spaces in between
- Comparing lengths of two objects at one end only

One recommendation for supporting students in constructing understanding of measurement of length as the spaces between, rather than the number of marks on a ruler, is to have students construct their own ruler (Van de Walle, et al., 2014, p.285). Students can use physical objects to mark off length-units on a strip of paper. Doing so helps students connect measurement as the iteration of a length-unit, such as one-inch or one-centimeter cubes to measurement with a tool such as a ruler (CCSWT, 2012, p.13). In addition, students will benefit from discussions around what they are counting. By focusing on the length-unit, students will develop understanding that in measurement, the unit is critical. For example, linking together varying size paper clips to measure is not an accurate form of measurement. Five small paper clips and two large paper clips cannot be used to articulate the length of an object as "seven paper clips long". In summation, instruction with measurement should provide students with opportunities to work with manipulative length-units (e.g., 1-inch tiles, 1-centimeter cubes), connect to tools such as rulers, and participate in discussion around their experiences.

Make Your Own Ruler

Strips of two colors of construction paper glued onto cardstock
 Discuss how the strips can be used to measure: laying them end to end
 Use discrepancies to discuss:
 units must have no gaps or overlaps
 units must be equal length
 units must be placed along path being measured
 Compare to a standard ruler: The numbers are at the end of the units; Notice where 0 is.



(A., V. D., Lovin, L. H., Karp, K. S., & Bay-Williams, J. M. (2014). *Teaching student-centered mathematics*. Boston: Pearson.)

Math Practice 6: Attend to precision

Focus on opportunities for students to develop MP.6 behaviors. This is the focus of the Math Practices and Problem Solving lesson 12-9. Reference the Teacher’s Edition (TE, pp. F28-F28A) and the *Nevada Academic Content Standards for Mathematical Practice*.

Note: The purpose of the curriculum guides is for additional considerations. Therefore, not all components may have additional notes included in this guide.

Essential Academic Vocabulary Use these words consistently during instruction.	
New Academic Vocabulary: (First time explicitly taught)	Review Academic Vocabulary: (Vocabulary explicitly taught in prior grades or topics)
estimate inch, in. foot, ft. yard, yd. height	nearest inch centimeter, cm nearest centimeter meter, m

Additional terminology that students may need support with: ruler, measuring tape, meter stick, yardstick

***Collaborative Team Conversations (CTC)**

Consider using **one** of the following as part of the formative assessment process at the lesson level to **collect student work** to analyze for **evidence of mathematical understanding**:

Guiding question: "Are students developing conceptual understanding of the inverse relationship between the size of the unit and the number of units that are needed to equal the length of an object?"

Lesson	Evidence	Look for
12-4	Solve & Share (student work samples)	Focus CTC around the big idea: <ul style="list-style-type: none"> • student strategies and models • accurate measurements of items • smaller units = more iterations
12-7	Quick Check (digital platform) items 3, 4 and 5	Focus CTC around data analysis and collection of student workspace (scratch paper). Printable version available under "Teacher Resources".

Learning Cycle Assessments (summative)	Topic Assessments SE pp. 753-758	Use <i>Scoring Guide</i> TE pp. 753-758
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Standards listed in **bold** indicate a focus of the lesson.

