Unit Outline: Measuring Up!

Grade Level 2 Math: **Measurement**

Introduction:

This unit focuses on further developing students' concept of linear measurement, and it provides opportunities for teachers to build the foundation for students who may not have background knowledge or prior instruction in this area. The unit offers support and scaffolding intended specifically for ELLs, but that would be beneficial for all students. It is important to address the specific language needs of ELLs as they engage with the rigorous curriculum that addresses the Common Core Standards. As ELLs learn new content-specific vocabulary and develop conceptual understanding of the content they are learning, specific language functions must also be developed and supported. Essential strategies and scaffolds to develop both content and language are embedded in this unit.

Unit Topic and Length

This unit consists of multiple lessons with supporting handouts and assessments. Some lessons take place over two days; others can be completed in a single instructional period. Teachers may use this unit outline as it is described below, integrate parts of it into an existing curriculum unit, and/or use it as a model.

The unit focuses on the following **Common Core Learning Standards:**

2.MD.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.

2.MD.6 Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

This unit also addresses the following **Common Core Learning Standards:**

2.MD.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

2.MD.4 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

2.MD.5 Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.

Mathematical Practice Standards that are addressed:

1. Make sense of problems and persevere in solving them. Students explain to themselves the meaning of a problem and look for entry points to its solution.
2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.
3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumptions, definitions, and previously established results in constructing arguments.
4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.
5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem.
6. Attend to precision. Students try to communicate precisely to others. They use clear definitions in discussions with others and in their reasoning.
7. Look for and make sense of structure. Students look closely to discern structure.
8. Look for and express regularity in repeated reasoning. Students notice if calculations are repeated, and look for both general methods and shortcuts.

Big Ideas/Enduring Understandings:	**Essential Questions:**
Measurement compares an item to an agreed-upon unit that may be standard or non-standard. Measurement tools such as rulers are standardized to allow for this comparison to be universally understood. A non-standard unit (such as a shoe, paperclip, etc.) can be used as a measuring tool, but is less likely to be meaningful or relevant once removed from the setting in which it is used. To measure anything meaningfully, the attribute (length, width, and height) to be measured must be understood. • Standard units are of equal size and do not change. • Units can be standard or non-standard. • Objects can be measured with different standard units like centimeters and inches. • Objects can be measured with non-standard units, such as crayons,	• How do we measure? • In what situations do we utilize measurement in the real world? Why? • What is the purpose of standard units of measure? • How do you calculate length from different starting points (not beginning at 0) using standard measurement tools? • How would you describe the size of an object? • Why might it be useful to measure an object using two different units?

paperclips, etc., as long as each unit has the same size. • The same-sized unit must be used consistently to measure any one object. • The smaller the unit being used, the more iterations will be needed to cover the given length of the object.	
Language Objectives: • Students will be able to state orally and in writing the length of an object using non-standard units of measure. • Students will be able to explain the criteria for measuring. • Students will be able to describe orally and in writing the size of an object in terms of length units using the words *inches, centimeters, length, long, height, width, wide,* and *size*. • Students will be able to explain orally and in writing why inches and centimeters yield different measurements when measuring the same length**.** • Students will be able to explain orally and in writing the difference between length and width. • Students will be able to use related math vocabulary to provide evidence to their partners and/or teacher of the way they measured and completed the task. • Students will be able to explain orally and in writing how and why measuring with the most appropriate tool is important and beneficial. • Students will be able to use introduced content vocabulary to describe the difference between two units in relation to the size of the unit.	**Content Objectives:** • Students will recognize length, width, and height as attributes of measurement. • Students will be able to measure and record the length, width, and height of an object using customary, metric, and/or non-standard units. • Students recognize the criteria for iteration, which is to follow a path to be measured with no gaps or overlaps, placing the unit of measure end to end. • Students will understand that units have a value that represents a measurement of space. • Students will be able to distinguish between inches and centimeters. • Students will be able to distinguish between length and width. • Students will be able to accurately measure using non-standard rulers and yard/meter sticks, i.e., measuring inches and centimeters by counting units (inches or centimeters) beginning at different points on the rulers and yard/meter sticks. • Students will be able to measure an object twice using customary and metric units, and compare how the two measurements relate to the size of the unit chosen. • Students will measure the length of an object by selecting and using appropriate tools (such as rulers, yardsticks, meter sticks, and measuring tapes) based on the attribute being measured.

Explicit Support for English Language Learners:

- *Total physical response (TPR)* is a language-learning method based on the coordination of speech and action. It was developed by James Asher, and it proposes that language is learned best through action.
- *Vocabulary and language development*: The teacher introduces new topics by discussing key vocabulary words. When teaching students new vocabulary, it is beneficial to identify and tier the words for explicit ELL instruction. Tier 1 words are words that are non-academic. They are words that may be used in everyday conversations. Tier 2 words are more general academic words that are regularly used in a school environment. Tier 3 words are technical words that are specific to the topic being studied. Identifying these words will help focus vocabulary instruction and development which will give ELLs a clear understanding of technical terms which they will use to communicate in classroom discourse.
- *Activating prior knowledge* means tapping into knowledge students already have about a topic. For example, a semantic web helps students to share what they already know about a topic and helps the teacher make connections with students' prior knowledge and new learning about the topic. Furthermore, it helps the teacher to clarify misconceptions about the topic and determine what areas need to be further developed.
- *Building background knowledge* develops the necessary vocabulary and foundational skills and concepts that will be taught. It is helpful for the teacher to provide a purposeful shared experience, particularly for ELLs who come from diverse backgrounds. The shared experience gives ELLs access to new content and vocabulary by explicitly linking concepts from past learning or experiences to new content.
- *Cooperative learning* (in small groups or partnerships) promotes the use of academic language, mathematical concepts, and social skills through peer interaction. It helps develop the four modalities of language acquisition for ELLs (reading, writing, speaking, and listening) through the content area of mathematics. When developing oral language, it is important for teachers to encourage participation, because students may come from countries with different social norms and cultures.
- *Visuals and modeling* support the development of concepts for ELLs by giving students clues that clarify meaning, solidify their understanding of the lesson, and increase their vocabulary as they hear the new words and associate them with the visual aid being provided. This helps to scaffold auditory comprehension. Pictures, diagrams, and charts make the content more accessible.
- *Cognates* are words that are similar in English and the student's native language. Drawing students' attention to similarities between their native language and the target language (English) helps them to better understand key concepts and enables them to bridge prior learning to new vocabulary.
- *Metacognition* involves teaching the student to think about his or her own thinking process. To teach metacognitive skills, the teacher must model the thinking processes as he/she works toward solving a problem and ask students to do the same. Students can be provided with guiding questions/prompts that they can ask themselves and rubrics in order to promote the development of metacognitive skills.

- *Teacher observation:* The teacher observes and records students' performance during independent and small-group practices. The teacher provides meaningful feedback to aid students in understanding concepts and ensure appropriate use of general and technical academic language.
- *Wait time* provides English language learners additional time after a question is posed to process, synthesize, and plan their responses.
- *Explicit instruction* is essential. Direct teaching of academic language, concepts, and skills is necessary to ensure that ELLs receive coherent, scaffolded, and seamless instruction.
- *Real-world contexts and relevant themes* allow the learner to connect with the content in a way that is engaging and applicable. This involves the use of real-life problem-solving situations to teach new concepts. Themes that appeal to students will generate interest and motivate them to learn more effectively.
- *Rate of speech:* The teacher should be cognizant of her/his speech patterns. ELLs benefit when a teacher enunciates clearly and slowly. She/he should also pause between sentences and thought groups.
- *Writing key concepts on the board* using sentence strips or index cards helps students connect the concept to the actual word. When possible, use different colors and fonts to highlight key concepts. This provides a reference point for students to review key terms throughout the lesson/unit and provides a visual aid for students to refer back to when they are using key terms and vocabulary in their speech or writing. Adding an illustration, if possible, can aid ELLs in making a connection to the vocabulary.
- *Partnering ELLs with strong English or bilingual speakers* provides language support for the beginning-level students and language practice for more advanced speakers. One strategy for partnering ELLs with stronger English speakers is *turn and talk*, where students turn to a partner to share a response. Another strategy is an *inner-outer circle*, where intermediate and advanced students can be paired in the inner circle and beginner and intermediate students in the outer circle (depending on the number of students in the class). The teacher is in the center of the circle. Students in the inner circle share first, and as they share, the teacher is listening and providing feedback. Then, the outer circle shares. Once everyone has shared, students are called on to share what their partner has stated. This accountability helps to keep students engaged in the activity. Students can then rotate clockwise and share with a different partner. This gives students more opportunity to practice vocabulary.
- *Hands-on activities* provide for a tactile learning experience. They address the needs of the kinesthetic learner. The physical, hands-on act reinforces the mathematical reasoning and supports speaking and listening skills.
- *Design multi-sensory lessons* (visual, auditory, tactile, kinesthetic).
- *Directions should be made clear*, written on the board or a chart for students to refer to. Pause between sentences and thoughts. Repeat, rephrase, and paraphrase. Use key words frequently when applicable.
- *Displaying a math word wall,* which students can refer to at any time. Words that are grouped by mathematical topics and accompanied by pictures or illustrations are even more effective.

- *Journaling* is a tool for students to express their mathematical thinking. It helps address the writing modality and provides an opportunity for students to use mathematical language and vocabulary in context. It also provides a great opportunity for students to write in their native language. Many students may solve problems differently because of a strategy learned in their native country. A colleague who is fluent/literate in the students' native language may help to assess their responses.
- *The Frayer Model* is a graphic organizer that can be used to develop language and deepen the understanding of technical vocabulary. This model assists students in thinking about and describing the meaning of a word or concept by defining the term, describing its essential characteristics, providing examples and non-examples of the idea.
- *Using realia* (real-life objects) helps contextualize students' learning. In math, it helps to engage students' kinesthetic learning, as they are able to touch and interact with objects pertinent to the task. In estimation, for example, ELLs and other students may benefit from running their fingers across the length of an object as they mentally iterate the unit with which they are estimating.

Evidence and Activities:

Pre-Assessment:

The pre-assessment addresses CCSS standards 2.M.D.2, and 2.M.D.6. It is designed to indicate students' strengths and weaknesses in the area of measurement. It will provide teachers with a baseline for instruction. The pre-assessment will also provide teachers with data to inform their instruction, to meet any challenges or address misconceptions that students may have, and to set up small learning groups**.**

Resources needed for the assessment: Counters, rulers, pencils, class set of initial assessment copies

Formative Assessment:

The formative assessment is designed to bring to light any misconceptions that students may retain as the unit progresses. The unit requires students to demonstrate an understanding of equal units and unit iteration as well as an understanding of the relationship between tiling and standard measuring tools. Students will begin to articulate the relationship between two different units of measure used in measuring the length of a single object. As with the pre-assessment, data generated by this formative assessment will be used to inform instruction.

Resources needed for the assessment: Counters, rulers, pencils, class set of formative assessment copies

Summative Assessment:

The summative assessment is the final formal assessment to show how students have progressed throughout the entire unit. The summative assessment is designed to measure the development of understanding at the end of the unit. Assessing can be a productive tool for

educators because it can impact the quality of planning and instruction as well as student learning and performance.

Resources needed for the assessment: Counters, rulers, pencils, class set of summative assessment copies

Linguistic Access:

In these supportive materials, a distinction between the vocabulary and language functions is needed to provide entry points to the math content. Both need to be clarified to ensure comprehension and avoid misunderstanding. This can be done by introducing and/or reviewing the most essential vocabulary words/phrases and language functions in context and with concrete models when applicable. This is necessary in order for English language learners to better understand the meaning of the terms. The following vocabulary and language functions are suggested:

Vocabulary Words/Phrases

In order for ELLs to have access to language and concepts, teachers must introduce new topics by discussing key vocabulary words. When teaching ELLs new terms, it is beneficial to identify and tier the words for explicit vocabulary instruction. Tier 1 words are words that are non-academic: they are words that may be used in everyday conversations. Tier 2 words are general academic words that are regularly used in a school environment. Tier 3 words are technical words that are specific to the topic being studied. Identifying these words will help focus vocabulary instruction and development, which will give ELLs a clear understanding of technical terms which they will use to communicate in classroom discourse.

- Tier 1 vocabulary is non-academic language.
- Tier 2 vocabulary is general academic language.
- Tier 3 vocabulary, which must be carefully developed, it is technical language and concepts specific to mathematics.

Unit Vocabulary

Tier 1	Tier 2	Tier 3
whole long tile wide touch ends size space	record state criteria represent appropriate reasonable compare comparison	length width height difference tiling measure iterate iteration

same more less larger smaller different gap between equal overlap follow ruler yardstick meter stick measuring tape tools part divide rectangle use shapes	determine precise accurate direction describe attribute difference explain distribute design	measurement attribute estimate approximate inch centimeter unit meter yard unit length metric customary non-standard partition equal shares half/halves third/thirds fourth/fourths attributes

<u>Language Functions</u>:

We use language for a variety of formal and informal purposes. Language functions are supported by specific grammatical structures and vocabulary. The language functions covered in this unit include:

- Comparing and contrasting
- Drawing conclusions
- Evaluating
- Interpreting
- Hypothesizing and speculating
- Giving instructions
- Expressing and supporting opinions
- Asking questions
- Asking clarifying questions
- Explaining

- Summarizing
- Estimating/approximating
- Agreeing/disagreeing

When teaching about language functions, it is important that teachers explicitly teach the vocabulary, grammatical structures, and phrases associated with each language function.

Content Access:

To provide content access to ELLs, it is important that they become familiar with the concept of measurement. Creating metric and standard rulers can help to develop familiarity with centimeters and inches. Students should be familiar with how to use measuring instruments and record measurements as well as with the number-line diagram. ELLs must be able to explain which tools are most appropriate for measuring, and how to accurately measure and compare using academic-language terms such as *appropriate, reasonable, attribute*, and *difference*. In order to successfully develop the concept of measurement, different models must be presented to ELL students.

Lesson Sequence:

Pre-Assessment

Lesson 1 – Iteration: Reviewing basics of measurement focusing on iteration

Lesson 2 – Estimating Station: Using non-standard and standard units of measurement

Lesson 3 – Using Tiles to Make Rulers: Creating a ruler using inches and centimeters; making connections between non-standard and standard units of measure

Lesson 4 – Measuring Twice: Measuring two times using standardized measuring tools; measuring in inches and centimeters

Lesson 5 – Measuring Using the Appropriate Tools

Formative Assessment

Lesson 6 – Funny Rulers: Measuring from different starting points on a ruler, yardstick, or meter stick (other than zero)

Summative Assessment

Lesson 1: Iteration

Introduction:

This lesson begins the unit on measurement. It is designed to allow teachers to solidify students grasp the concept of iteration, which is necessary to bridge understanding of the units on rulers, yardsticks, meter sticks, and measuring tapes.

Unit iteration is the act of identifying a unit, moving it along the length of an object to be measured without gaps or overlaps, and counting the number of units needed to measure the object. The units must be the same size.

Students were exposed to iterating in first grade. This lesson will either activate prior knowledge for students who already have experience with measurement or build background knowledge for those who have limited experience with measurement, and will provide an entry point to new learning for ELLs. This is a prerequisite for moving students to understanding how to use and read a ruler, yardstick, etc., by making the connection to unit iteration.

By the end of the lesson, you want to have established the criteria for measurement as well as key vocabulary.

This lesson also sets the foundation for the next two lessons: estimating using non-standard units and using one-inch tiles to make a ruler that is 12 inches long.

Mathematical Goals:

- Students will recognize length as an attribute of measurement.
- Students will be able to measure the length of an object using non-standard units, such as paperclips, pennies, or bears cutouts.
- Students will recognize the criteria for iteration: the path of an object is to be followed without any gaps or overlaps; measurement units must be placed end to end; and measurement units must be the same size.
- Students will be able to state and record the length of an object by the number of length units.

An important aspect of unit iteration is understanding that the measurement units must be the same size. Providing students with manipulatives of various sizes will give you the opportunity to see whether they have grasped this concept. Do they measure the length of the object with one unit measure, or do they mix the units?

Language Goals:

- Students will be able to state orally and in writing the length of an object using non-standard units of measure.
- Students will be able to explain the criteria for measuring.

Materials:

- One-inch tiles (six per student)
- Cutouts of strips of construction paper of various lengths
- Large pieces construction paper (Make sure that the strips of paper which students will be measuring can fit on the construction paper.)
- Experience-chart paper
- Sentence strips
- Markers (different colors)
- Glue
- Sentence strips with the words *length, iteration, measure,* and *non-standard* written on them (along with sentence frames)
- Small chart paper with the labels selected for the Frayer Model
- Paper bag or jar in which to place words for the Frayer Model activity (suggested words: *iteration, measure, length, non-standard*)
- Popsicle sticks (one per student)
- Teacher Resource #1: Manipulatives of Non-Standard Units (cutouts of paperclips, pennies, bears)
- Teacher Resource #2*:* Things to Remember When Measuring (includes Criteria for Measurement)
- Teacher Resource #3: Observation Recording Sheet
- Teacher Resource #4: Sample Math Log Graphic Organizer
- Handout #1: Pre-Assessment
- Handout #2: Frayer Model Template

Common Core Learning Standards:

1.MD.2 Express the lengths of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.

Limited to contexts where the object measured is spanned in a whole number of length units with no gaps or overlaps.

Standards for Mathematical Practice:

5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.

6. Attend to precision. Communicate precisely with others and try to use clear mathematical language when discussing their reasoning.

Common Issues	**Suggested Questions and Prompts**
Students leave gaps when placing tiles, not connecting them end to end.	➢ Facilitate student learning by cueing ELLs to the measurement reference chart, showing measuring model from mini-lesson, and/or asking students: *How do we place our units when we measure? Let's go to our reference chart. Can you show me how we place our units?* Visuals help ELLs by giving them clues that clarify meaning, solidify their understanding of the lesson, and increase their vocabulary as they hear the new words and associate them with the visual aids you provide. ➢ Have ELL students use vocabulary as they correct their placement of the units. They might state: "When I measure, I place the units end to end." Having ELL students use the vocabulary as they perform the activity helps to solidify understanding.
Students overlap tiles.	➢ Facilitate student learning by cueing them to the measurement reference chart, showing measuring model from the mini-lesson, and/or asking students: *How do we place our units when we measure? Let's go to our reference chart. Can you show me how we place our units?* Visuals help ELLs by giving them clues that clarify meaning, solidify their understanding of the lesson, and increase

	their vocabulary as they hear the new words and associate them with the visual aids you provide. ➢ Have ELL students use vocabulary as they correct their placement of the units. They might state: "When I measure, I do not overlap my units." Having ELL students use the vocabulary as they perform the action helps to solidify understanding.
Students do not follow the path of the object being measured.	➢ Facilitate student learning by cueing them to the measurement reference chart, showing measuring model from the mini-lesson, and/or asking students: *How do we place our units when we measure? Let's go to our reference chart. Can you show me how we place our units?* Visuals help ELLs by giving them clues that clarify meaning, solidify their understanding of the lesson, and increase their vocabulary as they hear the new words and associate them with the visual aids you provide. ➢ Have ELL students use vocabulary as they correct their placement of the units. They might state: "When I measure, I must follow the path of the object I am measuring." Having ELL students use the vocabulary as they perform the concept helps to solidify understanding.
Students may not recognize that each space is a unit of measurement and must be counted to measure the length of an object.	➢ Facilitate understanding of the concept by cueing students to count each tile (space) as a unit of measure.
ELLs may need help with forming a sentence to state the length of their object and its unit of measure.	➢ Model a sentence frame and post it where it is visible so ELLs can refer back to it when speaking. Sample sentence frames:

	• *The length of my paper is (# of tiles or non-standard units) .* • *The measurement of the length of my paper is (# of tiles or non-standard units) .* Sentence frames provide support for ELLs and enable them to participate in math discussions. They contextualize meaning of vocabulary. They also provide structure for practicing and acquiring the skills necessary to communicate in English. They may be used for speaking as well as writing.
ELLs may need help with the structure of language to state the criteria for measurement.	➢ Have ELL students refer back to the measurement experience chart for technical (Tier 3) and general academic language (Tier 2). Suggested sentence frames: • *When I measure, I _____.* • *Today I learned that when I measure, I _____.*

Vocabulary Instruction:

Tier 1	**Tier 2**	**Tier 3**
touch ends size space same gap overlap follow between	record state criteria	length end to end measure measurement unit non-standard iteration

In order for ELLs to have access to language and concepts, teachers must introduce new topics by discussing key vocabulary words. When teaching ELLs new terms, it is beneficial to identify and tier the words for explicit ELL vocabulary instruction. Tier 1 words are words that are non-academic. They are words that may be used in everyday conversations. Tier 2 words are general academic words that are regularly used in a school environment. Tier 3 words are technical words that are specific to the topic being studied. Identifying these words will help focus vocabulary instruction and development, which will give ELLs a clear understanding of technical terms they will use to communicate in classroom discourse.