NVACS (Content and Practices)	Mathematical Development of the Big Idea	Instructional Clarifications & Considerations
Lesson 12-1: Estimating Length		
<p>2.MD.A.3</p> <p>MP.2 MP.5 MP.6</p>	<p>Access Prior Learning: In first grade, (1.MD.A.1) students indirectly compared the lengths of two objects by using a third object.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of how to estimate the length of an object using the length of a known object. Students will use objects as models, but will express final measurements as the nearest inch, foot, or yard.</p>	<p>Estimation in measurement is often needed in real-world applications. To build students' estimation competencies, the Progression Documents indicate that "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." (CCSWT, 2012, p.15).</p> <p>Topic Opener: Consider using one A/D/E (Assessment/Differentiation/Enrichment) day to begin this topic with a "Make Your Own Ruler" experience as suggested in the Instructional Note at the beginning of this document. Also, consider limiting the <i>Topic Opener</i> to discussion of the <i>Topic Essential Question</i> (TE, p. 687), <i>Review What You Know</i> (TE, p. 688), <i>Vocabulary Review Activity</i> (TE, p. 688), and <i>Topic 12 Vocabulary Words Activity</i> (TE, p.688A) for the words <i>estimate</i>, <i>inch</i>, <i>foot</i> and <i>yard</i> only. Introduce remaining vocabulary words as they appear in instruction. Post the essential question and student strategies on your math focus wall.</p> <p>Solve & Share: During problem solving, child-watch for students who demonstrate understanding of length as measuring from end-to-end. These students should align both ends of their thumb or elbow/fingers to both ends of the object they are measuring to accurately find objects that are about 1 inch or 1 foot long. If students are only attending to one end when they align their thumb or arm, ask them to compare the object they estimate to be 1 inch or 1 foot long to those of a peer. Ask, "Does it make sense that this object is about the same length as _____?" During the share, draw upon students' language and explanations to refer back to the word <i>estimate</i>, as previously discussed in the <i>Topic Opener</i>.</p> <p>Independent Practice/Math Practices and Problem Solving: As previously indicated, students do NOT need to do all of the problems in their Student Edition. However, ALL students NEED to have opportunities to solve problems at varying DOK levels. The <i>Independent Practice</i> page offers problems that support procedural skill and fluency. The <i>Math Practices and Problem Solving</i> page offers problems that support application. The <i>Quick Check</i> items (marked with a pink check) offer both opportunities. Have students complete these items first and continue on to other items as appropriate.</p>

Lesson 12-2: Measure With Inches		
<p>2.MD.A.3 2.MD.A.1</p> <p>MP.1 MP.3 MP.5 MP.6</p>	<p>Access Prior Learning: In the prior lesson, second grade students used a known object to estimate the length of another object.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of the measurement of length and height to the nearest inch, using a ruler.</p>	<p>Focus child-watching in this lesson on students' ability to use a ruler correctly, and to measure an object from end-to-end. Students will benefit from first measuring by iterating physical objects such as 1-inch tiles or with the ruler they constructed in the <i>Topic Opener</i> before using a ruler. Teaching Tool 43 offers printable 1-inch squares.</p> <p>Solve and Share: Ensure that all children have access to physical 1-inch objects to support the concept of length-unit iteration (not leaving spaces between units). This concept is illustrated by contrasting Melissa's Work with Henry's Work in the Analyze Student Work samples (TE p.699). Child-watch for evidence of student understanding that measurement requires no gaps or overlaps. Continue to watch for students who measure the object from end-to-end. During the share, be sure to highlight misconceptions that arise so they may be explored and clarified by students. Examples may include gaps, overlaps, only aligning to one end of the line, or using units that are not the same size.</p> <p>Visual Learning: Consider providing students with rulers that only contain inches for this lesson (Reference Teaching Tool 42 for a printable version). Give students time to explore rulers and discuss what they notice before engaging in the Visual Learning animation. As suggested in the Coherence note (TE p.700), point out that there are no gaps or overlaps on a ruler. During the animation, students may need support with understanding the halfway mark. Ask, "Where is the halfway mark between 1 inch and 2 inches? How do you know? Why is it called the halfway mark? Does it look different?"</p> <p>During the <i>Do You Understand? Show Me!</i> (TE, p.700), consider keeping track of child-watching on a checklist of important measurement ideas, similar to the list of misconceptions in the Instructional Note at the beginning of this document.</p> <p>Independent Practice/Math Practices and Problem Solving: Encourage students to work in pairs. For item 3, have them explain how they estimated before they measure to support the understandings developed in lesson 12-1.</p>
Lesson 12-3: Inches, Feet, And Yards		
<p>2.MD.A.1 2.MD.A.3</p> <p>MP.2 MP.5 MP.6 MP.8</p>	<p>Access Prior Learning: In this topic, students have estimated and measured length in inches, feet and yards.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of measurement to the nearest inch, foot and yard.</p>	<p>Draw upon students' understanding of equivalence in other domains, such as place value when working with measurement equivalencies such as 12 inches in 1 foot.</p> <p>Solve & Share: In addition to what is asked, also require students to explain <i>how</i> they estimated and <i>why</i> they think the object identified is about 1 inch, 1 foot or 1 yard, respectively. Child-watch for students who use a known object to estimate the lengths of unknown objects.</p> <p>Visual Learning: Give students time to explore measuring tools including yardsticks and measuring tapes prior to the <i>Visual Learning</i> animation. Engage students in a discussion of what they notice about each tool and encourage them to compare and contrast these tools to a ruler. Also, ask students to identify scenarios when one tool would be more appropriate than another. Consider capturing this information and student ideas on an anchor chart to add to the math focus wall. Continue to add to this chart through the remainder of the topic.</p>
Lesson 12-4: Measure Length Using Different Customary Units		
<p>2.MD.A.2 2.MD.A.1</p> <p>MP.2 MP.3 MP.5 MP.6 MP.8</p>	<p>Access Prior Learning: In first grade (1.MD.A.1), students understood measurement of length as the number of same-size length units that span with no gaps or overlaps.</p> <p>In this topic, second grade students have estimated and measured with customary units including inches, feet and yards.</p> <p style="text-align: center;"><i>-continues on next page-</i></p>	<p>In this lesson, students connect the size of the unit to the amount of iterations needed to measure a given length by measuring objects twice (2.MD.A.2). For example, a smaller unit such as inches requires more iterations than a larger unit, such as feet, to measure the same length. Thus, there is an inverse relationship between unit size and number of units needed for a given length. This understanding helps students choose appropriate measurement tools (2.MD.A.1) given the context and item to be measured.</p> <p>Solve & Share: During problem solving, continue to child-watch for understanding of measurement concepts. Again, consider keeping record of these understandings through the use of a checklist. If your students are showing misconceptions with measurement or the use of measurement tools, consider having two students measure the same object and discuss the discrepancy in their results. Also, during the share, have students model how they measured their object of choice to clarify existing misconceptions, doing so without losing focus on the essential understanding of the inverse relationship of unit size to measurement.</p> <p>* CTC: <i>Solve & Share</i> (student work samples)</p>