To introduce new vocabulary to ELLs it is beneficial to use visuals and total physical response (TPR), which will help students internalize the meaning of new vocabulary. Using illustrations and physical movement helps students internalize vocabulary and its meaning.

Direct instruction of vocabulary for ELLs should include:

- Hearing, repeating, and writing the word
- Generating definitions with more familiar terms
- Discussing what is known about the word
- Providing examples and non-examples
- Engaging in extended discussions/activities with the word

Creating sentences using the words in their math log entries

The Frayer Model is a great strategy which could be used to develop vocabulary. This model uses a graphic organizer to analyze words, deepen understanding, and increase vocabulary.

Preparation for Lesson:

Prior to presenting the lesson, prepare the following:

- Pre-cut strips of construction paper (of various lengths) that students will be measuring
- Pre-cut manipulatives students will using to measure and paste (see **Teacher Resource #1: *Manipulatives of Non-Standard Units***)
- Construction paper on which students will paste their sentence strips and measurement units.

Place items in containers (paper bags or jars) and/or on trays for easy distribution. Write the vocabulary words that will be explicitly taught on sentence strips—one word per sentence strip.

Write the following sentence frames on an experience chart or sentence strips so they can be displayed and be visible to all students:

Sentence frames are scaffolds that provide necessary support for ELLs in the development of language and enable them to participate in math discussions by contextualizing the meaning of the vocabulary being used. They also provide structure for practicing and acquiring the skills needed to communicate in English. By posting written sentence frames in the classroom, you are modeling language as well as providing a visual which students can refer back to.
They contextualize the meaning of the vocabulary being used.

- *The length of my paper is _(# of tiles or non-standard units)_.*
- *The measurement of the length of my paper is _(# of tiles or non-standard units)_.*

Write the following language and content objectives on the experience chart:

- Content objective: Students will be able to measure the length of an object using non-standard units of measurement.
- Language objective: Students will be able to orally state criteria for measuring to a partner.

Suggested Lesson Outline:

Pre-Assessment

To assess students' strengths and weaknesses in the area of measurement, distribute **Handout #1: *Measurement Pre-Assessment*** and six one-inch tiles to each student. Explain that they will use the tiles to answer questions 2a through 2d on the handout. Give students sufficient time to answer the questions independently. When time is up, collect the handouts, making sure the student's name appears on his/her handout.

Whole-Class Discussion

Bring students to the meeting area. Start by telling them:

Today we are going to begin our lessons on measurement. I would like find out what you know about measurement from first grade or from things you do at home. Let's start by brainstorming what we know about measurement. I am going to give you a few minutes to think about measurement and plan what you are going to say. Thumbs up when you are ready to share.

Call on students to share their ideas on measurement. Have their classmates use popsicle sticks to show whether they agree or disagree with each statement. Students are called upon to justify their agreement or disagreement. Write the responses that were agreed upon by the rest of the class on an experience chart with the heading "Measurement."

Some guiding questions to facilitate learning are:

- Why do we measure?
- Why is measurement important?
- How do we measure an object?

Using popsicle sticks is a strategy that keeps ELLs engaged in the conversation. It can be used as an informal assessment for understanding. You can prepare the sticks by writing "agree" on green Post-its and "disagree" on red Post-its, and stapling or gluing them back-to-back onto the popsicle sticks. Once the routine is established, they can also be used in other content areas. You can model conversational language for this strategy with the following sentence frame to help ELLs justify their answers*: I agree/degree with (classmate's name) statement because _____.*

Sample students responses:

- We measure to find out how long something is.
- So that the dress my mom makes for me is the right size.
- I use a ruler to measure how long something is.

After recording the agreed-on student responses on the measurement chart for reference, read them aloud and have students repeat them after you.

Mini-Lesson: Introduce the Objectives of the Lesson

Display the content and language objectives that you have written on the experience chart.

Read the objectives of the lesson to students:

- Content objective: Students will be able to measure the length of an object using non-standard units of measurement.
- Language objective: Students will be able to orally state criteria for measuring to a partner.

Introducing and explaining language and content objectives helps students understand the outcome of the lesson and how they are going to show that they met the objective. It also gives the teacher the opportunity to explicitly teach the genera and technical academic language students will need to comprehend the concept and complete the task.

Reread the content objective. Then, highlight the word "measure" and ask students: *What does it mean to measure?*

Provide wait time using the fist-to-chest strategy. Then, call on students for responses. Guide students to generating the meaning of measure: a comparison to some other known unit to find the size of something. Write the definition on the measurement chart for reference. Then, post the word "measure," written on a sentence strip, with an illustration of something being measured. The sentence strip and illustration will be moved to the word wall at the end of the lesson. Then, have the class come up with a movement that depicts measuring.

Tell students: *Our content objective states that we are going to measure length using non-standard units.* Highlight the word "length" in the content objective.

"Wait time" gives ELLs the time to process the question/task, formulate their ideas, and prepare their responses.

Fist-to-chest strategy: Students bring their fist on their chest and put one finger up for each response they come up with. This keeps the students who come up with responses quickly engaged in their thinking by coming up with more possible responses. It also relieves pressure on students who need extra time.

Highlighting Tier 2 and Tier 3 vocabulary in the content and language objectives in a different color or by underlining will signal to students that they are important words and that they have to use during independent/small-group practice and the share. Explicitly teaching ELLs technical vocabulary will help develop their English. Seeing where words are placed on the math word wall will aid in identifying words and increase the use of mathematical language when speaking and writing.

Show students a strip of paper and ask: *Who can tell us what length is? If I want to measure the length of this paper, what would I be measuring?*

Provide wait time using the fist-to-chest strategy. Then call on students to give their responses. Facilitate students' thinking to establish a definition for length: the longest side of an object. Identify the longest side of the paper as the length to be measured. Post the word "length," written on a sentence strip, with an illustration depicting it. They will be moved to the word wall at the end of lesson. Then, have the class come up with a movement that depicts length. (TPR)

TPR – Creating a movement with students that explains the word will aid in ELLs' internalizing its meaning.

Say to students: *We are going to measure length with non-standard units. What do you think non-standard units are?*

Provide wait time using the fist-to-chest strategy. Then, call on students to give their responses. Guide students to the conclusion that non-standard are units other than the regular units used for measurement in rulers, tape measures, etc.; non-standard units could be objects used in everyday life, even body parts. Post the word "non-standard" written on sentence strip with an illustration. (You can even use the manipulative cutouts of non-standard units on Teacher Resource #1 that students are going to use in their independent practice). They will be moved to the word wall at the end of lesson.

Explain to students that they will be using paper clips, bears, and pennies cut-outs as non-standard units. Refer to the posted definition of non-standard units.

Next, read the language objective to the class:

- Students will be able to orally state criteria for measuring to a partner.

Say: *Remember, the language objective tells us how we are going to show that we met the content objective. So you are going to be able to "state" to your partner—which means you will able to tell your partner—the criteria for measuring. What are criteria?*

Guide students in establishing that criteria are accepted steps used in making a decision about something. You could make the connection to students' checklists or rubrics already used in the classroom.

Paste a strip of paper on the measurement reference chart and say: *We want to measure the length of this strip of paper. What do we need to do? What steps do we have to follow? I am going to give you time to think about it. When you think you know the answer, put your fist to chest.*

Call on students to give you the procedure for measuring the strip of paper. Glue non-standard units on the chart. This will serve as a model for students as they work independently.

Using visuals and labeling helps contextualize language for ELLs.

The measurement reference chart, which can be referred to as needed, is an important scaffolding tool for ELLs. It will also be built upon as the unit progresses.

As you model, purposely leave gaps, do not follow the path, overlap tiles, mix the non-standard units, and ask students if this is the correct way to measure. Have students use the "agree"/"disagree" popsicle sticks to show their thinking. You will call on students to respond based on their "agree" or "disagree" responses. This is a quick assessment so that misconceptions may be addressed at this point.

This portion of the mini-lesson will establish the criteria for iteration. List the criteria for measurement—*iteration*—on the measurement chart as you model it using non-standard units (see Teacher Resource #2):

- We use the same size units to measure.
- We do not leave spaces or gaps in between our units.
- Our tiles are not on top of each other or overlapping.
- We put our tiles end to end.
- The ends of our tiles touch.
- Our tiles have to follow the objects we are measuring.
- When we measure, we iterate units.

Tell students: *This is called iteration. When we measure, we leave no gaps or overlap, we follow the path of the object being measured, we place units end to end, and we use the same-sized units to measure.*

Have students repeat the word "iteration," write it on the measurement chart, and have student repeat it again, clapping out the syllables. Post the word "iteration" written on a sentence frame, and move to the math word wall at the end of lesson.

After you have completed measuring the length of the strip of paper, record the length and the unit measure. State the length using the preplanned sentence frames:

- *The length of my paper is (# of tiles or non-standard units) .*
- *The measurement of the length of my paper is (# of tiles or non-standard units) .*

You might have a student come up and model another example, depending on time spent in the meeting area and students' attention span.

Independent Practice

Explain to students that they are now going to practice measuring and that they have to keep in mind everything that they have learned about measurement. Point to the measurement chart and tell students that it is a resource for them to use when doing the activity or using language. Show students construction paper, and explain where they are going to glue their strip of paper, their units of measure, and record their measurement.

Tell students that when they complete the task, they are going to state the length of the object to their partner using a sentence frame. At this time, show and read the sentence frame to the students, and have students repeat it, two or three times:

- *The length of my paper is (# of tiles or non-standard units).*

  or

- *The measurement of the length of my paper is (# of tiles or non-standard units).*

Have students go back to their table, and then ask: *Who can explain to the class what we have to do?*

Use a Think-Pair-Share strategy so that all students can be engaged and thinking. Have students think independently about the task and plan what they are going to say. Then, tell them to share their thoughts with a partner. Finally, have one or two students come up and explain to the class what they are going to do. Ask students if they would like to add anything to these statements. Circulate around the room and facilitate the vocabulary and formation of sentences, and assess that everyone understands the task.

Clarifying, sharing, and understanding goals for learning and criteria promote success for ELLs by providing feedback to students that will move learning forward.

Distribute the materials you have prepared prior to the lesson and have students begin the task.

As students measure their objects, note your observations on **Teacher Resource #3*: Observation Recording Sheet.*** Record which students are:

- leaving gaps
- overlapping
- not following the path
- using different units of measurement

Refer back to "Common Issues" for suggestions on facilitating learning and the benefits for ELLs.

Facilitate learning by cueing students to refer back the measurement chart and questioning them.

Sample questions:

- How do we identify what is the length of an object?
- How do we place units of measurement to find the length of an object?
- How many units/spaces long is the object?
- What do we do when we iterate?

Give students the time necessary to complete task. Then, bring them back together and tell them that they are going to share their measurement with a partner. Go over the sentence

frame using student work to model completing the sentence frame. Modeling gives students a clear expectation of the outcome.

Tell students: *Now let's practice what you are going to state to your partner.*

Give students a few minutes to practice as you circulate the room assisting students who may have difficulty.

Next, have students turn to their partners and select who will go first. Then, tell the students who are going first to share their measurement with their partner, remembering to use the sentence frame. Circulate around the room and assist students who are having difficulty with language.

When students have finished sharing their measurement with their partner, have them switch roles—the students who shared now listen; the students who listened now share. Again, circulate around the room and assist students with language development as needed. After students finish sharing, have them come to the meeting area with their recording sheets and lead a class discussion on measurement.

Shared Discussion

In the meeting area, explain that they will be exploring measurement and that the activity they have just finished was to access what they learned about measurement in first grade. Assign students to pairs to share their work.

Suggestions for selecting students who will share:

- Use your observation notes to select students who did something you want other students to become aware of.
- Select students who had a misconception and through questioning figured it out so that they can explain that process.

In order to target the important aspects of tiling and iteration, prompt students to state that there are no gaps or overlaps and that the units of measure are the same size, are placed end to end, and they follow the path of the object being measured.

Revisit the measurement reference chart with the students and add any points that may not be listed.

Refer students back to the language objective:

- Students will be able to orally state criteria for measuring to a pair partner.

Tell students: *Now that we have practiced measuring, we are going to state to our partner what are the criteria for measuring. We can refer back to our chart if we need to.*

Suggested sentence frames for the share:

- *When I measure I, _____.*
- *Today I learned that when I measure, I _____.*

Select a student to model with you what the turn-and-talk should look and sound like:

- *Today I learned that when I measure, I cannot leave any spaces between my units of measurement. Now it is my partner's turn.*

Then, have the student share his/her thoughts on measuring using the sentence frame as modeled.

Ask students if they have any questions about the task, and clarify the task if there are any questions.

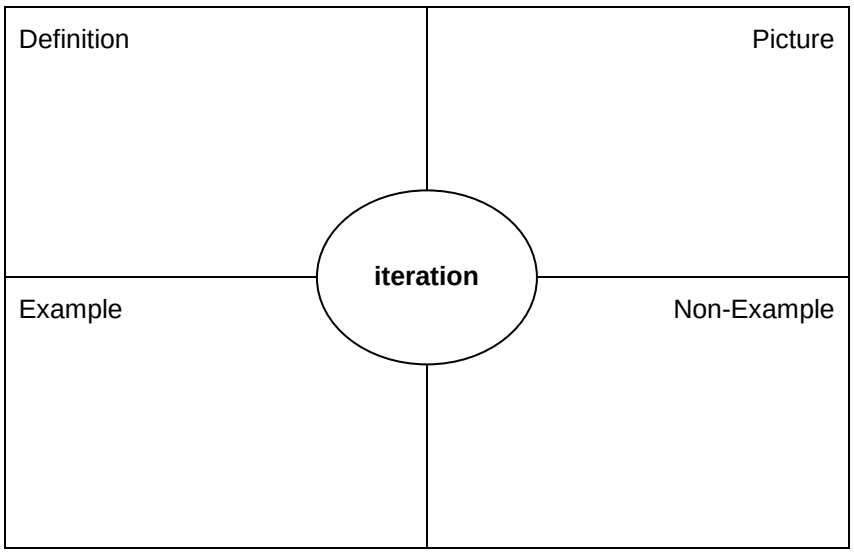
Place students in an inner and outer circle. You can mix intermediate and advanced students in the inner circle and mix beginner and intermediate students in the outer circle, depending on the number of students in your class. You are in the center of the circle. Have students in the inner circle share first. As they share, listen and provide feedback. Then, have the outer circle share. Once everyone has shared, you might call on students to share what their partner stated. Knowing that they are accountable helps keep students engaged in the activity. After hearing the student share his/her partner stated, ask the partner: *"Is that what you stated?"*

You might have students rotate clockwise and have students share with different partners. This gives students more opportunity to practice vocabulary.

Call on students to post the words that are written on sentence strips on the word wall, and have them repeat the words two or three times.

Follow-up Activity

Use a Frayer Model to have students go back and think about the Tier 3 vocabulary that was used throughout this lesson and any other vocabulary you feel your students need further engagement with. From the measurement reference chart, select one of the words that were explicitly taught: *iteration*. Model how to create a Frayer Model for this word (see **Handout #2: *Sample Frayer Model***.)



After you have modeled completing the Frayer Model, ask students if they have any questions. Students will be working in groups of four or five. You may create groups with mixed English-language fluency. If this is their first time working in groups, routines for working should be established. Distribute chart paper and markers (giving each student a different color and stating that all colors must appear on their Frayer Model makes sure that all students are participating). It must also be established that everyone in the group has to agree on what goes onto the Frayer Model. Have one student from each group select a Tier 3 vocabulary word from a paper bag, which will be his/her group's word to use.

The Frayer Model is a strategy which can be used to develop language and deepen the understanding of technical vocabulary. This model also uses a graphic organizer to analyze words, deepen understanding, and increase vocabulary.

Give groups time to work on their vocabulary words. Circulate around the room and facilitate student thinking by cueing and questioning students as they come up with their ideas and record them. When all groups are finished, have them share with the class. If more than one group responded to the same word, have subsequent groups identify what they wrote that was different from what the first group wrote.

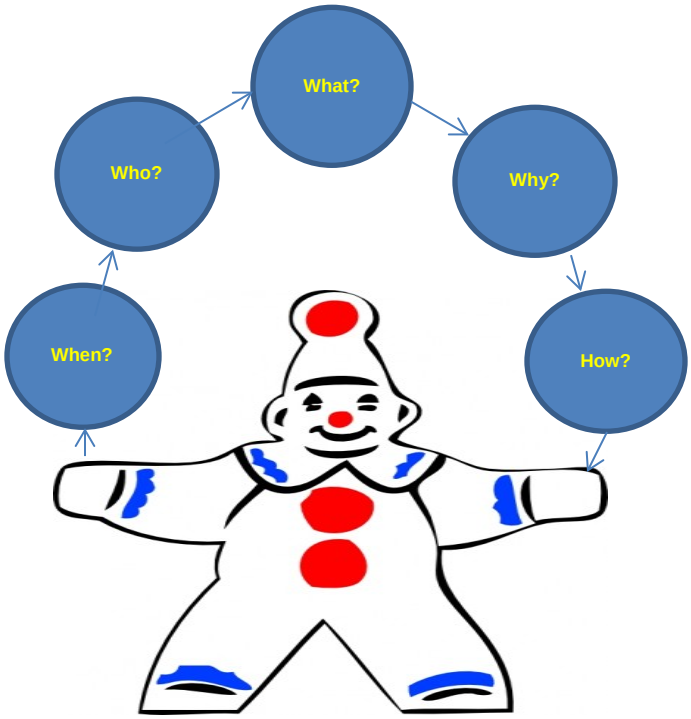
If some groups are finished before others, you might have children go on to the math log activity explained below.

Math Log Activity

Students go back to their seats and reflect on their math lesson, journaling what they learned in math today.

To assist students with the writing process, it is beneficial to establish math logs early in the school year.

Distribute a graphic organizer that has the elements you would like students to include in their math logs. For example, you can distribute handout similar to **Teacher Resource #5: *Sample Math Log Graphic Organizer*** or design your own handout and distribute it. Teacher Resource #4 shows a clown juggling, and each ball he juggles is labeled with one of these elements (see below).



Model how to fill in graphic organizer so that students understand the activity.

Suggested prompts for students to respond to:

- What did we do in math today?
- Why is measurement important in our everyday lives?

Note: The prompts you give students should allow for them to address as many of the five elements shown as possible: When? Who? What? Why? How?

Use of graphic organizers is helpful for students to organize their thinking. Graphic organizers help ELL students organize their thinking in a sequence format, which will make it easier for them to transition to writing sentences and paragraphs.

Graphic organizers can be modified to elicit specific responses from students.

Suggested Math Center Activities

- You may place extra strips of paper and manipulatives for students to repeat this activity in their math logs.
- You may place actual objects—such as crayons, markers, and books—for students to measure with non-standard units and then record in their math logs by drawing and labeling this work.
- Have Frayer Model templates photocopied for student use.

- **Homework**

Have students select something in their home to measure and then record their work in their notebook. They must draw a picture and/or label the object they are measuring, and record the measurement and the non-standard unit.

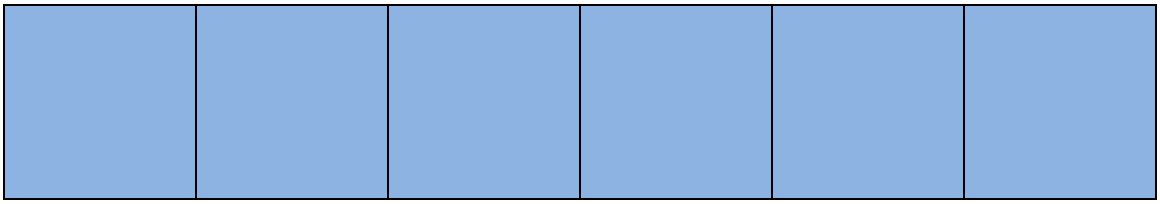
Bulletin board idea: Independent student work pieces may be displayed on a classroom bulletin board.

Lesson 1: Iteration

Handout #1: Measurement Pre-Assessment

Name: _____ **Date:** _____

1. Look at the picture of the bar of soap below. If each blue square is 1 inch, what is the length of the bar of soap? The bar of soap is _____ inches long.



2a. Using counting tiles, measure the length of each object shown below.

- The length of the picture of the spoon below is how many tiles? _____

- The length of the picture of the fork below is how many tiles? _____

- The length of the picture of the pencil below is how many tiles? _____

2b. List the pictures of the spoon, fork, and pencil in order, from shortest to longest:

_____

2c. Which objects are longer than the spoon?

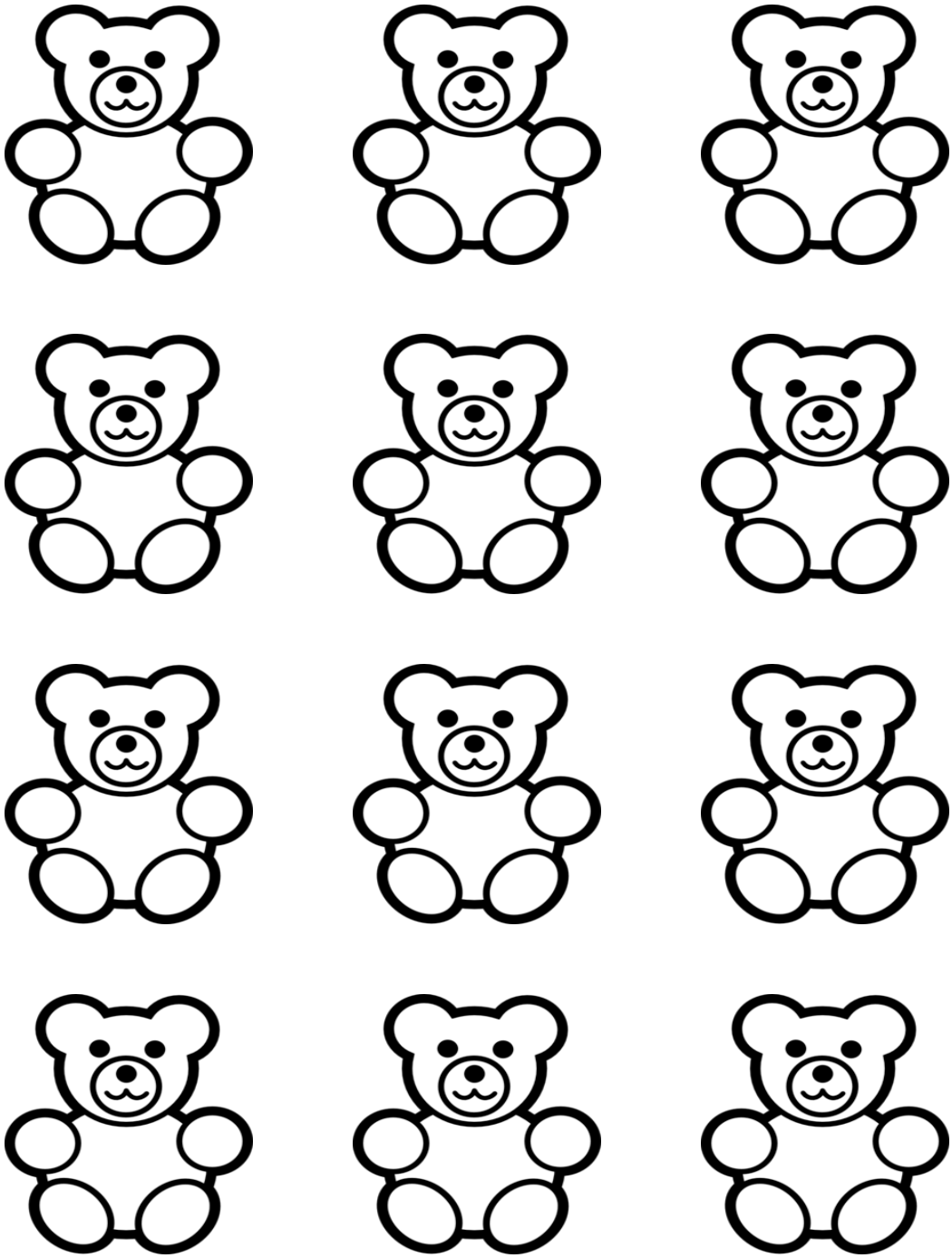
_____

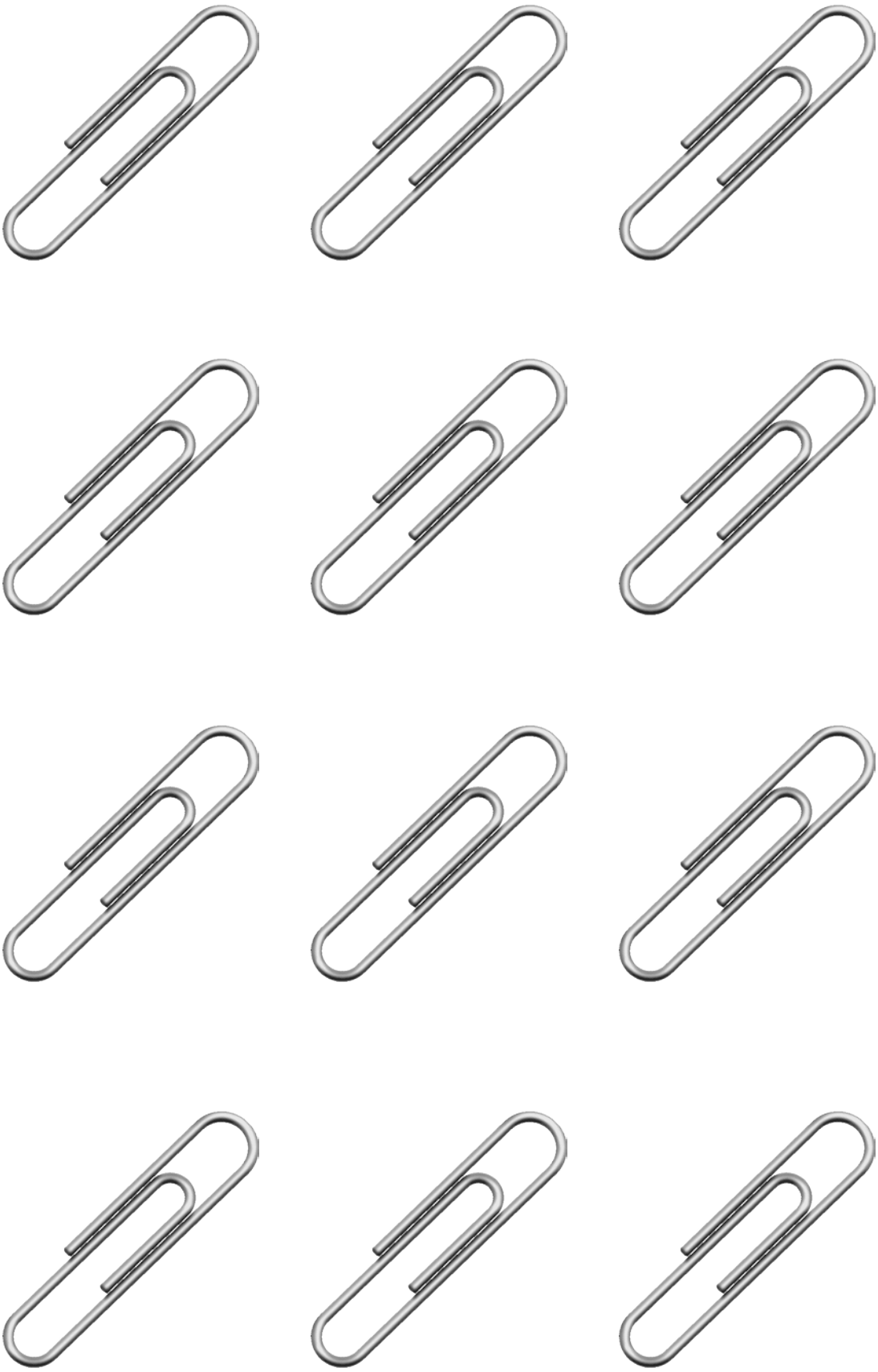
2d. How much longer is the fork than the pencil?

_____

Lesson 1: Iteration

Teacher Resource #1: Manipulatives of Non-Standard Units





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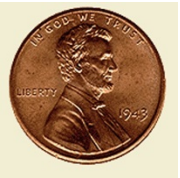
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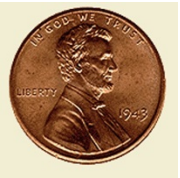
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Lesson 1: Iteration

Teacher Resource #2: Things to Remember When Measuring

Note to Teacher: By the end of the lesson, you want to establish the meaning of key vocabulary words as well as the criteria for measurement. These could be added to the measurement reference chart while modeling in the mini-lesson and/or during the share after students practice.

Key Vocabulary

- *Length* is the longest side of an object.
- *Measure* is a comparison to some other known unit to find the size of something.
- *Non-standard units* are objects that are not part of a consistent system of measurement; they come in different sizes, such as paper clips, coins, or body parts.

Criteria for Measurement

- We use the same size units to measure.
- We do not leave spaces or gaps in between our units.
- Our tiles are not on top of each other or overlapping.
- We put our tiles end to end.
- The ends of our tiles touch.
- Our tiles have to follow the objects we are measuring.
- When we measure, we iterate units.

Lesson 1: Iteration

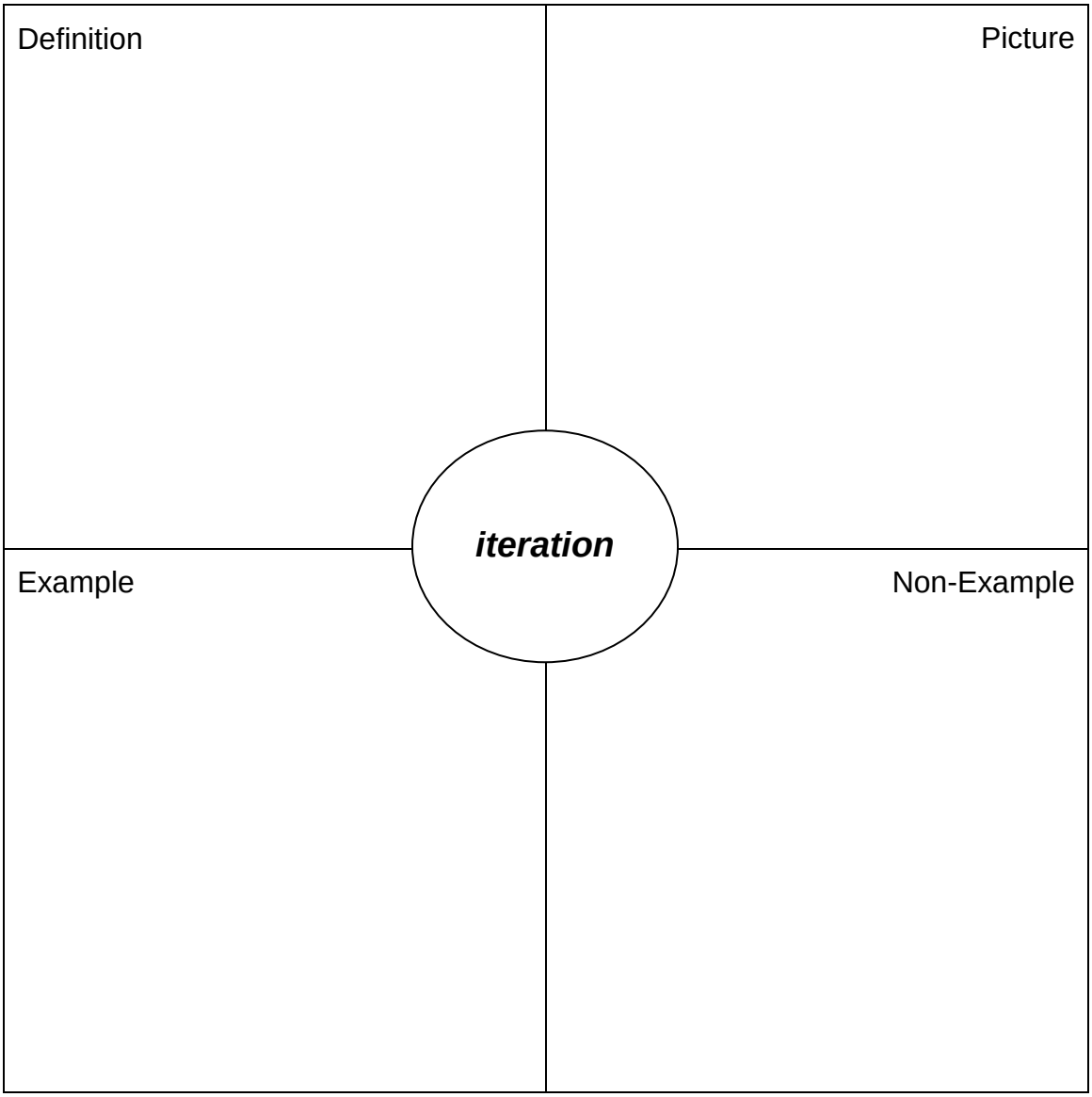
Teacher Resource #3: Observation Recording Sheet

Date: _____ **CCLS:_____**

Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:
Name:	Name:	Name:	Name:

Lesson 1: Iteration

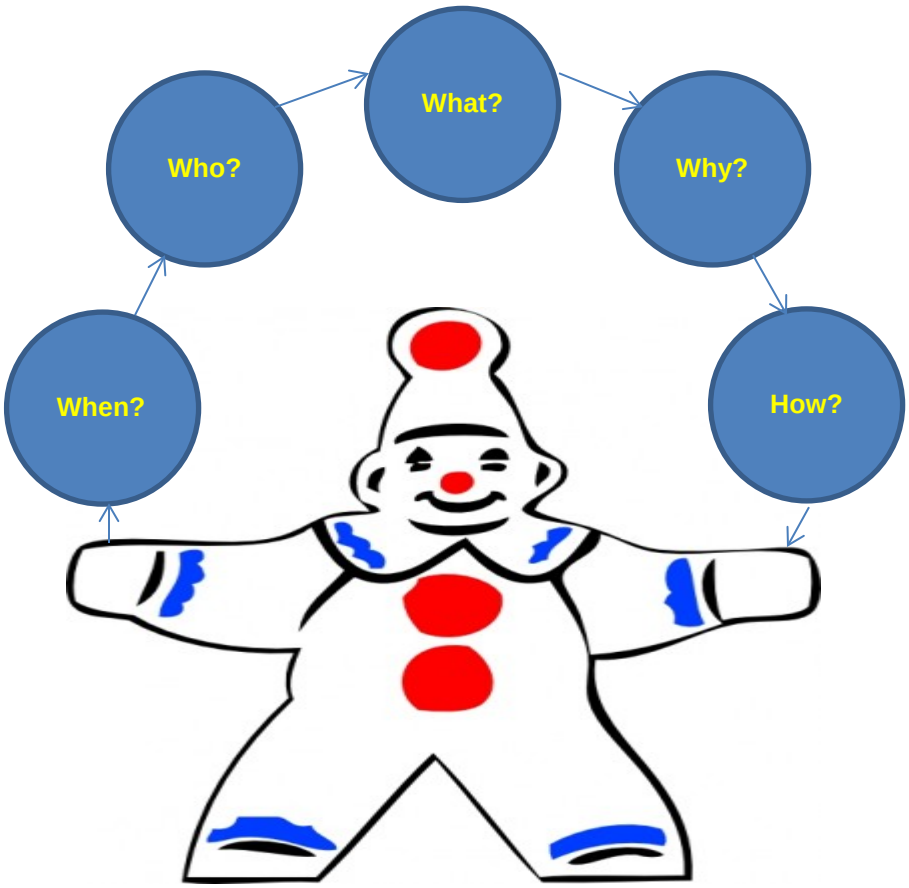
Handout #2: Sample Frayer Model



Lesson 1: Iteration

Teacher Resource #4: Sample Math Log Graphic Organizer

Name: _____ Date: _____



Directions: Answer the questions below, addressing as many of the ideas that the clown is juggling as you can.

1. What did we do in math today?

   Who? _____

   What? _____

   _____

   Where? _____

_____

Why?_____

_____

How? _____

_____

2. Why is measurement important in our everyday lives?

Why? _____

_____

What? _____

_____

Who? _____

_____

Where? _____

_____

How? _____

_____

Lesson 2: Estimation Station

Introduction:

The focus of this lesson is estimation. Prior to this lesson, students will have been exposed to tiling and iteration by using various non-standard length units to measure the length of an object. This lesson builds on this principle of unit iteration as the basis for measuring. It introduces the inch and centimeter as standard units of measure, and it provides an opportunity for students to compare various objects based on size as they try to find objects that approximate the length of an inch and the length of a centimeter. Finally, students use this understanding of inches and centimeters to estimate the length of an object by visualizing how the inch or centimeter unit would be tiled, with no gaps or overlaps across the length of the object, as learned in the previous lesson.

Mathematical Goals:

- Students will make estimates by comparing objects based on size and relating their estimates to inch and centimeter approximations.

Language Goals:

- Students will state an estimate of length in terms of centimeters and inches.
- Students will provide a reason for their estimates orally and in writing using the words *about*, *close to,* or *same as.*

Materials:

- Sticky notes
- Pencils
- Glue
- Pre-cut paper strips that measure one inch (one per student)
- Pre-cut paper strips that measure one centimeter (one per student)
- Inch and centimeter cubes, tiles, or counters per table (as a kinesthetic option for tactile learners)
- Various pre-selected classroom objects or have students look around for objects in the classroom during the lesson
- Handout #1: Pre-Assessment Sheet
- Handout #2: Estimation Worksheet
- Handout #3: Exit Slip

Common Core Learning Standards:

2.MD.3 Estimate lengths using units of inches, feet, centimeters, and meters. (This lesson focuses on estimates using inches and centimeters.)

Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them. Students explain to themselves the meaning of a problem and look for entry points to its solution.

2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.

3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.

4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.

5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.

6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Common Issues	**Suggested Questions and Prompts**
An ELL student is unable to understand a question or prompt that the teacher is using to assess the class.	To assess student understanding of the prompt, distribute or have available the Clarifying and Explaining My Thinking Chart (included at the end of the unit). Check in with beginning-level ELLs prior to completing the task by having them point on the chart to their level of understanding. A student at a Level 1 recognizes the math vocabulary, but is unable to explain it. Have such students draw their responses and provide them with a sentence frame that will scaffold their writing such as: • *I can use _____ to measure ____ by _____.*
Students may have a difficult time finding classroom objects that measure about an inch or centimeter.	Pre-select items or have pictures of items that measure an inch and a centimeter, respectively, ahead of time.
Students may be able to estimate in one unit but not in the other.	Point out the difference between the units by making a comparison: 1 in. = 2.54 cm. Use a visual to show this comparison.
Students forget to specify the unit.	Demonstrate the difference between their

	response in inches and their response in centimeters. For example, if students answered 3, show them 3 inches by tiling 3-inch tiles or strips of paper. Then, show 3 centimeters by tiling 3-centimeter cubes or strips of paper. Have the students point out the difference in length between the two.
Students count individual units or shapes instead of estimating the length of a figure in its entirety. *Below, the student counted five shapes:* = 5	Revisit the concept of unit iteration and the criteria for measuring using non-standard units: • Units must be of the same size. • The path the units follow is the length of the figure.