	<p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of the inverse relationship between the size of the length-unit and the number of units needed to measure a given length. They construct this understanding by measuring objects twice, with two different units.</p>	
<p>Lesson 12-5: Measure With Centimeters</p>		
<p>2.MD.A.3 2.MD.A.1</p> <p>MP.2 MP.3 MP.5 MP.6 MP.7</p>	<p>Access Prior Learning: In this topic, students have estimated and measured with customary units including inches, feet and yards.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of estimating and measuring length and height using centimeters.</p>	<p>As indicated in the NVACS (2.MD.A.1 and 2.MD.A.3) second grade students are expected to estimate and measure lengths using both customary and metric units. Consider having students repeat the “Make Your Own Ruler” activity by iterating physical 1-centimeter units on a strip of paper before the lesson.</p> <p>Solve & Share: Ensure that all children have access to physical 1-centimeter objects, such as base-ten unit cubes, to support the concept of length-unit iteration (not leaving spaces between units). Continue to child-watch for evidence that student understanding of measurement is generalized from their work with customary units to their work with metric units.</p> <p>Visual Learning: Provide students with rulers that show only centimeters (Reference Teaching Tool 44 for a printable version) or rulers that show both inches and centimeters. Give students time to explore the rulers and discuss what they notice before engaging in the <i>Visual Learning</i> animation. Encourage students to connect their experience and understanding with rulers and inches to centimeters. Record new thinking to the anchor chart started in lesson 12-3.</p> <p>Independent Practice/Math Practices and Problem Solving: Encourage students to work in pairs. For item 5, have them explain how they estimated before they measure to support the understandings developed in lesson 12-1.</p>
<p>Lesson 12-6: Centimeters And Meters</p>		
<p>2.MD.A.1 2.MD.A.3</p> <p>MP.2 MP.3 MP.5 MP.6 MP.8</p>	<p>Access Prior Learning: In lesson 12-5, students estimated and measured length and height with centimeters.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of measuring length and height with centimeters and meters.</p>	<p>Solve & Share: In addition to what is asked, also require students to explain <i>how</i> they estimated and <i>why</i> they think the object identified is about 3 centimeters or 1 meter long, respectively. Child-watch for students who use a known object to estimate the lengths of unknown objects. Reference the instructional note in Lesson 12-1 regarding estimation in measurement.</p> <p>Visual Learning: Give students time to explore measuring tools including meter sticks and measuring tapes prior to the <i>Visual Learning</i> animation. Engage them in a discussion of what they notice about each tool and encourage them to compare and contrast these tools to a ruler. Also, ask students to identify scenarios when one tool would be more appropriate than another would.</p>
<p>Lesson 12-7: Measure Length Using Different Metric Units</p>		
<p>2.MD.A.2 2.MD.A.1</p> <p>MP.1 MP.2 MP.3 MP.5 MP.6</p>	<p>Access Prior Learning: In this topic, students have estimated and measured with metric units including centimeters and meters.</p> <p>Securing the Big Idea: In this lesson, students are <i>securing</i> understanding of the inverse relationship between the size of the length-unit and the number of units needed to measure a given length. They construct this understanding by measuring objects twice, with two different units.</p>	<p>In this lesson, students connect the size of the unit to the amount of iterations needed to measure a given length by measuring objects twice (2.MD.A.2). For example, a smaller unit such as centimeters requires more iterations than a larger unit, such as meters, to measure the same length. Thus, there is an inverse relationship between unit size and number of units needed for a given length. This understanding helps students choose appropriate measurement tools (2.MD.A.1, MP.5) given the context and item to be measured.</p> <p>Solve & Share: In addition to what is asked, have students write an explanation of <i>why</i> they think one unit needs more units to measure the pencil, inches or centimeters, supporting MP.3 behaviors.</p> <p>*CTC: <i>Quick Check</i> (digital platform)</p>

Lesson 12-8: Compare Lengths		
<p>2.MD.A.4 2.MD.B.5</p> <p>MP.2 MP.3 MP.4 MP.5 MP.6</p>	<p>Access Prior Learning: In this topic, second grade students have estimated and measured length and height in both customary and metric units.</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding that the difference in the lengths of two objects can be found using subtraction.</p>	<p>Students' experiences with (a) measuring two parts of a path and adding them together, and (b) using subtraction to compare lengths will lay a foundation for addition and subtraction with lengths in Topic 13.</p> <p>Solve & Share: During child-watching, look and listen for evidence of estimation strategies such as those identified in the lesson 12-1 instructional note.</p> <p>Independent Practice/Math Practices and Problem Solving: Items 8-11 and 14 offer students an opportunity to apply fluency with basic addition and subtraction facts. Child-watch for students' flexible use of strategies such as making ten, think addition and doubles.</p>
Lesson 12-9: Math Practices And Problem Solving: Precision		
<p>2.MD.A.1 2.MD.A.3</p> <p>MP.1 MP.2 MP.3 MP.5 MP.6</p>	<p>Access Prior Learning: In first grade, students engaged in the Standards for Mathematical Practice including MP. 6 Attend to Precision</p> <p>Developing the Big Idea: In this lesson, students are <i>developing</i> understanding of Math Practice 6: Attend to Precision by selecting tools, units and methods to measure precisely.</p>	<p>Consider using the <i>Math Practice 6 Animation</i> on Pearson Realize Online for an example of MP.6 behaviors. Refer to the <i>Math Practices and Problem Solving Handbook</i> for ideas on developing, connecting and assessing MP.6 (TE, p.F28-F28A).</p> <p>MP. 6 Behaviors:</p> <ul style="list-style-type: none"> • Computes accurately • Uses symbols appropriately • Accurately uses problem-solving strategies • Specifies and uses units of measure appropriately • Decides whether an exact answer or estimate is needed • Calculates efficiently, accurately, and fluently

References

Common Core Standards Writing Team. (2012, June 23). *Progressions for the Common Core State Standards in Mathematics (draft). K-5, Geometric Measurement*. Tucson, AZ: Institute for Mathematics and Education, University of Arizona.

Council of Chief State School Officers. (2010). *The Nevada Academic Content Standards*. Retrieved from http://www.doe.nv.gov/uploadedFiles/nde.doe.nv.gov/content/Standards_Instructional_Support/Nevada_Academic_Standards/Math_Documents/mathstandards.pdf.

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