Vocabulary Instruction:

Tier 1	Tier 2	Tier 3
size	compare	length
long	approximate	unit length
short	notice	estimate
about		standard
instead		measure
altogether		inch
		centimeter

Suggested Lesson Outline (with Embedded Support for ELLs):

Prior to the lesson, pre-cut paper strips that measure one centimeter and paper strips that measure one inch so that each student can receive one of each. Alternatively, you may choose to have counters that measure one inch and one centimeter. Also have available objects of various lengths, including objects that measure approximately one inch and approximately one centimeter. Students will need these for a scavenger hunt.

The lesson begins with a math fluency practice.

Math Fluency Practice

To prepare students for representing whole number sums and differences within 100 on a number line (CCS 2.MD.6), students will practice counting up from different starting points on the number line.

Begin by gathering students at the meeting area, where a number line with numbers going up to 100 is displayed or clearly visible. Point to the number 18 on the number line and say:

This morning when I went to the cafeteria, there were 18 students having breakfast. Then 15 more students came.

Write the words “15 more” on the board or chart. Use a gesture to show that “came” means to arrive.

Point to the number line then, ask:

How can I use the number line to help me figure out how many students were in the cafeteria for breakfast altogether?

Provide time for students to think about the mathematical process required for them to answer the question. They will need to use the number line to count up from the number 18.

Posing a real-world, scenario provides an opportunity for ELLs to practice problem solving in a familiar context. To provide support with vocabulary for ELLs, display a picture of a cafeteria and point to students in the picture as you are posing the problem to the class.

Depending on their background, ELLs can have varying levels of language and vocabulary at their disposal. The word “came” is critical for answering this math problem because it indicates the operation of addition. Using a gesture to briefly explain the meaning of this term provides an entry point for ELLs to complete the task. Using the number line to point to the 18 provides a visual reference for students. Writing “15 more” scaffolds students’ auditory comprehension.

Gestures and visual references help to scaffold oral instructions.

Encouraging students to think about and verbalize a mathematical procedure helps to develop their metacognitive thinking. *Metacognition* involves teaching the student to think about their thinking processes. To teach metacognitive skills, the teacher must model the thinking processes as he/she works toward solving a problem and asks students to do the same.

Point to the number line, and tell students:

The number 18 represents the number of students who were in the cafeteria. To find how many students were there altogether, I have to count up 15 spaces on the number line, because the problem says that 15 more

Support ELLs by providing the necessary content vocabulary and developing their understanding of a problem in a sequential and logical way.

came.

Then, point to the phrase “15 more,” and say:

I will have to pretend that the spaces on the number line are students, so as I count up, I am counting 15 more students.

Demonstrate counting 15 more spaces up to the number 33, and then say:

There were 33 students in the cafeteria. Notice how I used the word “students” instead of just saying the number 33? I am stating the unit, which are students. If I didn’t say the unit, you wouldn’t know if I meant 33 cookies or 33 crayons. I have to say 33 students because that is the unit I am counting.

Explicit instruction in math vocabulary and unit specification provides ELLs with concrete examples, which they can later use to model their own responses. Specifying the unit being used is an important aspect of measurement that students will revisit throughout the unit. Repeated practice will help establish this as a routine.

Pose additional problems involving counting up using different numbers of students and other school settings, such as the library, auditorium, or gym.

Support vocabulary development for ELLs by displaying pictures of the different school settings.

Include examples such as:

- There were 23 students in the library, and 19 more came.
- There were 34 students in the auditorium, and 25 more came.
- There were 52 students in the gym, and 12 left.

Support ELLs by using a gesture to demonstrate the meaning of the word “left,” and demonstrate how counting on the number line shifts direction.

In the last example, students will need to recognize the shift towards subtraction.

<u>Lesson Pre-Assessment</u>

Distribute **Handout #1: *Pre-Assessment Sheet*** to the class and read the directions aloud:

Draw how you would use pennies, unit squares, or paper clips to measure the <u>length</u> of the objects below.

Reading the prompt aloud ensures that all students have access to the task, regardless of their language ability. Changing speech patterns focuses students’ attention on a specific word or concept, highlighting its importance. The term *length* is addressed in the previous lessons.

Provide time for students to draw and write their responses. When time is up, collect the filled-in handouts, making sure students’ names appear on them.

Whole-Class Guided Instruction

Begin the lesson by reviewing what was learned in the previous lesson.

In our last lesson, you used different non-standard units to measure the length of different objects. Today we are going to learn about the inch and the centimeter—two units that are used to measure here in the United States and around the world.

Reviewing content that was addressed in a previous lesson enables ELLs to make connections and build content knowledge in a systematic way. It provides reinforcement for important vocabulary and links prior learning to new skills and concepts.

Based on your learning yesterday, tell your partner why you think it might be important and helpful for us to use the same units to measure.

Provide time for students to talk to a partner.

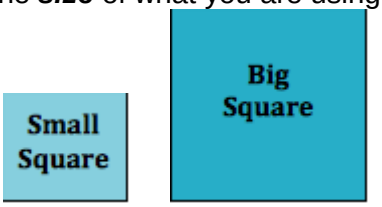
Circulate around the room as students share their responses with partners.

Support beginner ELLs by providing a copy of the Answering Questions Chart (in Resources for ELLs) and pointing to the *"Why?"* This will help them understand that they need to give a reason using the word "because."

Next, tell students:

It is important to have the same unit so that you have the same measurement. Countries around the world have agreed to use length units that are <u>standard</u> so that everyone, no matter where they live, would have the same measurement.

Display the following vocabulary words/terms learned so far on a vocabulary chart and review with the class:

unit	What you are tiling and using to measure
length unit	The ***size*** of what you are using to measure 
standard	The same unit length used in a particular place or country by agreement.

ELLs benefit from having written text and visual representations to refer back to. It is important to prepare ELLS for the lesson by reviewing vocabulary and providing the definition of new terms that will be used so that they are able to develop their conceptual understanding without struggling to understand new words and terms associated with the learning. Visuals help ELLs connect a new word or concept to a graphic representation they may be familiar with so that they make an association that helps them understand the meaning.

When the lesson is over, move all vocabulary word/terms to the word wall, where the key vocabulary from Lesson 1 has been posted.

Tell students: *Today you are going to see how using the same standard unit helps you to compare objects based on size. By the end of the lesson, you will be able to estimate, or guess, the length of an object because you will have an understanding of the size of the standard units we will be using—inches and centimeters.*

Distribute pre-cut paper strips that measure an inch. Have the class label the strip of paper with the abbreviation for *inch (in.).* Next, distribute pre-cut paper strips that measure a centimeter. Have the class label the strip of paper with the abbreviation for *centimeter (cm).*

The inch and the centimeter are standard units of measure. Anywhere you go in the world, the inch measures exactly the same and the centimeter measures exactly same as the strips you are holding. Compare your inch with your partner's inch. Are they the same? Now compare your centimeter with your partner's centimeter. Are they the same? This means that they are standard.

Point to the vocabulary chart where the word "standard" is listed and review the definition. Next, have students compare the inch with the centimeter.

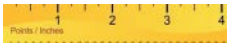
Ask: *Are they the same?*

The class should notice that the inch is bigger.

Explain that even though the inch and the centimeter are both standard, they do not measure the same length.

Ask: *What do you notice about the length of the inch? What do you notice about the length of the centimeter?*

Add the words "inch" and "centimeter" to the vocabulary chart. Fill in the blanks as students compare the inch and centimeter strips of paper:

inch (in.) 	A *standard* unit of measure that is ___ than a centimeter
centimeter (cm)	A *standard* of measure that is ____ than an inch

Next, tell students: *Today we are going to find objects that measure approximately an inch and approximately a centimeter. "Approximately" means more or less the same. The objects we find might be just a little bigger or just a little bit smaller than the inch or centimeter.*

"Approximate" is a Tier 3 vocabulary word that is used frequently throughout the lesson. Therefore, it is important that students are clear about its meaning.

These strips will provide a visual reference for students to compare the size of the unit with the objects they find, which measure approximately that size.

Distribute **Handout #2: *Estimation Worksheet***. After modeling how to glue the strips of paper on an enlarged version of the chart on the handout, have students glue their strips of paper in the corresponding rows on their handout.

Tell students they are going to go on a scavenger hunt. Explain that a scavenger hunt is a game in which individuals or teams try to find and bring back certain items, and that the items they will be hunting for today are classroom objects that measure one inch and classroom objects that measure one centimeter.

Give the following directions to students:

Draw and label a picture of three objects you find that measure approximately an inch or centimeter next to the unit length you just glued. But first, let's think about how you will find objects that measure approximately an inch or a centimeter.

Point to the centimeter and inch strips of paper as you give the directions for the scavenger hunt, so that students understand they will find objects that measure approximately those sizes.

Ask students to partner with a classmate to form pairs. Provide time for student pairs to think about how they will find objects of a similar length, having already glued their strips on the paper. Circulate as they share their ideas and elicit responses for the class to share out loud.

Encouraging students to think about how they will apply what they have learned about measurement to the task at hand helps to develop metacognition. Metacognition involves teaching students to think about their thinking processes. In this example, students will need to compare the length of the object to the inch and centimeter strips.

Conclude by saying:

You will have to compare your object to the strip that measures an inch and the strip that measures a centimeter. "Comparing" means looking closely to see whether they are the same or different.

For example, I can compare the width (not the length) of my pencil to the centimeter strip to see if it measures a centimeter. When I hold my pencil next to the centimeter strip, I can see that they are <u>approximately</u>, or about, the same length. So, I can say that my pencil's width measures about a centimeter.

"Compare" is a Tier 2 vocabulary word. It is an academic term that students will encounter in different subjects. Therefore, it is important to explain the meaning of this term for ELLs and provide a demonstration so that students can see what this term means when applied.

Notice how I compared by seeing if the width was the same as the centimeter strip? I used the word "approximately" because the pencil was almost the size of a centimeter. On the Estimation Worksheet, I can draw a picture of my pencil next to the centimeter strip, with an arrow pointing to the part of my pencil that measures a centimeter (the width).

Explicit instruction is essential. Direct teaching of academic language, concepts, and skills is necessary to ensure that ELLs receive coherent, scaffolded, and seamless instruction.

Small-Group Work (Guided)

Students will work with a partner to complete the top half of the Estimation Worksheet handout, which asks students to find objects that measure approximately one inch and approximately one centimeter. Partners will work together to find and compare different objects to the inch and centimeter strip. However, each student will have his/her own worksheet to complete.

This is an example of cooperative learning. Cooperative learning (in small groups or partnerships) promotes the use of academic language, mathematical concepts, and social skills through peer interaction.

It helps to develop the four modalities of language acquisition for ELLs (Reading, Writing, Speaking, and Listening) through the content area of mathematics. When developing oral language, it is important for teachers to encourage participation because students may come from countries with different social norms and cultures.

Encourage students to use mathematical language with their partners:

When you find an object you want to compare, tell your partner if you think it measures approximately one inch or centimeter.

You may provide a sentence frame to scaffold students' oral language:

- This _____ measures approximately _____.

Circulate around the room while students are working to make sure that students' approximations are accurate and that they are indicating the length measurement they are focusing on. Have students draw and label the objects using an arrow to point to the part of the object that measures the length they are determining.

Then, say:

Now that we have examples of approximately how big an inch and a centimeter are, we can begin to <u>estimate</u> the length of longer objects by comparing. When you estimate, you make a guess using what you already know.

The word "estimate" is a Tier 3 word. It is a technical term used in reference to a mathematical concept being taught in this lesson. It is important for ELLs to have a clear understanding of this term and how to apply it.

Write or display the word "estimate" on the vocabulary chart with the definition. Make sure students understand that the word can be used as both a verb and a noun.

estimate	Verb: To guess using what you already know. Noun: A guess using what you already know.

Explicit instruction and direct teaching of academic language, concepts, and skills is necessary to ensure ELLs receive coherent, scaffolded, and seamless instruction. Concrete examples provide a reference for students to model their thinking while completing a task.

Then, teach students how to make an estimate about the length of an object, using what they know about the size of an inch and the size of a centimeter.

I can estimate the length of this book [or other classroom object] by using what I know about centimeters and inches. I know that an inch is about the size of a quarter. I can mentally iterate or imagine about 10 quarters lined up along the length of this book. Since one quarter measures approximately or about an inch, so I can estimate, or guess, that this book measures approximately 10 inches. Visualizing helps me see it in my mind. This helps me to make an estimate.

Students will record their estimates on the Estimation Worksheet on Handout #2. It is helpful to have an enlarged version of the chart at the bottom of the handout in order to model how students are to record their estimates.

Then demonstrate how you would make an estimate using centimeters:

I know that the centimeter is a smaller unit, so I will need more centimeters than inches. I can imagine about twice as many centimeters as inches, so I can estimate that this book is about 20 centimeters. I doubled the number of inches (10+10=20).

Explicit instruction, direct teaching and concrete examples equip ELLs with the necessary content knowledge and provide them with a strong foundation on which to model their thinking and use of academic language.

Partner Work

Students will work with partners to complete the bottom half of the Estimation Worksheet by estimating the length of different objects, such as a pencil, a book, and a sneaker. You may choose to have real-life objects for students to look at while making estimates.

Using of realia (real-life objects) helps contextualize students' learning. In math, it helps to engage students' kinesthetic learning as they are able to touch and interact with objects pertinent to the task. In estimation ELLs and other students may benefit from running their fingers across the length of an object as they mentally iterate the unit they are estimating with.

The language objective for this portion of the lesson is for students to justify their estimates by making a comparison. When they are finished with their estimates, students will choose an item, write their estimate, specify whether it is in inches or centimeters, and explain why.

Independent Work

Students should complete page 2 of the Estimation Worksheet handout independently. This task asks students to estimate the length of various objects on the page. This provides an opportunity for the teacher to assess whether students are estimating the length of an object in its entirety or counting individual units. The task also allows the teacher to assess whether students are specifying the unit. Finally, it provides opportunities for the student to make comparisons with other objects on the page that may be of a similar size.

Exit Slip

Distribute **Handout #3: *Exit Slip*** to each student. This end-of-lesson assessment consists of three questions requiring students to make estimates.

The first question asks students to estimate the length of a line. This provides an opportunity for the teacher to assess students' use of approximation and to see whether they specify a unit.

The second question asks students to estimate the length of a string of beads. This provides an opportunity for the teacher to assess whether students resort to counting individual beads without recognizing the shift in size of the beads

The third question asks students to measure the length of a line of shapes organized into a pattern. The objective is for students to use what they've learned about estimating by making a comparison with a smaller approximated unit. This provides an opportunity for the teacher to assess whether students can look beyond the pattern of the shapes and recognize that length is measured from end to end, therefore their estimate of length must measure the distance between the first rectangle and the last rectangle.

When time is up, collect the Exit Slips, making sure students' names appear on them.

Lesson 2: Estimation Station

Handout #1: Pre-Assessment Sheet

Name: _____ Date: _____

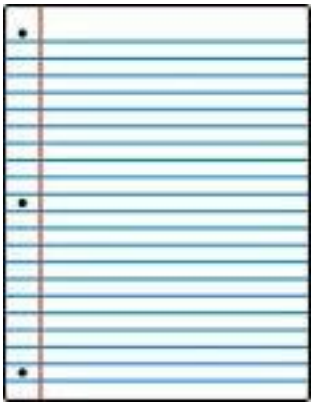
1. *Choose a unit to use to measure:*

penny

paperclip

unit square

2. *Draw how you would use pennies, paperclips or unit squares to measure the length of the objects below:*

Pencil	*Book*
Piece of paper 	*Sneaker*

Lesson 2: Estimation Station

Handout #2: Estimation Worksheet (*Page 1 of 2*)

Name: _____ **Date:** _____

Standard Unit ***Glue the strips paper here.***	**Objects** ***Draw the objects here.***
1 inch	
1 centimeter	

My Estimates

Names of Classroom Objects	**My estimate using inches (in.)**	**My estimate using centimeters (cm)**

I estimate that _____ measures _____ inches/centimeters because _____

_____

_____

Lesson 2: Estimation Station

Handout #2: Estimation Worksheet *(Page 2 of 2)*

Name: _____ **Date:** _____

<u>Directions</u>: Estimate the length in inches or centimeters of the objects in each box. Write your estimate on the line.

|_____| *My estimate =* _____

|_____| *My estimate =* _____

|_____| *My estimate =* _____

|_____| *My estimate =* _____

|_____| *My estimate =* _____

Lesson 2: Estimation Station

Handout #3: Exit Slip

Name: _____ Date: _____

1. *Estimate the length of the line below:*

My estimate = _____

2. *Estimate the length of the string of beads below:*

My estimate = _____

3. *Estimate the length of the line of shapes below:*

My estimate = _____

Lesson 3: Using Tiles to Make Rulers

Introduction:

This is a two-day lesson plan. Both days have been designed to give students a hands-on experience with measuring length. Students will measure with unit tiles and create both metric and centimeter rulers. They will then measure common objects with their rulers.

Day 1 of the Lesson: Creating and Using an Inch Ruler

Mathematical Goals:

- Students will understand that units have a value.
- Students will become familiar with one-inch units.
- Students will accurately measure objects using their self-created rulers.
- Students will measure length using standard units.

Language Goals:

- Students will tell objects' lengths based on their recordings on *a graphic organizer.*
- Student will complete sentence frames related to measurement (e.g., *I found _____, which is 3 inches*.)

Materials:

- One-inch tiles
- Sentence strips cut to 12 inches
- Markers
- Handout #1: Measuring Objects with One-Inch Tiles and a Ruler
- Handout #2: Recording Measurements in Inches
- Handout #3: Inches Exit Slip

Common Core Learning Standards:

2.MD.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.

Standards for Mathematical Practice:

2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.
3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.

4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.

5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.

6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Common Issues	**Suggested Questions and Prompts**
Student does not line up the ruler properly.	Provide teacher and peer guidance to make sure the student starts at the correct spot.
Student is answering a question in inches when he/she was asked about centimeters.	Have students circle the unit. Refer students to the measurement chart made in Lesson 1.

Vocabulary Instruction:

Tier 1	**Tier 2**	**Tier 3**
mark tiles overlap	design distribute explain	hash mark inch ruler measurement

Suggested Lesson Outline (with Embedded Support for ELLs):

All vocabulary words should be recorded on a math word wall. This allows students to refer back to previously-taught concepts and make connections.

English language learners need explicit vocabulary instruction. Introducing key concepts by first discussing the vocabulary related to that concept allows ELLs to build a knowledge base.

Whole-Class Instruction

Review math words from the math word wall. Have one student come up to the front, point to the word and read it, and then have the class repeat the word. (For more active involvement, pass out words and have each student come up and read his/her word and place it on the word wall).

Tell students: *Today we are going to review what we have learned about measurement. Can someone tell me what we have learned so far?*

Review key terms and ideas. Write key concepts on the board.

Ask: *What is an inch?*

After hearing students' responses, write the word "inch" and its definition on the board: By agreement, an inch is a U.S. standard unit of measure.

When possible, use different colors and fonts to highlight key concepts. (Different math standards can be identified by using different color markers on index cards or sentence strips.) A key can be posted beside the word wall.

Show students one-inch tiles. Measure a tile with the inch ruler, and ask:

How many inches long is my tile?

Next, rotate the tile a one-quarter turn, and repeat the question: *How many inches long is my tile?*

Do this one more time, then ask: *Does it matter which side of the tile I use to measure? Why or why not?*

If I grabbed another tile from the batch of one-inch tiles, would the sides also measure one inch? Why or why not?

Group Work

Pass out one-inch tiles to students at their tables. Have students work in pairs to measure the tiles with a ruler to show that these tiles are one inch on all sides.

Set up measuring stations with different objects (e.g. crayons, staplers, notebooks, etc.) Distribute **Handout #1: Measuring Objects with One-Inch Tiles and a Ruler** and review it with the class. Explain that the student pairs will measure the objects shown in the left-hand column on the worksheet with the one-inch tiles, and then record their measurements in the appropriate boxes. Point out that they can pick whatever object they find to fill in the "Free

Working in small groups, where students communicate in a comfortable setting, promotes learning for ELL students. Having ELLs use their native language is an effective way to activate prior knowledge and allows them to develop conceptual understanding while learning English. ELLs may also be more willing to take risks in small groups, seeking help with English from their peers.

Choice" boxes. When they have finished filling in the worksheet, bring the class back together to have students discuss their answers. If answers vary, the idea that some people left a gap or overlapped the tiles can be addressed.

Ask: *Why do you think the answers varied? What should we do so that answers are the same?*

Refer back to the chart "Things to Remember When Measuring" created in Lesson 1.

Now the teacher can address why it is important to place the tiles right next to each other and that it is also important not to have tiles overlap each other:

Ask students if they had any problems using the tiles to the objects, and if so:

- *How could it be easier to measure these objects using something other than tiles?*
- *What tool is used to measure the length of objects?* [A ruler]
- *How many units do most rulers have?*

Have students watch as you model making a ruler using the one-inch tiles. You could do this by using a magnetic board and magnetic tiles, or you could use a sentence-strip chart—placing down the 12-inch paper strip that will be turned into a ruler, then placing the one-inch tile over it, *carefully marking where each tile begins and ends,* to show that 12 one-inch cubes make one 12-inch ruler. When you have finished making the ruler, have some students come up and make their own rulers using the tiles.

Next, tell students: *Mathematicians use the term "hash marks" to mean the lines on the ruler.*

Show students where you have put a number of hash marks on the ruler you made, and ask: *How far apart are my hash marks? Can someone come up and label the first hash mark for me?*

After the first hash mark has been labeled, ask: *What number should we label the next hash mark? Does labeling the hash marks help you measure? How?*

Display another ruler, one showing gaps between the tiles. A ruler can be displayed that overlaps the units.

If I leave gaps between the tiles, how does that affect my measurement? What happens when I overlap my tiles?

Have students to go back and create their own rulers. Make sure that they label them with numbered hash marks as well as their names. When they finish, tell them to re-measure the items on Worksheet #1.

Next, distribute **Handout #2: Recording Measurements in Inches** to students, and explain that for the next task they will be working with a partner.

Explain the task: *Now that we are experts, we are going to walk*

Sentence frames provide support for ELLs and enable them to participate in math discussions. They contextualize and bring meaning to the vocabulary. They also provide structure for practicing and acquiring the skills necessary to communicate in English.

around the room identifying objects by drawing them or writing down their names. We are going to find as many different-sized objects as possible, and we are going to measure their length using the rulers you have made.

When time is up, have students return to the meeting area and share the different objects found for each length. Sentence frames can be used, e.g., *I discovered a _____ that is ____ inches _____ long.*

Ask students: *Who found an object that is one inch long? Who found an object that is two inches long?*

Have two experience charts at the front of the room titled "Objects in Our Room That Are One Inch Long," and "Objects in Our Room That Are Two Inch Long." The charts can list each object and the names of the partners who discovered it. Charts can remain posted so that students can reference what one inch or two inches look like.

Listing the various objects of each length allows ELLs to benefit from other students' thinking. It also helps ELLs with bridging and building schemas.

Below is a sample of the chart to be displayed in the classroom for each length unit. You can also have students draw the object to scale and write their names next to their drawings.

Reference Charts by Unit Size

One-Inch Objects in Our Room	Discovered by

Assessment

Distribute **Handout #3: Inches Exit Slip** with two lines to measure. There is also a journal entry to make. Children will use their own rulers to measure these two lines and write their answers on the paper. The page can be stored in a special folder labeled "Measurement."

Journals enable students to express themselves in their first or second language, which will help them recall the lesson. They provide a place for students to state what they have learned and what questions still linger. The NYS Math Assessments have constructed response questions which require students to be able to describe their thinking.

Homework

Students will take their rulers home to measure at least three objects of different lengths, recording the name of the object and its measurement.

Day 2 of the Lesson: Creating and Using a Centimeter Ruler

Mathematical Goals:

- Students will create rulers using standard metric units.
- Students will use their metric rulers.
- Students will understand the centimeter as a unit of measure.

Language Goals:

- Students will use their journals to write about math experiences.
- Students will be able to complete the following sentence frame:

  The _____[object]_____ is _____ cm long.

Materials:

- Sentence strips cut to 12 inches (30.5 cm)
- Centimeter tiles
- Objects to measure
- Different colored paper cut into centimeters
- Burger King crowns, sentence strips, classroom borders, etc.
- Handout #4: Recording Measurements in Centimeters
- Handout #5: Centimeters – A Crowning Achievement
- Handout #6: Centimeters Exit Slip

Common Core Learning Standards:

2.MD.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.

Standards for Mathematical Practice:

2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.
3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.
4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.

5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.

6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Suggested Lesson Outline (with Embedded Support for ELLs):

Whole-Class Instruction

Review the previous day's lesson with the class:

Yesterday we created a ruler together using one-inch tiles. Today we are going to create a centimeter ruler. What size tiles do you think we should use?

Add the word "centimeter" to the word wall, and ask:

Who can come up and read the words on our math word wall?

Call on a student to come up and point to a word and read it aloud. Have the class repeat the word. Then, call on someone else for the definition of the math term. This is repeated until all the words from the unit have been completed.

Next, ask students if they have any questions about the previous day's lesson. After answering questions that students might have, tell them:

Yesterday we made a ruler using one-inch units. Today we are going to make a centimeter ruler.

Have students pay close attention as you model how to make a ruler using the one-centimeter tiles.

Tell them that if they finish making their centimeter ruler before everyone else, they can practice measuring some objects.

Independent Work

Ask students to begin to create centimeter rulers independently. (This should not be difficult since they made one-inch rulers the previous day.)

Give students sentence strips pre-cut to 30.5 centimeters and place the one-centimeter tiles in the center of the table. Ask students if they understand what they are expected to do, and tell them to raise their hand if they need help with the task.

Have additional objects on tables that students can measure once they have finished creating their rulers so that those who finish early will not distract others.

Circulate around the room and give help to those students who no need help with the task. Once all students are finished creating their rulers, give them **Handout #4: Recording**

Measuring in Centimeters to list objects that they have measured using their centimeter rulers. Upon completion, ask students to move to the meeting area and discuss the answers on their worksheet with a neighbor. When they finish, tell them:

Now let's all listen attentively as we go over the answers on the worksheet. When you give your answers, please use the sentence frame that I've written on the board:

- *The____[object]_____ is ____ cm long.*

As students are called on to answer the questions, ask if anyone has a different measurement for the same object. If anyone does, ask them how the measurement differs and how they got it. Correct any misconceptions that students might have.

Tell students that they are now going to make centimeter crowns. Explain that when they return to their seats from the measuring stations, they are going to take the centimeter colored paper pieces that you will be distributing and glue them together, one after another. Students will have the choice in selecting the colored paper they might want in their design of the crown.

When you go back to your seat you will take the centimeter colored paper pieces and glue them one next to the other onto (Burger King crowns, sentence strips, classroom borders). When you are finished you will write down how many centimeters the total length around your head is.

Model making a crown and answer any questions students have about the task.

Independent Work

Students make their crowns independently using one-centimeter squares cut out of colored paper. If color paper is not available, plain white sheets can be cut and colored by students.

This offers the opportunity to teach colors if ELLs do not know them. Quickly show the color and name it.

Circulate around the room, helping students who need assistance with the task.

Next, distribute **Handout #5: *Centimeters – A Crowning Achievement*** and have students write their responses to the questions independently. When time is up, call on students to share their responses.

Assessment

Distribute **Handout #6: *Centimeter Exit Slip*** and review it with the class. When students have finished completing it, collect the Exit Slip, making sure that students' names appear on the handout. (Suggestion: Students can use their response to question 4 on the handout as a journal entry.)

Journals enable students to express themselves in their first or second language, which will help them recall the lesson. They provide a place for students to state what they have learned and what questions still linger. The NYS Math Assessments have constructed-response questions which require students to be able to describe their thinking.

Homework

Students can measure objects in their houses using their new centimeter rulers.

Suggested Measurement Centers

1. *Measure Me:* A center with a measuring tape and a list of body parts. Students can measure themselves or a partner to complete the sheet. (The page can be placed in a sheet protector and children can use dry-erase markers so the center will not have to be constantly replenished with paper.
2. *Measure Me Big:* After completing the first activity children can use butcher block paper and the measuring tape to make a life-sized figure.
3. *Framed:* Have an old classroom border in a box. Ask students to bring a favorite picture or writing piece to the center and measure the page size. Measure and cut the border to fit around the picture or paper.
4. *Larger Than a Yardstick, Smaller Than a Ruler:* Students are given a yardstick, a 12-inch ruler, and a page that has three columns. The first column is labeled “Smaller than a ruler”; the middle column is labeled “Larger than a ruler, smaller than a yardstick”; and the third column is labeled “Larger than a yardstick.” Have students list objects in the appropriate columns.
5. Once the three columns on the *Bigger Than a Yardstick, Smaller Than a Ruler* page are filled in using classroom objects, students can make lists of things in their home or community.

Lesson 3: Using Tiles to Make Rulers

Handout #1: Measuring Objects with One-Inch Tiles and a Ruler

Name: _____ **Date:** _____

Object	**Number of Tiles Used to Measure Object**	**Measurement of Object Using a Ruler**	**Measurement of the Object in Inches**
Crayon			_____ inches
Stapler			_____inches
Notebook			_____ inches
Find an Object			_____ inches

Was it easier to measure using the tiles or the ruler? Why or why not?

_____

_____

_____

Lesson 3: Using Tiles to Make Rulers

Handout #2: Recording Measurements in Inches

Name: _____Date: _____

Directions: Look around the room and measure the length of different items using your ruler with inch markings. In the boxes below, record the object you measured and the number of inches that the object measures. You can write the name the object you are measuring or draw a picture of the item you have measured.

Object Measured	Measurement in Inches
Example (writing and drawing the name of the object): Pen 	5 inches

Lesson 3: Using Tiles to Make Rulers

Handout #3: Recording Measurements in Centimeters

Name: _____Date: _____

Directions: Look around the room and measure the length of different items using your ruler with centimeters markings. In the boxes below, record the object you measured and the number of centimeters that the object measures. You can write the name the object you are measuring or draw a picture of the item you have measured.

Object Measured	Measurement in Centimeters
Example (writing and drawing the name of the object): Pen 	15 centimeters

Lesson 3: Using Tiles to Make Rulers

Handout #4: Inches Exit Slip

Name: _____**Date:** _____

1. Measure the following lines using inch tiles or the ruler that you made.

   _____ This line is _____ inches long.

   _____ This line is _____ inches long.

2. Did you use the inch tiles, or the ruler or both to measure the lines?

   _____

3. Choose one of the following two prompts to write about:

   - *In math class today, I learned ...*

     or

   - *I wish I was only 3 inches tall because ...*

   _____

   _____

   _____

   _____

   _____

Illustrate your response to the prompt you chose.

Lesson 3: Using Tiles to Make Rulers

Handout #5: Centimeters – A Crowning Achievement

Name: _____ **Date**: _____

Directions: Now that you have completed making your "centimeter ruler crown," answer the following questions:

1. How many centimeters of blue did you use to make your crown? _____
2. How many centimeters of red did you use to make your crown? _____
3. How many centimeters of green did you use to make your crown? _____
4. How many centimeters of yellow did you use to make your crown? _____
5. Did you use an additional color tile? _____ If yes, which color? _____
6. How many tiles of this additional color did you use? _____
7. Which color did you use the most? _____
8. Which color did you use the least? _____
9. How many centimeters does your head measure? _____
10. How is working with centimeter tiles and rulers similar to working with inch tiles and rulers?

    _____

    _____

    _____

11. How is working with centimeter tiles and rulers different from working with inch tiles and rulers? _____

    _____

    _____

    _____

Lesson 3: Using Tiles to Make Rulers

Handout #6: Centimeters Exit Slip

Name: _____ **Date:** _____

1. Measure the following colored lines using centimeter tiles or a centimeter ruler. Fill in the blank space in the sentence frame that appears next to each line. Then, copy the completed sentence onto the blank line under the sentence frame

   _____ This line is _____ centimeters long.

   _____

   _____ This line is _____centimeters long.

   _____

2. Are the two lines the same length? Yes or no? _____

   How do you know this? _____

   _____

3. When you measured the two lines, did you use centimeter tiles, or a centimeter ruler, or both? _____

4. Choose one of the prompts below, and write your response in the space provided:

   - What it would be like to be King of the Centimeters? or
   - What have you learned about measuring in centimeters?

   _____

   _____

   _____

   _____

   _____

Lesson 4: **Measure Twice**

Introduction:

This lesson has been designed to give students a hands-on experience with measuring the length of an object. Students will measure using both standard units of measure: the inch and the centimeter. They will then compare the measurements they obtained and determine why the numbers are different.

Mathematical Goals:

- Students will distinguish between inches and centimeters.
- Students will estimate length in inches and centimeters
- Students will measure and record the length of an object using inches and centimeters.

Language Goals:

- Students will describe orally and in writing the size of an object in terms of length units using: *inches, centimeters, length, long, size*.
- Students will explain orally and in writing why inches and centimeters yield different measurements when measuring the same length.

Materials:

- Post-it notes
- Pencils
- Student-created inch and centimeter rulers from previous lesson
- Inch and centimeter tiles or counters per table (as a differentiation option for students who need tactile practice with tiling and unit iteration)
- Classroom objects of various sizes
- Handout #1: Measure Me Twice! (includes menu of classroom objects with labels)
- Handout #2*:* Exit Slip

Common Core Learning Standards:

2MD2 Measure length of an object twice using length units for two different measurements. Describe how the measurements relate to size.

2MD3 Estimate lengths using units of inches, feet, centimeters and meters.

(Note: This lesson focuses on estimates using inches and centimeters.)

Standards for Mathematical Practice:

2. <u>Reason abstractly and quantitatively.</u> Students make sense of the quantities and their relationships in problem situations.

3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.
4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.
5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.
6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Common Issues	**Suggested Questions and Prompts**
Student is unable to understand a question or prompt the teacher is using to assess understanding.	To assess student understanding of the prompt, distribute or have available the Clarifying and Explaining bookmarks (included at the end of this unit). Check in with beginning level ELLs prior to completing the task by having them point on the bookmark to their level of understanding. A student at a Level 1 recognizes the math vocabulary but is unable to explain it. Have such students draw their responses and provide them with a sentence frame that will scaffold their writing such as: • *I can use _____ to measure _____ by _____.*
Students may have difficulty distinguishing between inches and centimeters.	Point out the size difference between the units and demonstrate the difference by tiling the smaller length unit (the centimeter) next to the larger unit (the inch).
Students may have difficulty articulating the difference between the two length units.	Provide sentence frames and chart relevant vocabulary to be used throughout the unit.
Students may assume that they always need to start at the zero mark on a ruler to measure.	Have students count the spaces on the ruler instead of following the number sequence in order to help them understand that length is a measurement of length units that are aligned with no gaps or overlaps. Provide experiences for students to measure at different starting points on the ruler.

Vocabulary Instruction:

Tier 1	Tier 2	Tier 3
size long more smaller larger different	describe compare difference	inch centimeters ruler estimate length unit unit length measure

Suggested Lesson Outline (with Embedded Support for ELLs):

This lesson focuses on measuring the length of an object twice using standard units of measure: the inch and the centimeter. Prior to this lesson, students will have been exposed to tiling using various non-standard length units. They will have used various classroom items to develop a conceptual understanding of the actual size of an inch and the actual size of a centimeter. They will also have made estimates by approximating the length of various objects using their understanding of inches and centimeters. Finally, they will have made the connection between non-standard length units and the markings on a ruler that represent inches and/or centimeters by making their own inch and centimeter rulers. In this lesson, they will further develop their understanding of inches and centimeters as standard units of length by using rulers to make exact measurements. They will measure an object twice and compare the measurements they obtained using inches with those made using centimeters and determine why the numbers are different.

Math Fluency Practice

To prepare for representing whole number sums and differences within 100 on a number line (2MD6), students will practice counting up from different starting points on the number line. Begin by gathering students at the meeting area, where a number line with numbers going up to 100 is displayed or clearly visible. Point to the number 56 and say:

Yesterday I took the bus to go see the dentist. When I was on the bus at 56th Street, I realized I was running late. The dentist's office is on 72nd Street. I

Posing a real-world scenario provides an opportunity for ELLs to understand how measurement and problem solving are related. It also provides an opportunity for ELLs to apply their learning about measurement in different contexts. This aligns with Mathematical Practice Standard 4 that requires students to apply the mathematics they know to solve problems arising in everyday life.

called the dentist's office and the receptionist asked how many blocks away I was.

Write the number 72 to provide a visual reference.

How can I use the number line to help me figure out how many blocks away I was?

Provide wait time for students to think about the mathematical process required for them to answer the question. They will need to use the number line to determine the distance. Signal when it is time to share with their partners.

Encouraging students to think about and verbalize a mathematical procedure helps to develop their metacognitive thinking. *Metacognition* involves teaching the student to think about the thinking process. To teach metacognitive skills, the teacher must model the thinking processes as he/she works toward solving a problem and asks students to do the same. Support ELLs by providing the necessary content vocabulary and developing their understanding of a problem in a sequential and logical way.

Next, tell them: The space between the numbers 56 and 72 is how many blocks away I am from the dentist's office. This is called "distance." We need to measure the distance in order to find out how many blocks away I am. In a previous lesson, we learned that we can count length units to measure. In this case, the length units are blocks. So in order for me to find out how many blocks away I was, I am going to imagine that the spaces between the numbers are blocks and I will count them one by one.

Demonstrate how to count the length units by counting the number of spaces between 56 and 72. Then, pose additional problems for students to practice determining distance on a number line. Include examples such as finding the distance between:

- 63 and 81
- 45 and 57
- 48 and 23

In the last example, it is important to point out that directionality is not necessarily relevant in this exercise of counting length units, although it is important when using the number line to calculate sums and differences.

Exposing ELLs to a different way of measuring distance on a number line (such as counting backwards on the number line) provides an opportunity for them to solidify their conceptual understanding of iteration as a measure of unit length, which in this case is not affected by directionality.

As they move forward in subsequent lessons, students will build on this fundamental principle of measurement. For example, students will be asked to measure with a broken ruler. To accomplish this, they will need to understand that, although the ruler is used for standardized measurements, the fundamental counting principle applies to the space that represents the standardized unit, not the numerical value assigned to that space on the ruler.

Lesson Pre-Assessment

Prior to the lesson, prepare a chart with the following prompt:

- *What are some ways you can measure the length of your pencil? Draw or write your response on a sticky note.*

Read the prompt out loud, pausing to emphasize the word "length," which is addressed in previous lessons. Provide time for students to think about their responses prior to handing out sticky notes.

Reading the prompt aloud ensures that all students have access to the task, regardless of their language ability. Changing speech patterns focuses students' attention on a specific word or concept, highlighting its importance. The term "length" is addressed in the two previous lessons.

Posing this question serves as an assessment of students' ability to apply their understanding of the word "length" as an attribute of an object and to articulate a process for measuring this particular attribute, in this case using a pencil.

Provide time for students to write or draw their ideas and prepare to share with a partner. You may choose to partner beginning-level students with more advanced students in order to provide scaffolding.

Partnering ELLs with strong English speakers or bilingual speakers provides language support for the beginning-level students and language practice for more advanced speakers.

Set the guidelines for sharing by encouraging the use of complete sentences when sharing. Provide a sentence frame as necessary:

- *I would measure my pencil by____.*

Explicit instruction is essential. Direct teaching of academic language, concepts, and skills is necessary to ensure that ELLs receive coherent, scaffolded, and seamless instruction.

Sentence frames provide support for ELLs and enable them to participate in math discussions. Frames contextualize and bring meaning to vocabulary. They provide a structure for practicing and acquiring the skills necessary to communicate in English.

Model the use of this complete sentence, and point out the difference between using precise language instead of simply saying "I wrote ..." or "I drew ..."

Once students have shared with one another, call on them to share their partners' responses.

This is a good time to encourage advanced speakers to summarize what their partner shared, or to encourage beginning or intermediate speakers to share responses using new vocabulary they may have learned from their peers. It also provides an opportunity for the class as a whole to compare their ideas to those of their peers. Establish a way for students to show that they had a similar idea as their peers by showing a "thumbs up," for example.

Have the students come up and place their Post-it notes on the chart. These

may be referred to throughout the lesson. Conclude by saying:

As you can see, there are different ways to measure the length of an object. Today we are going to measure using a measuring tool: the ruler.

Whole-Class Guided Instruction

Tell students: *Today we are going to measure objects twice. There is an old saying: "Measure twice, act once."*

Have students share their ideas on the meaning of the saying. Then, say:

The saying refers to measuring twice to ensure accuracy—so that an action like cutting a piece of wood only has to be done once.

Begin the lesson by reviewing what was learned in the previous lesson.

In our last lesson, you made inch and centimeter rulers. How did you create these rulers?

Reviewing content that was addressed in a previous lesson allows ELLs to make connections and build content knowledge in a systematic way. It provides reinforcement for important vocabulary and links prior learning to new skills and concepts.

Provide time for students to talk to a partner. Then, summarize their response by saying: *You made the inch and centimeter rulers by using one-inch or one centimeter tiles and marking the space for each unit length, then numbering the spaces.*

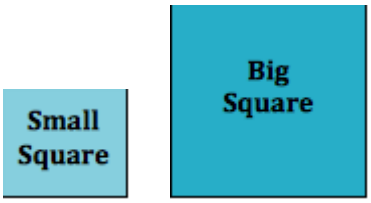
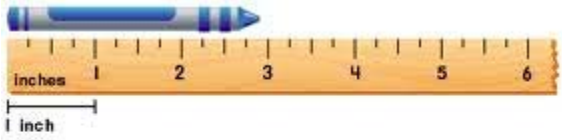
Support beginner ELLs by providing an Answering Questions bookmark (in Resources) and pointing to the word *"HOW."* This will help them understand that they need to explain a procedure.

Next, introduce the lesson objective:

Today we are going to measure different objects using these measuring tools that you created. By the end of the lesson, you will be able to tell what the length of an object is by using the words "inches" and "centimeters."

Include an image or example for each length unit to provide visual support for ELLs.

On chart paper, list the italicized vocabulary words that will be targeted in the lesson with a definition.

Vocabulary	Example
length	A measurement of the ***longest*** side of an object
unit	What you are tiling and using to measure
length unit	The ***size*** of what you are using to measure 
ruler	A measuring ***tool*** that shows the unit already tiled, labeled, and numbered
inch	A unit of measure that is _____ (bigger, smaller) than a centimeter 
centimeter	A unit of measure that is _____ (bigger, smaller) than an inch

Read aloud the key vocabulary terms and definitions. Fill in the blanks for inches and centimeters using the words “bigger” or “smaller” by having students compare the unit lengths on the rulers they created the day before. Students also compared the inch and centimeter in a previous

ELLs benefit from having written texts and visual representations to refer back to. It is important to prepare ELLS for the lesson by reviewing vocabulary and providing the definition of new terms that will be used. Visuals help ELLs connect a new word or concept to a graphic representation that they may be familiar with.

lesson, so they should already have this understanding.

Have the students hold the inch and centimeter rulers side by side. Then, ask: *Which one is longer?*

The class should come to a consensus that both rulers are the same size. They both represent the same length.

Support beginner ELLs by pointing to the final numbers at the end of the ruler and asking if they are the same. This visual cue provides some scaffolding, allowing ELLs to see the numbers you are referring to.

How many inches are there? [There are 12 inches.]

How many centimeters? [There are about 30 centimeters.]

Why is there a difference?

Why are there more centimeters than inches?

Explain to students that they will need to compare the size of the centimeter and the inch.

When I compare the sizes of the centimeter and the inch, I can see that the centimeter is smaller than the inch.

Hold up one of the individual centimeter and inch tiles students used to create the rulers.

This is a fundamental concept that all students, including ELLs, need to grasp in order for them to be able to explain why different units produce different measurements. Students will need to speak to the length of each unit in order to explain why a measurement of the same attribute of an object yields a different number depending on the unit that is used. Support beginner ELLs by referencing the Answering Questions bookmark and pointing to the word *WHY*. This will help them understand that they need to give a reason using the word *because*.

Demonstrate by tiling centimeter tiles beneath an inch tile to show that you need approximately 2 centimeter tiles to cover the length of an inch. Then, help students make the connection between this relationship of centimeters to inches and the numbers that appear on a ruler.

The centimeters are smaller so you need more centimeters to cover the same length. That is why there are more centimeters than inches.

Revisit the objective of the lesson.

At the beginning of the lesson, I explained that today we would measure objects using the inch and centimeter rulers as measuring tools. How do you think we will use these rulers to measure? What will we do to measure with these rulers?

Encouraging students to think about how they will apply what they have learned about measurement to the task, helps to develop metacognition. Metacognition involves teaching the student to think about the thinking process. To teach metacognitive skills, the teacher must model the thinking processes as he/she works toward solving a problem and ask students to do

the same. In this case, the teacher begins by first proposing the question, then modeling the response.

Tell students: *I know that to measure, I have to compare the size of the object with the unit I am using. I can use the ruler to count, or iterate, how many units long my object is. First, I need to decide which unit I am working with.*

Specifying the unit is critical in this exercise and implicit in the Common Core Standard for Measurement 2MD3, which states that students will measure an object twice, using units of different lengths for the two measurements and describe how the two measurements relate to the size of the unit chosen.

As you model measuring using centimeters, say:

Watch as I determine which unit I am using. This ruler has smaller markings. I know that the smaller unit is the centimeter unit, so I will first find the length of my object using centimeters. I think the length of this object is about 5 centimeters because it looks about the same size as 5 centimeter tiles lined up side by side. That is my estimate. Notice I used the word "centimeter" to identify the unit, and the word "length" to tell that I am measuring how long my object is.

Alternatively, you may choose to model using the inch tiles for students who need reinforcement in this area. You might say:

This is the inch tile. I know this because it is larger than the centimeter tile. I will measure the length of my object using inches by lining inch tiles next to my object. I think the length of my object will be 3 inches, because it looks about the same size as three of the inch cubes tiled side by side. That is my estimate. Notice how I used the word "inch" to tell the unit I am using, and the word "length" to tell that I am measuring how long my object is.

Modeling the language and mathematical thinking students can use to make estimates helps ELLs structure their thinking.

Record your estimate on an enlarged version of the Measure Me Twice! Chart (**Handout #1: Measure me Twice!**). Estimating is an exercise students learned at the beginning of the unit and should continue to practice throughout.

After recording the estimate on the chart, model how to find an exact measurement.

To find the exact measurement, I can place my object at a starting point on my ruler. The starting point is the first unit I am going to count.

When measuring, the starting point will not always be the beginning of the ruler. This is addressed in a subsequent lesson, where students are asked to measure the length of objects using a broken ruler for which the starting point is a number other than 0. However, for the purpose of this lesson on obtaining accurate measurements using students' self-created rulers, the starting point will be the beginning of the ruler.

Continuing modeling for the class, saying: *To find the length, I will count the length units (centimeters) from the starting point until I reach the end of my object.*

Demonstrate how to count the units from the starting point until you reach the end of the object by touching each unit on the ruler and counting aloud.

Touching each unit (as opposed to looking at the numbers) will help to draw students' attention away from the actual numbers on the ruler and focus more on the spaces, or length units, that you are essentially counting in order to determine the length. Students will need to grasp this fundamental measuring concept in order to understand that the individual length units determine the measurement, not the numbers on a ruler.

Record the length of the object using both inches and centimeters. Pause to acknowledge the difference in the numbers: *I measured the same object, but my measurements are different. Explain to your partner why you think there is a difference.*

Students should agree that the measurements are different because the size of the units used to measure is different.

On the Measure me Twice! chart, write the explanation for the difference in measurements: *The length in centimeters is a different number from the length in inches because the units are of different sizes.*

Underline the key math vocabulary in the explanation.

Written examples provide a model for students to follow when providing a mathematical response. Underlining or highlighting key terms helps emphasize the importance of using relevant math vocabulary.

Guided Language Practice

Instruct partners to go back to their tables, where they will have an object to measure. Students should choose the unit they will use first to measure the object and tell their partner: 1) the unit they chose, and 2) how they know it is that unit (as modeled previously). You might provide the following sentence frames:

- *I will measure the length using _____.*
- *I know this unit is _____ because _____.*

Next, instruct students to estimate the length and provide a rationale for their estimate. You might provide the following sentence frame:

- *I estimate the length of my object is _____ because _____.*

While students share their estimates, circulate around the room, making sure that they are identifying the unit and that their rationale includes a comparison with a different object or unit.

Finally, have students measure the length in the unit they have selected and record it next to the appropriate unit label until they have a measurement in both inches and centimeters. Have partners share their measurements using the language model from earlier in the lesson:

- *The length of the ____[object]____ is _____ inches.*
- *The length of the ____[object]____ in centimeters is _____ centimeters.*

Encourage and reference the use of vocabulary that was charted and displayed previously in the lesson. To differentiate for tactile learners, or students who need practice with tiling, students may choose to use inch or centimeter tiles.

This structured conversation between partners ensures that students are following the mathematical procedure they were taught, and provides an opportunity for students to use math vocabulary and language as they narrate the process of identifying a unit, making an estimate and measuring the object.

> Depending on their level of language proficiency, ELLs benefit from verbalizing their actions and thought processes with a partner.

Independent Work

Independently, students will select objects from the menu of classroom objects. They will make an estimate of the length of the object using both inches and centimeters. Then, they will measure the length using their self-created inch and centimeter rulers.

> This will provide practice estimating and measuring real-life objects. The use of real-life objects, or *realia*, helps to contextualize learning for ELLs.

Share

When finished, partners can share their measurements and compare their findings. Students may find that they have different measurements for the same object, at which point they will need to discuss how accurately they measured and if they need to work together to measure again to ensure accuracy.

Extension Activity

Gather students at the meeting area, once all students have completed the measurement for inches and centimeters. Instruct students to find a body part that measures approximately 1 inch and a body part that measures approximately 1 cm.

> When giving these instructions, use the ruler or inch/cm tile and point to your body to help beginning-level language learners make the connection between the instructions and the task. This strategy integrates the use of *Total physical response (TPR),* which is a language-learning method based on the coordination of speech and action.

Once students have identified body parts that measures approximately 1inch and 1 centimeter, have them measure one of the objects they selected again using the body part. Prompt students to think about how they might use a body part such as a finger to measure.

Model how to use a finger space to tile across an object. Students should be familiar with this concept of tiling and unit iteration from previous lessons. Have partners compare the measurement they obtained using their body part to the one they obtained using the ruler. Students should notice that the measurements should be similar or close because they are using a similar unit length.

Encouraging students to think about how they will apply what they have learned about measurement to the task helps to develop meta-cognition.

End-of-Lesson Assessment

Pose the following assessment prompt orally:

Sally measured her pencil using inches and then centimeters. She noticed that the two measurements were different even though she was measuring the same object. Why are the two measurements different?

(One point will be awarded for each math vocabulary word used correctly in your response.)

Posing a prompt orally is one way of developing students' auditory comprehension. It provides an opportunity for students to engage in a task by focusing their listening on particular information. Listening comprehension is one of the modalities that ELLs must develop in the language acquisition process. Alternately, depending on students' language ability, you may choose to distribute the exit slip with the prompt after reading it aloud. In this case, reading the prompt aloud ensures that all students have access to the task, regardless of their language ability. The visuals in the handout provide language scaffolds.

Once the prompt is posed aloud (you might choose to do so twice), distribute **Handout #2: *Exit Slip*** for students to record their responses.

Once students have written their response, pose the following prompt, which also appears on the handout:

When Sally went to the store to buy a pencil box, she realized she didn't have a ruler. How else can Sally measure the boxes to make sure her pencil will fit? How do you know this will work?

When time is up, collect the exit slips for assessment, making sure students' names appear on their handouts.

The first prompt asks students to apply their understanding of length unit and the importance of specifying the unit. It also encourages students to use mathematical language in their response.

The second prompt asks students to apply their understanding of non-standard units of measure to make approximations or estimates. Both of these concepts are addressed in previous lessons as well as in this lesson about measuring twice.

Lesson 4: Measure Twice

Handout #1: Measure Me Twice! *(Page 1 of 2)*

Name: _____ Date: _____

Directions: Working with a partner, select an object to measure from the menu below.
Make an estimate about the length of the object in inches and centimeters.
Then, measure the actual object using your ruler.

Menu of Classroom Objects

Notebook	*Computer*	Stapler
Poster	*Chair*	*Table*

Complete this activity with your partner:

Name of the Object	Estimate	Measurement
_____	It is _____ inches long. It is _____ centimeters long.	It is _____ inches long. It is _____ centimeters long.

Lesson 4: Measure Twice

Handout #1: Measure Me Twice! ***(Page 2 of 2)***

Directions: Working independently select objects from the menu of objects and draw a picture of them to measure. Make an estimate about the length of each ***actual*** object in inches and centimeters. Then, measure the length of that ***actual*** object using your ruler.

Complete this activity independently:

Picture of the Object	Estimate	Measurement
	_____ inches _____ centimeters	_____ inches _____ centimeters
	_____ inches _____ centimeters	_____ inches _____ centimeters
	_____ inches _____ centimeters	_____ inches _____ centimeters
	_____ inches _____ centimeters	_____ inches _____ centimeters

Lesson 4: Measure Twice

Handout #2: Exit Slip

Name: _____ Date: _____

<u>Sally's Pencil Box Dilemma</u>

1. Sally measured her pencil using inches and then centimeters. She noticed that the two measurements were different even though she was measuring the same object.

1 inch

about 2 centimeters

Why are the two measurements different? (One point will be awarded for each math vocabulary word used correctly in your response.)

Why are the two measurements different?

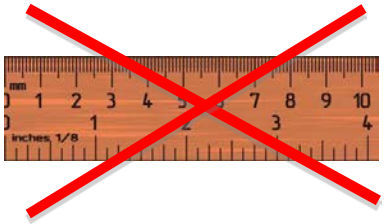
_____

_____

_____

_____

2. When Sally went to the store to buy a pencil box, she realized she forgot her ruler.



How else can Sally measure a pencil box to make sure that her pencil will fit?

_____

_____

_____

How do you know this will work?

_____

_____

_____

_____

Lesson 5: Measuring Using Appropriate Tools

Introduction:

This lesson was designed to teach students to evaluate the appropriateness of the tools they select to measure items of various sizes. The lesson builds upon mathematical ideas learned in previous lessons. The concept of equal units should be in place at this point so that students can deepen their understanding of measuring. Students will also have the opportunity to conceptualize their understanding of this concept through writing in their math journals.

Mathematical Goals:

- Students will be able to measure the length of an object twice, using units of different lengths for the two measurements.
- Students will be able to describe how the two measurements relate to the size of the unit chosen.
- Students will measure the length of an object by selecting and using appropriate tools, such as rulers, yardsticks, meter sticks, and measuring tapes.

Language Goals:

- Students will be able to explain orally and in writing how and why measuring with the most appropriate tool is important and beneficial.
- Students will be able to use content vocabulary introduced to describe the difference between two units in relation to the size of the unit.

  Note: Be sure to point out patterns of English language structure.

Materials:

- Vocabulary chart/word maps
- Pictures of different measuring tools
- Visual vocabulary cards: *ruler, yardstick, meter stick, measuring tape, length, height, width*
- Rulers (6-inch and 12-inch), yardsticks, meter sticks, measuring tape
- Items to measure: cereal box, classmate's face, classmate's height, classroom door, textbook
- Previously generated measurement lesson charts with ideas and vocabulary definitions for reference, including "Things to Remember About Measuring" chart from Lesson 1
- Sufficient space to play a game with movement
- Teacher Resource: Sample Frayer Model
- Handout #1: Frayer Model

- Handout #2: Appropriate Measures Scavenger Hunt
- Handout #3: Exit Slip
- Handout #4: Solving Word Problems

Common Core Learning Standards:

2.M.D.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.

2.M.D.1 Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them. Students explain to themselves the meaning of a problem and look for entry points to its solution.
2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.
3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.
4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.
5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.
6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Common Issue	**Suggested Questions and Prompts**
Student lacks comprehension of the term “appropriate” (right for the purpose).	Use examples as a way to provide a context for the word “appropriate” (right for the purpose). Explicitly explain the meaning of the term.
Student measures item, but use the unit scale incorrectly.	Student must align the object with the equal units in order to get an accurate measurement. Ask: *What does it mean to line up the ruler?*
Student may have some difficulties formulating sentences to share ideas both orally and written.	Use sentence frames. Ask: *How can we rephrase that statement to make it clearer and easier for your classmates to understand?*

Vocabulary Instruction:

Tier 1	Tier 2	Tier 3
size	appropriate reasonable compare difference	inch (in.) centimeter (cm) meter (m) length width height *foot/feet* unit measure

Suggested Lesson Outline (with Embedded Support for ELLs):

Day 1 of the Lesson 5

Tell students that the lesson will begin with writing a math journal entry.

Pose the following prompt for students to respond to in their math journal:

- *What would school be like for you if you were 6 inches tall? What would your life be like?* If you have the resources to be able to check the work, allow the students the opportunity to make the journal entry in their native language if they are fluent in that language.

Even the opportunity for students to discuss their thinking with a classmate who speaks the same native language would be helpful. The students can then record their response to the prompt in either their native language or English or both.

Whole-Class Guided Instruction

Tell students: *Today we are going to measure objects by selecting the appropriate (right for the purpose) tool to measure with. As you have learned in the earlier measurement lessons, there are some choices for measuring tools. Today we have 6-inch and 12-inch rulers. We also have yardsticks, meter sticks, and measuring tape.*

Ask: *What if we were asked to measure the length of the classroom, would it make sense to use a paperclip? Why or why not?*

Elicit responses from students. Guide them in understanding that there are a variety of measuring tools that can be used to measure a variety of items. Some tools are more appropriate than others because of the size of the object that is being measured.

Record students' responses on a chart, and next to each response write the name of student whose idea it is. This collection of ideas on a chart provides a reference point for students, one that can provide support for students who have not offered any ideas—students who need to remember and build on the ideas of others. Provide wait time for students to allow them to access, organize, and formulate their ideas/thinking into grammatically correct, conceptualized sentences.

Next, hold up and introduce each measuring tool using vocabulary cards that everyone can see—a paper clip, a 6-inch ruler, a 12-inch ruler, a yardstick, a meter stick, a measuring tape—and then call on students to respond to the following questions:

What does the word "appropriate" mean? Which of these tools would be the most appropriate (right for the purpose) tool to use to measure the length of the classroom? Why? Is this a reasonable (fair and sensible) decision?

Whole-Class Guided Practice

Explain that we can measure the length of an object, the height of an object, or the width of an object.

Ask: *Who can tell me what we mean when talk about the length of something?*

Elicit examples of length to help students visualize the concept of length, then measure examples that are available from end to end on their longest side.

Next, ask: *When we talk about the width of something, what do we mean?*

Elicit examples of width to help students visualize the concept of width, the measure from left to right, side to side.

Next, ask: *When we talk about height, what do we mean?*

Elicit examples of height to help students visualize the concept of height—something that is measured vertically (upward), from bottom to top.

Make sure students understand the differences between length, width, and height before moving on to the next task.

Whole-Class Game

Assign students to groups (two to four) and tell them they are going to play a game.

Explain the game to the class: *Each group member will be given a number, and when your number is called, it is your turn to go to the corner that has the picture of the appropriate tool to measure the object that I call out.*

Let's go over the pictures of the different measuring tools in each corner. For example, which would be the most appropriate tool to measure the length of a swimming pool?

Provide sufficient wait time for students to allow them to access, organize, and formulate their ideas/thinking into grammatically correct, conceptualized sentences. *Use sentence frames such as: "I think that a _____ is the most appropriate tool to measure the ____[object]___ because_____.*

The following is a list of objects that you can call out to students during the game. You do not have to use all of these examples.

- The width of a desk
- The height of the flagpole
- The length of a car
- The length of an eggshell
- The width of the classroom door
- The length of a ship
- The height of a person
- The height of a building
- The length of a fence
- The length of classroom

Call out as many examples as time will allow. Remember to discuss the examples using these suggested essential questions:

- *Why is this tool the most appropriate (right for the purpose) to measure …?*
- *Could you use any other measuring tools?*

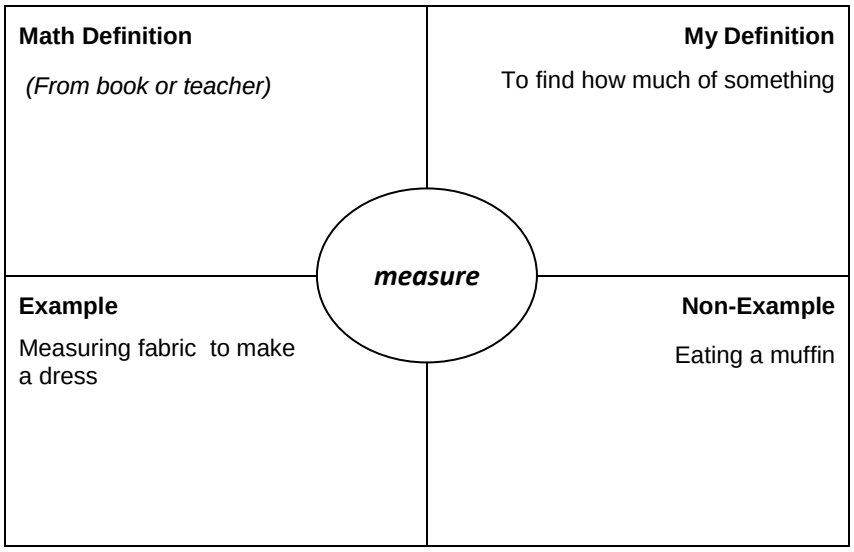
Use the visual vocabulary cards to familiarize students with each measuring tool. Elicit the importance of using appropriate (right for the purpose) tools to measure objects.

Visual representations are a helpful tool for ELL students, as they provide a visual reference for the clarity of concepts and definitions. You can also access a variety of free online translation websites, other students, teachers, or parents as a resource in order to provide more clarity for ELLs in their native language. They can also utilize the Frayer Model template for further vocabulary development.

Small-Group Work

Tell students: *Now that we have thought a little about length, width, and height, we can explore the definitions using this vocabulary graphic organizer. Take a look at this graphic organized called a Frayer Model, where I explore the term "measure." The math definition can be found in a dictionary, in your math textbook or reference book. The rest of the graphic organizer is a place for you to share what you understand about the term or word. Let's read what I understand about the word "measure."*

Display an example of a Frayer Model (**Teacher Resource: *Sample Frayer Model***), which is a type of graphic organizer. Model how to fill it in. Explain that the "Math Definition" is provided by the teacher and "My Definition" is created by the student. The student also provides an example of the term as well as a non-example of the term. Explain that the prefix "non-" (or "not") changes the meaning of a word to its opposite. For example, "working" means something or someone is doing something or functioning ("the computer is working"), whereas "non-working" means something or someone is **not** doing something or **not** functioning ("It's a non-working computer").



Next, distribute copies of **Handout #1*: Frayer Model*** to students. Assign them to small groups or pairs, and allow them time to complete the graphic organizer. You might create groups with mixed English-language fluency. Each group gets one word: "length," "width," or "height."

Share Small-Group Work

After you jigsaw the words for differentiation, allow students to report their understandings to the class. Allow students opportunities to challenge or critique the thinking of their classmates.

Day 2 of the Lesson 5

Tell students: *Today we are going to begin with a math journal entry.*

Display the following prompt and read it aloud to the class:

- *What would life be like if you were a giant? Explain, using details and giving examples.*

Whole-Class Guided Practice

Explain that today the class is going to work on measuring items with the measuring tools that were learned in the previous session.

Today I will show you how to select the appropriate—right for the purpose—tools and accurately measure an item. We have a 6-inch ruler, a 12-inch ruler, a yardstick, a meter stick, and a measuring tape.

What are some things you would measure with a 6-inch ruler?

What are some things you would measure with a 12-inch ruler?

What are some things you would measure with a yardstick?

What are some things you would measure with a meter stick?

What are some things that you would measure with a measuring tape?

Chart responses on a concept map with examples of things to measure. Include visual representations of the things we can measure with each measuring tool.

Provide wait time for students (especially ELLs) to allow them to access, organize, and formulate their ideas/thinking into grammatically correct, conceptualized sentences.

Next, tell students: *Look at the cereal box I'm holding. We have a 6-inch ruler, a 12-inch ruler, a yardstick, a meter stick, and a measuring tape. Which one do you think would be the most appropriate tool to measure the length of the cereal box? Why?*

Elicit responses that show an understanding of the relationship between the size of the object and the choice of the unit of measurement. Students should conclude that a ruler is the most appropriate tool to use to measure the cereal box.

Now that I have chosen and used my ruler to measure the cereal box, I can measure this one item using different standard length units of measurements. What are the standard length units of measure that would be most appropriate for us to use? How much does it measure? What is the difference between the two units? Which unit produces the longer measurement and why? Are the measurements the same?

After allowing wait time, elicit responses and guide students to the understanding that inches are the most appropriate unit of measurement. Record students' responses to guiding questions on a chart, and record students' names next to their statements.

Provide thinking time for students to formulate ideas. Don't "GPS" students: allow them to share their original thoughts and promote the questioning of thoughts provided—to build on, and to clarify or debunk the ideas provided.

Small-Group Work

Assign students to small groups to practice selecting and using appropriate tools to measure objects.

Distribute **Handout #2: *Appropriate Measures Scavenger Hunt*** and tell students:

Now you are going to select and use the appropriate tools to measure the items using particular length units. This is great opportunity for you to practice.

The use of concrete objects/manipulatives provides a real, three-dimensional context for students. Contextualization is one of the recommended scaffolds to support ELLs in accessing the mathematics in the lesson. Sentence frames may be included to provide the correct context for the content words to be used properly. This provides a fluent, grammatically correct, exemplar of speech.

Small-Group Share

After the activity, have students share their group's work with the class.

Exit Slip

Distribute **Handout #3: *Exit Slip*** and tell students to ask themselves: What did I learn about today?

When time is up, collect the exit slips for evaluation, making sure students' names appear on them.

Day 3 of Lesson 5

Tell students: *Today we are going to begin with a math journal entry.*

Display the following prompt and read it aloud to the class:

- *How would measurement be different if we did not have standard units of measure like centimeters and inches? Explain, using details and examples.*

Whole-Class Guided Practice

Explain that this day the class is going to work on word problems that involve measurement.

We are going to look for key, or important, information in a word problem and figure out what we have to do to solve it.

Display the following word problem and read it aloud to the class, *making sure they understand what a tire swing is*:

- *Mr. Brown measured a piece of rope that he wanted to use to make a tire swing. The rope looked too long to make the tire swing, so he cut off 23 inches. Then his rope was 70 inches long. How many inches was Mr. Brown's rope before he cut it?*

Ask students: *What information does the problem tell us? It tells us that Mr. Brown had a piece of rope. But the rope was too long, so he cut it to make it shorter. He cut off 23 inches, and now the rope measures 70 inches*. Take a look at the bar model/diagram:

70 in.	23 in.

70 + 23 = 93 inches

"Cut off" (or subtracted) lets you know that rope is 23 inches shorter than it was before Mr. Brown cut it. So, if I add the 23 inches back to the 70 inches of rope Mr. Brown now has, I know that the rope was 93 inches before he cut it.

Let's solve another problem using a number line:

- *Sue plants a tree with her dad. In three months, the tree grows 36 inches. After six months, the tree grows another 36 inches. Sue's dad trims 6 inches off the tree. How tall is the tree now?*

Call on students as you guide them through solving this word problem.

Independent Work

Distribute **Handout #4: *Solving Word Problems***. Tell students they will now have an opportunity to work independently to solve word problems involving the measurements of items in length units.

Circulate around the room as students try to solve the word problems, guiding them when needed.

When time is up, call on several students to share their answers. Answer any questions and clarify any misconceptions they might have.

Lesson 5: Measuring Using Appropriate Tools

Teacher Resource: Sample Frayer Model

Math Definition	**My Definition** To find how much of something
Example Measuring fabric to make a dress	**Non-Example** Eating a muffin

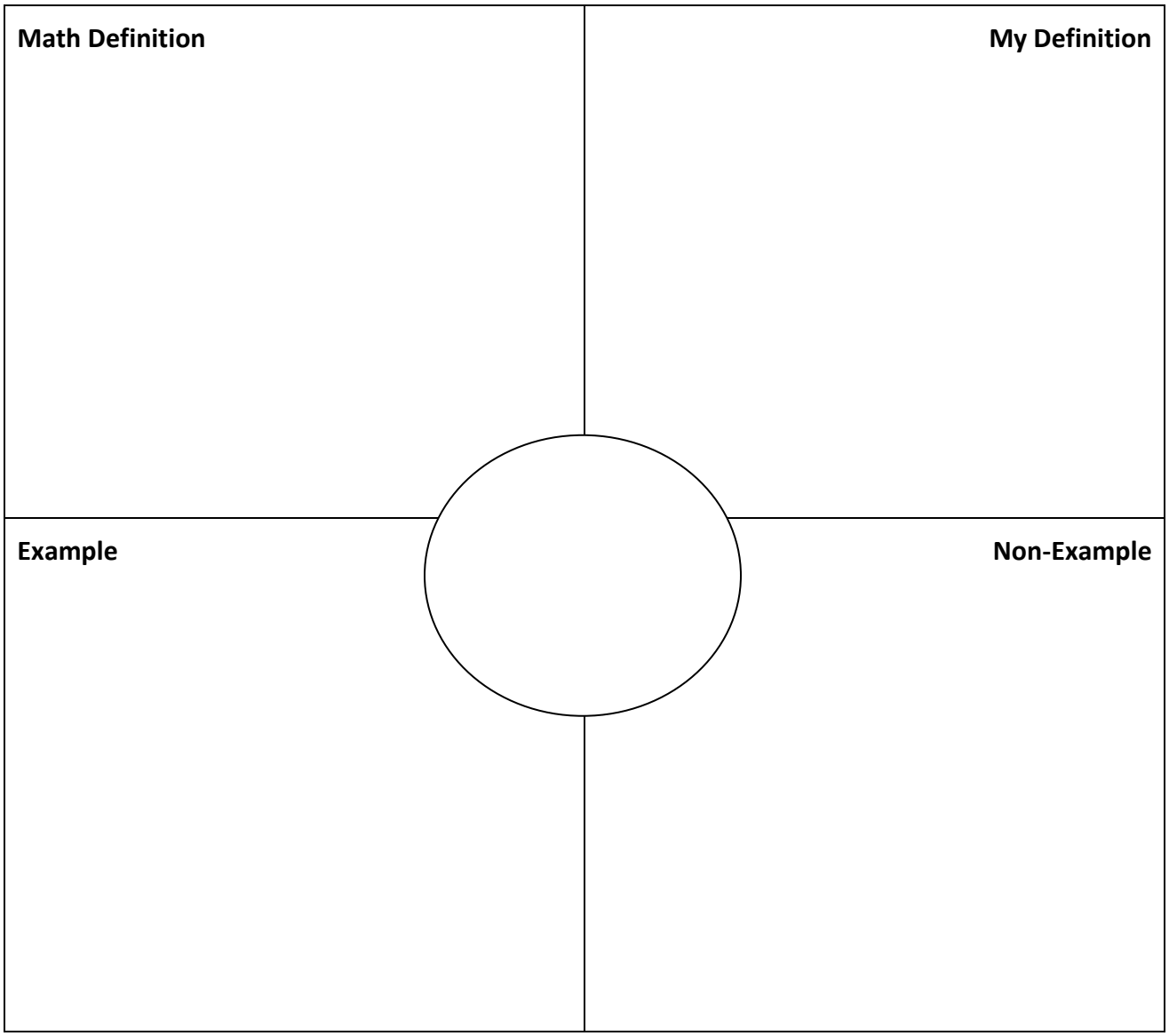
measure

Lesson 5: Measuring Using Appropriate Tools

Handout #1: Frayer Model

Name: _____ **Date:** _____

Directions: In the center circle, write in the word ("length" or "width" or "height") that the teacher has given you. Then, fill in the on the boxes on the graphic organizer with the appropriate information.



Lesson 5: Measuring Using Appropriate Tools

Handout #2: Appropriate Measures Scavenger Hunt

Name: _____ **Date:** _____

Directions: You are going to measure different items by selecting two units of different length: centimeters and inches, which are smaller units or yards and meters, which are larger units. There are different items around the room. You are going to hunt for the items listed on your recording sheet. Some items on the list ask you to hunt for items of a certain size. List the name of the item you chose to measure. Measure the items using the most appropriate measuring tools.

RECORDING SHEET

Items	Centimeter (cm)	Inch (in.)	OR	Meter (m)	Yard (yd.)
For example: The length of a paperclip 	3 cm	1 inch		--------	-------
The length of a friend's face 					
The length of a textbook 					
The height of the classroom door 					

The height of a friend					
An item that is about 6 inches long _____					
An item that is approximately 16 centimeters long _____					
An item that is between 2 and 3 meters wide _____					
An item that is approximately 3 centimeters in length _____					
An item that is close to 2 inches wide _____					

Complete the following sentence frames about measuring a friend's face:

1. The most appropriate (right for the purpose) tool to measure my friend's face was the _____.

2. I used these two units of measurement: _____ and _____.

3. When I measured my friend's face in _____ units, it measured _____.

4. When I measured my friend's face in _____ units, it measured _____.

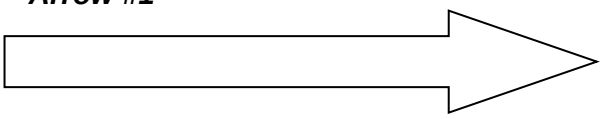
Lesson 5: Measuring Using Appropriate Tools

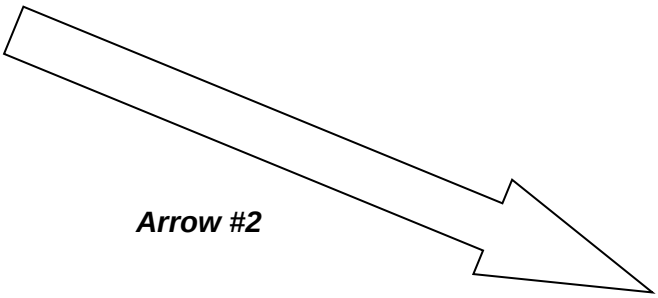
Handout #3: Exit Slip

Name: _____ **Date**: _____

Directions: Use the appropriate (right for the purpose) measuring tool to figure out the length of both arrows. Then, answer the questions that follow.

Arrow #1





Arrow #2

What is the length of Arrow #1? _____

What is the length of Arrow #2? _____

Which arrow is longer? _____

What is the difference in length? _____

What two different length units should we use to measure these arrows?

_____

Why might it be useful to measure an object using two different units?

_____

_____

_____

_____

_____

Lesson 5: Measuring Using Appropriate Tools

Handout #4: Solving Word Problems

Name: _____ Date: _____

Directions: Solve each word problem by looking for the key words that will signal or tell you what to do.

1. At Yankee Stadium, Derek Jeter hit a baseball 25 feet farther than Alfonso Soriano did. If Jeter hit the baseball 300 feet, how far did Soriano hit it?

Soriano hit the baseball _____ feet.

2. The second graders had a long-jump contest on Field Day. Michael jumped 52 inches, and David jumped 64 inches. How much farther did David jump than Michael?

David jumped _____ inches farther than Michael did.

3. Maria was 28 inches tall when she started kindergarten. She grew 4 inches in kindergarten, 2 more inches in the first grade, and more 3 inches in the second grade. How tall was Maria at the end of the second grade?

Maria was _____ inches tall at the end of the second grade.

On the lines below, create your own word problem—one that involves adding or subtracting lengths. When you have finished, exchange your work with a partner. Your partner will solve the problem you created, and you will solve the problem your partner created.

Problem: _____

_____

_____

_____

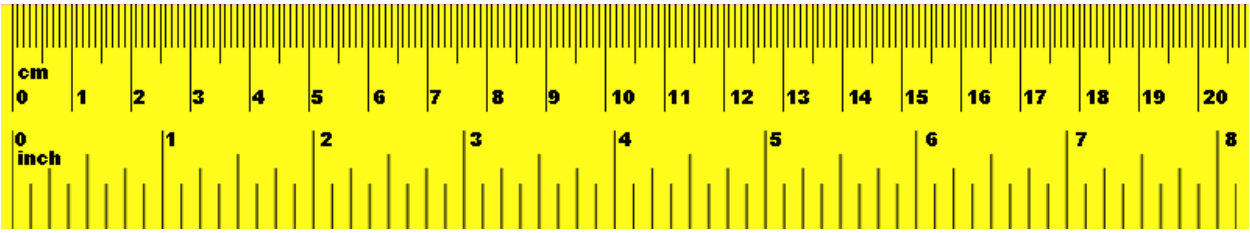
_____

_____

Formative Assessment: Measurement

(Follows Lesson 5)

Name: _____ **Date:** _____



1. Measure the picture of the sneaker in inches and centimeters.

   _____ inches _____ centimeters

   Why are the measurements different?

   _____

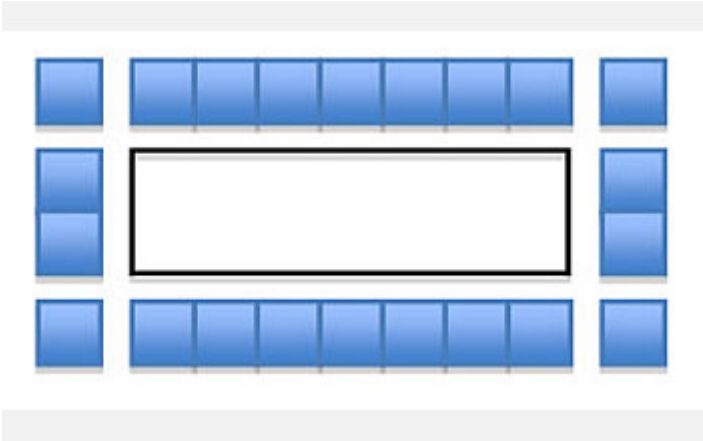
   _____

   _____

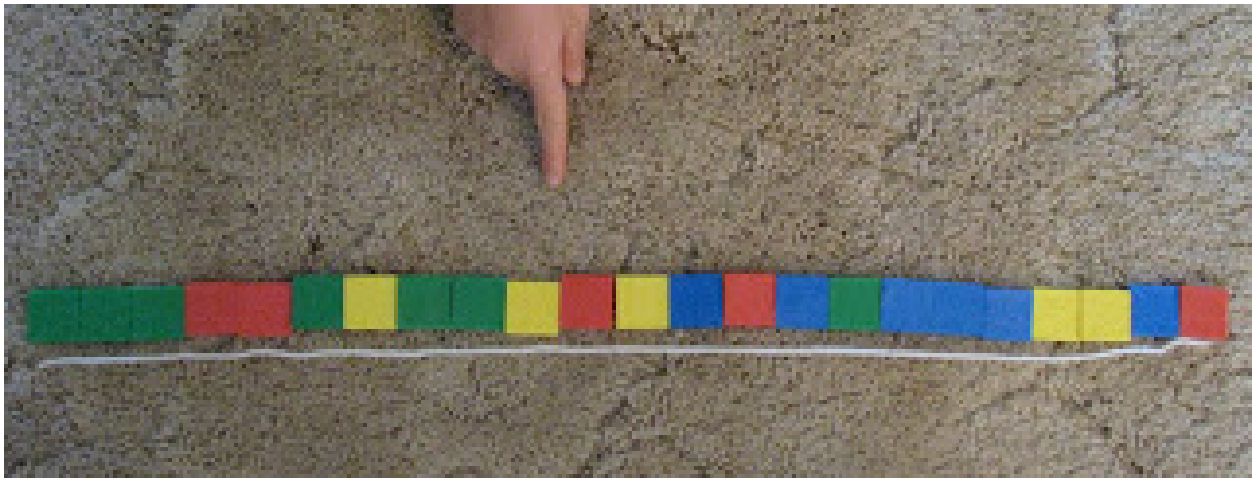
   _____

1. The measurement of the length of the object below is 7 units. What is the measurement of the width?

   The width measures _____ units.



2. Jake used counting tiles to measure the string.



Did Jake use his tiles correctly to measure the string? _____

How do you know?

_____

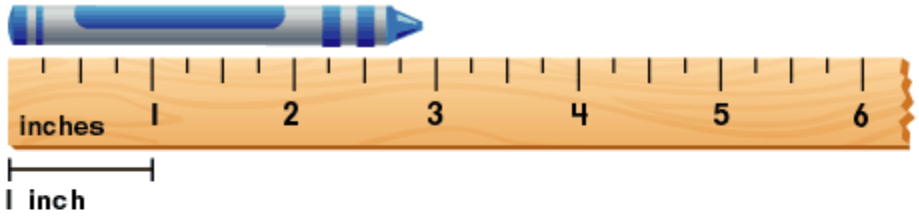
_____

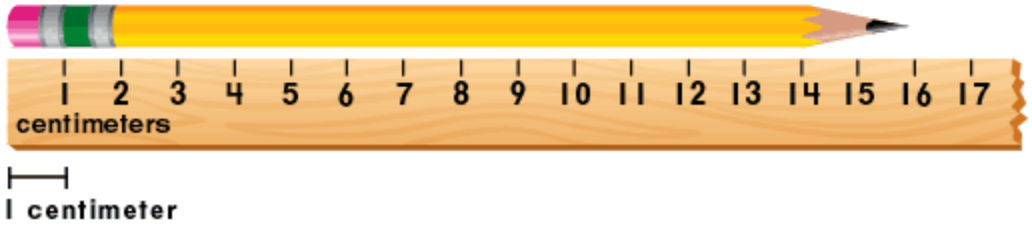
_____

_____

What is the measurement of the string? _____

4. Approximately how much do the items shown below measure?





The crayon measures approximately_____ inches.

The crayon measures approximately_____ centimeters.

The pencil measures approximately _____ inches.

The pencil measures approximately _____ centimeters.

5. Which **tool** should you use to measure a school bus? Put an “X” next to your answer.
    a. measuring tape ____
    b. ruler ____
    c. meter stick ____

6. Which **unit** should you use to measure a subway car? Put an “X” next to your answer.
    a. inches _____
    b. feet _____
    c. centimeters ____

7. Mary had a piece of string. The first time Mary measured her string, it measured about 5 centimeters. The second time Mary measured the string it was 2 inches. Why is there a difference in the measurement using these two units?

_____

_____

_____

_____

Lesson 6: Funny Rulers

Introduction:

This lesson builds on skills learned in lessons one through six using inches and centimeters as whole units of measurement. The student will be able to measure from any whole number on the ruler, yardstick, or meter stick instead of from the 0 mark. The focus is on precision and the importance of measuring in everyday life.

Mathematical Goals:

- Students will be able to distinguish between length and width.
- Students will be able to accurately measure using altered rulers, yardsticks, or meter sticks, measuring inches and centimeters by counting units (inches or centimeters) beginning at different points on the rulers, yardsticks, or meter sticks.

Language Goals:

- Students will be able to explain orally, in writing, and by illustrating the difference between length and width.
- Students will be able to use related math vocabulary to provide evidence of how they measured and completed the task to their partners and/or teacher.

Materials:

- Rulers and yard/meter sticks with the first two or three beginning units (numbers 1 or 2 inches, and about 12 minimum in centimeters) concealed with masking tape.
- Experience –chart paper
- Easel
- Desk or table work stations (6-8)
- Classroom items, such as crayons, pencils, notebooks, folder, book baskets (5-6)
- Handout #1: Measuring Objects Worksheet
- Handout #2: Exit Slip
- Teacher Resource: Observation Checklist

Common Core Learning Standards:

2.MD.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.

Standards for Mathematical Practice:

1. Make sense of problems and persevere in solving them. Students explain to themselves the meaning of a problem and look for entry points to its solution.
2. Reason abstractly and quantitatively. Students make sense of the quantities and their relationships in problem situations.

3. Construct viable arguments and critique the reasoning of others. Students understand and use stated assumption, definitions, and previously established results in constructing arguments.
4. Model with mathematics. Students apply the mathematics they know to solve problems arising in everyday life.
5. Use appropriate tools strategically. Students consider available tools when solving a mathematical problem, recognizing the strengths and limitations of each.
6. Attend to precision. Students try to communicate precisely to others. Students use clear definitions in discussions with others and in their reasoning.

Common Issues	**Suggested Questions/Prompts**
Students are unsure where to begin the measurement on the line or measuring device.	Ask: *Does it matter where you start measuring on the number line? Where are the whole numbers on your number line? Let's start by lining up the bottom of the crayon at 3, and counting how many units long your object is.* Then, assess their counting and have them count again to double-check their accuracy, and to practice picking a point on the number line that is the beginning of a whole unit.
Students are unfamiliar with using the number line.	Reteach/review the concept of directionality on the number line. Have students create and label their own number line. Use a ruler to demonstrate how the numbers increase as you move up the line (to the right), and how they decrease as you move down the line (to the left). Pair beginning students with peers who have mastered using the number line and who speak the same native language for support.
Student may confuse centimeters with inches.	Teachers should reteach as they circulate around the room, reminding students that the inch side has larger units than the centimeter side, that the customary ruler ends with the number 12, and that there are many more numbers on the metric side of the ruler.

Vocabulary Instruction:

Tier 1	Tier 2	Tier 3
long wide	accurate accuracy direction	length width

It is critical that ELL students be supported by charts and visual aids to aid in their comprehension of new content. Vocabulary words are best displayed in large, bold print, with accompanying illustrations, photos, and diagrams, if possible. Briefly review vocabulary from previous lessons (ruler, yardstick, meter stick) that is on the word wall for the measurement unit. Check for comprehension by using an equity system where student names are pulled randomly so that all students are accountable for mastery of the unit vocabulary. If a student is unsure of the meaning of a word, allow him/her to "phone a friend" and select a volunteer for support. Then, have several students provide evidence that the word is a working part of their vocabulary by using the word in a complete sentence. Introduce the lesson vocabulary: *wide, width, long, length, direction,* and *accurate* and *accuracy*.

Suggested Lesson Outline (with Embedded Support for ELLs):

Whole-Class Guided Instruction

Task: Starting at a whole number other than 0 on the altered ruler/yardstick, students will measure the length and width of various classroom items in both inches and centimeters. Encourage students to make additional individual choices of other items in the classroom to measure and record on their worksheets in the optional spaces provided if they are early finishers. Students will fill in the label for their optional choices (e.g., SmartBboard, trashcan, or bookcase).

Prior to the lesson, post the aim on the task on the measurement chart:

- *How can you measure the length and width of classroom objects?*

Introduce the lesson vocabulary: *wide, width, long, length, direction,* and *accurate/accuracy.*

Tell students: *Today we are going to continue learning about how to measure objects in inches and centimeters. We will be measuring the attributes of length and width. Who can tell me what the words "length" and "width" mean?*

Use adequate wait time to elicit response from students who are just beginning to acquire the language.

Utilize Total Physical Response (TPR), which assists the students in retaining vocabulary and content through related physical actions. Have the students stand up and say *length* and raise their hands in front of them and make a scissoring motion towards the ceiling then to the floor with their arms and repeat the word *length* several times.

If there is no response or the responses are inaccurate, remind students that length means how long an object is.

Let's repeat the definition of "length." "Length" means how long an object measures from top to bottom. Repeat the sentence again: "Length" means how long an object is.

Who can tell me what "*width* means?

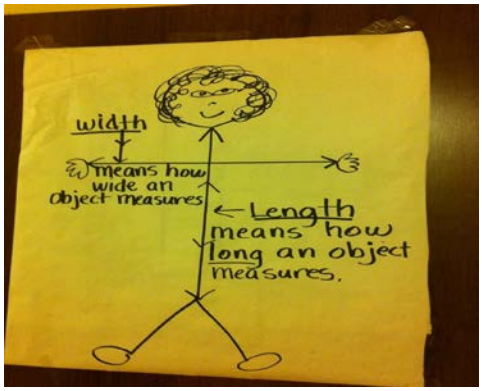
If there are no answers or the responses are not correct tell the students that "width" means how wide an object measures from side to side. Have the students repeat the definition.

Let's repeat the definition of "width." "Width" means how wide an object measures from side to side.

Then, have they repeat it again.

Display a chart (see below) for the duration of the unit that shows a student, labeled with arrows that illustrate length and width.

Model extending your arms from side to side in a "T" formation and have the students do the same. Have the students stand up, copy your gesture and say width several times to reinforce the definition. Using action (Total physical response) helps the students to make a memory connection with the language.

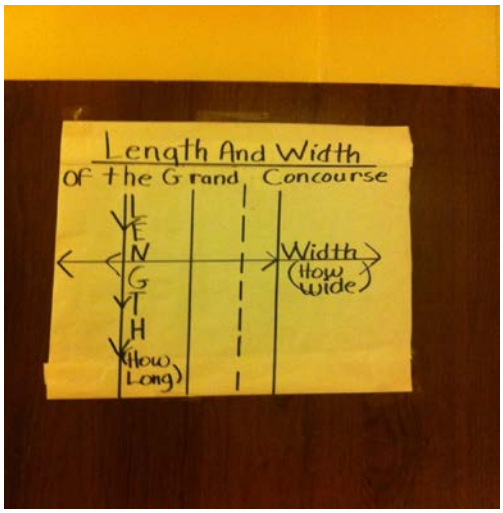


Ask students: *When do we measure the length and width of things?*

Show them a piece of fabric, and tell them that when we sew, we buy fabric in lengths that are measured.

That's how we know how much we need for our dresses or sweaters and how much we have to pay at the fabric store.

Today we are going to learn how to measure the length and width of different objects with rulers, yardsticks, and meter sticks. Please open your notebooks and write vocabulary words "length" and "width." "Width" means the distance from side to side across an object, and "length" means how long an



object is.

Display a chart (right) illustrating a road labeled the Grand Concourse.

This is drawing of the Grand Concourse, which is a big street in the Bronx. The length is five miles and the width is 180 yards.

Have the students copy the chart in their math notebooks.

Then ask students to help you label the length and width of the Grand Concourse with two large arrows drawn the length and width of the chart.

Which arrow should I write "length" on? I want the whole class to show me by using your hands. Is it from side to side, or top to bottom on this chart?

Once the students have demonstrated length with their arms, label the vertical arrow on the chart.

Ask: Where should I write "width"? Can you show me with your arms?

When they are done, have them close their notebooks.

Next, ask: *What does the word "accurate" mean?*

Using a real-world example like a well-known thoroughfare in the neighborhood helps the learner visualize, connect with the content, become more engaged and be able to integrate content with everyday life.

Support ELL students by modeling an up-and-down scissor motion again with your arms in front of your body again and ask them to do the same thing to demonstrate the concept of length. This is another informal way to assess student comprehension of "width" and "length."

Allow adequate wait time for students to formulate their answers. Again, support ELLS by modeling a "T" with your body and ask them to do the same. Then have them draw the arrows in the chart of the Grand Concourse in their math notebooks with the appropriate labels.

If there are no answers or students express misconceptions, explain that "accurate" means exact—with no overlaps, gaps, or mistakes.

Who can tell me why it is important to measure accurately? Turn and talk to a partner for two minutes about why measuring accurately is important.

Circulate while the students are discussing the importance of measuring accurately and listen for conversations that address the prompt. When the "turn and talk"' is complete, call on two students whom you heard discussing relevant ideas to share them with the class.

Use a "turn-and-talk" strategy to allow the students to formulate responses and translate their response from their native language to English. Rehearsing their responses helps ELL students gain confidence when speaking.

Following the share, tell students: *I can tell you a problem that I had when I didn't measure accurately. I bought a chair without measuring the width of my door carefully. I paid $25 to have*

it delivered to my home. When it was delivered, it was too wide to get through the front door. I had to send the chair back to the store. So, I didn't get the chair I wanted and I lost the $25 I paid to have it delivered!

Ask students to share any problems they experienced by not measuring something accurately.

Explain that today they are going to keep practicing how to measure different things in the classroom in inches and in centimeters.

Say: *Here are some rulers and yard and meter sticks for you to use as you measure accurately.*

Then, acting surprised, say: *Oh, no!*

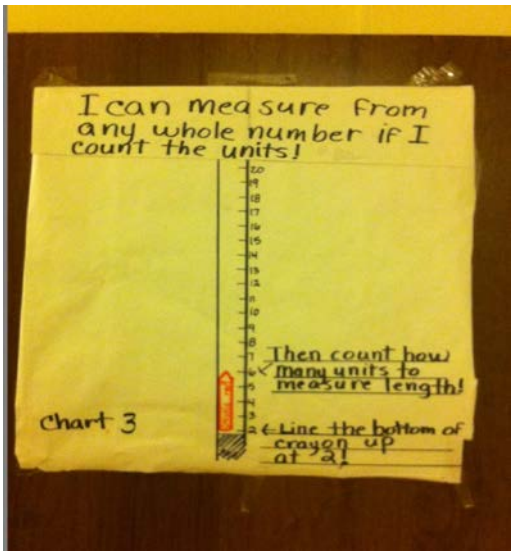
Look at the measuring devices and let the class know that someone has covered up the beginning numbers on the measuring devices.

We are going to have to start our measurement at two. Who has a strategy for measuring a crayon when the ruler starts at a number other than at zero?

Support ELL students by asking for voluntary participation. This helps them overcome shyness and embarrassment. Ask a student to come forward to help you draw the altered ruler on the chart (example below) to illustrate how you are going to line your crayon bottom up with the 2 on the yardstick and count up until you reach the end of the crayon.

I think I will line up the bottom of the crayon right at the edge on the whole number 2 and count by units up to the top of the crayon: 1, 2, 3, 4 units. I think this crayon is 4 inches long, but I better double-check. It's always important to measure twice.

Model a think-aloud. This builds meta-cognitive skills, and encourages ELL students to verbalize how they will approach the task and solve problems.



Measure the crayon a second time, and say:

That's right. The crayon is 4 inches in length! But can I do the same thing with centimeters? Who can help me solve my measurement problem using centimeters to measure the length of this crayon with the broken ruler?

The ruler starts at 11 centimeters, but we can still measure height and width even if our rulers and sticks do not begin at 0—if we remember to line up the bottom of our object with a whole number on the measuring devices and count the number of units.

Post a chart labeled "Measuring Tools We Use" and glue an actual ruler and yard/meter stick on to it and label accordingly. Visual aids such as charts and labeled realia (actual objects that are often labeled and used to illustrate concepts) assist ELL students in retaining content and are useful throughout the math unit.

Small-Group Activity

Tell the students they will work in teams of two using similar rulers and yard/meter sticks. **Distribute Handout #1: *Measuring Objects Worksheet*** to the students to record their data on.

Have pairs of students go to work stations in different areas of the room to measure and record the lengths and widths of the classroom objects on their worksheet. Remind them to refer to the charts if they need help.

When assigning small-group work, partner beginning students with peers who speak their native language and/or have strong mathematical skills in English. Talking about the task in their native language helps the student access prior knowledge and comprehend new language.

Explain that once they have finished recording their assigned measurements, they can select other objects to measure and record on their work sheet.

To ensure student success, the lengths and widths of the items on the worksheet should be of exact inch-unit sizes. Avoid measurement of items that have fractional numbers.

Remember that it is important to differentiate for advanced students as well. Some may be ready for the concepts of fractional units such as half-inches. Be ready to discuss this concept with students who have noticed items that measure in fractional units during their independent explorations.

Using a teacher's observation note-taking system, identify students who may need additional support or group work. (See **Teacher Resource: *Observation Checklist*** for reproduction and use.)

As you circulate around the classroom, redirect and remind the students to use the artifacts and charts from the lesson and throughout the unit. This provides a visual point of reference that can be used as students are completing tasks and acquiring a new language.

After about 15 minutes, regroup the students in the meeting area and select several students to share their worksheet results with the class.

Collect the worksheets and add to student portfolios.

As the students share results, repeat their sentences after they have described what they have measured and the length and width of each item. Recast their sentences if necessary. (Recasting is the practice of restating a sentence correctly with regard to grammar, pronunciation and word order so the student hears the preferred language.) This is preferable to explicit correction, where an instructor may draw attention to the mistakes in the presence of other students, which can be embarrassing and cause the student to refrain from speaking in the classroom. Enunciate carefully and emphasize important vocabulary.

Independent Assessment

Say: *Please, go to your seats. I have one more measuring task for you to complete.*

Distribute the **Handout #2: *Exit Slip*,** and review it with the class. Explain that they are to measure the length and width of the

Authentic assessments like exit slips monitor comprehension on a daily basis and identify any gaps or concepts that need to be reviewed or retaught.

objects on the exit slip, working independently with the “funny” ruler.

When time is up, collect the independently completed exit slips, making sure students’ names appear on them. Use the exit slips to assess comprehension and determine appropriate grouping and the need for additional instruction and differentiation.

Lesson 6: Funny Rulers

Handout #1: Measuring Objects with Funny Altered Customary and Metric Tools

Directions: Measure the following objects at your math station. Measure them in **inches** and **centimeters.** Double check your work by measuring twice. Make sure you are counting units from a **whole** number.

1. No. 2 pencil

The length of the No. 2 Pencil is	_____ centimeters long.	_____ inches long.
The width of the No. 2 pencil is	_____ centimeters wide.	_____ inches wide.

2. Eraser

The length of the eraser is	_____ centimeters long.	_____ inches long.
The width of the eraser is	_____ centimeters wide.	_____ inches wide.

3. Sticky notes

The length of the pad of sticky notes is	_____ centimeters long.	_____ inches long.
The width of the pad of sticky notes is	_____ centimeters wide.	_____ inches wide.

4. Your choice...

The length of the _____ is	_____ centimeters long.	_____ inches long.
The width of the _____ is	_____ centimeters wide.	_____ inches wide.

Lesson 6: Funny Rulers

Handout #2: Exit Slip

Directions: Measure the items in the pictures in inches (in.) and centimeters (cm) with the "funny" (altered) measuring tools. Then, fill in the appropriate blank spaces in the sentences that are below each picture.

Lollipop

1. The length of the lollipop is _____ inches long.
2. The length of the lollipop is _____ centimeters long.
3. The width of the lollipop is _____ inches wide.
4. The width of the lollipop is _____ centimeters wide.

Key

1. The length of the key is _____ centimeters long.
2. The length of the key is _____ inches long.
3. The width of the key is _____ centimeters wide.
4. The width of the key is _____ inches wide.

Unit: Measuring Up! A Second Grade Math

Student Self-Assessment: Measurement Unit Checklist

Name: _____ Date: _____

Place a check next to how you feel you are doing when working on our measurement unit.

I understood the concept and was able to complete the task independently.

I understood the lesson but needed help to complete the task.

I was confused with the lesson and I needed help to complete the task.

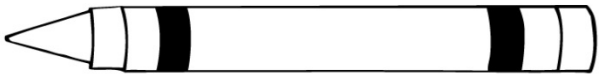
Learning Objective			
I can iterate with no gaps or overlaps, and my units are the same size.			
I can select appropriate tools for measuring length.			
I can measure the length of an object.			
I can measure the length of objects using different length units.			
I can describe the relationship of different-length units.			
I can estimate lengths using inches and feet.			
I can estimate lengths using centimeters and meters.			
I can find the difference in length of two objects.			
I can add to solve word problems that involve length.			
I can subtract to solve word problems that involve length.			
I can add using a number line.			
I can subtract using a number line.			

Unit: Second Grade Math

Summative Assessment

Name: _____ **Date:** _____

1. About how long is this crayon?



a) 3 yards b) 3 feet c) 3 inches d) 3 meters

2. Estimate the length of a brand new pencil in inches and centimeters.

   Record your estimation:

Inches	Centimeters

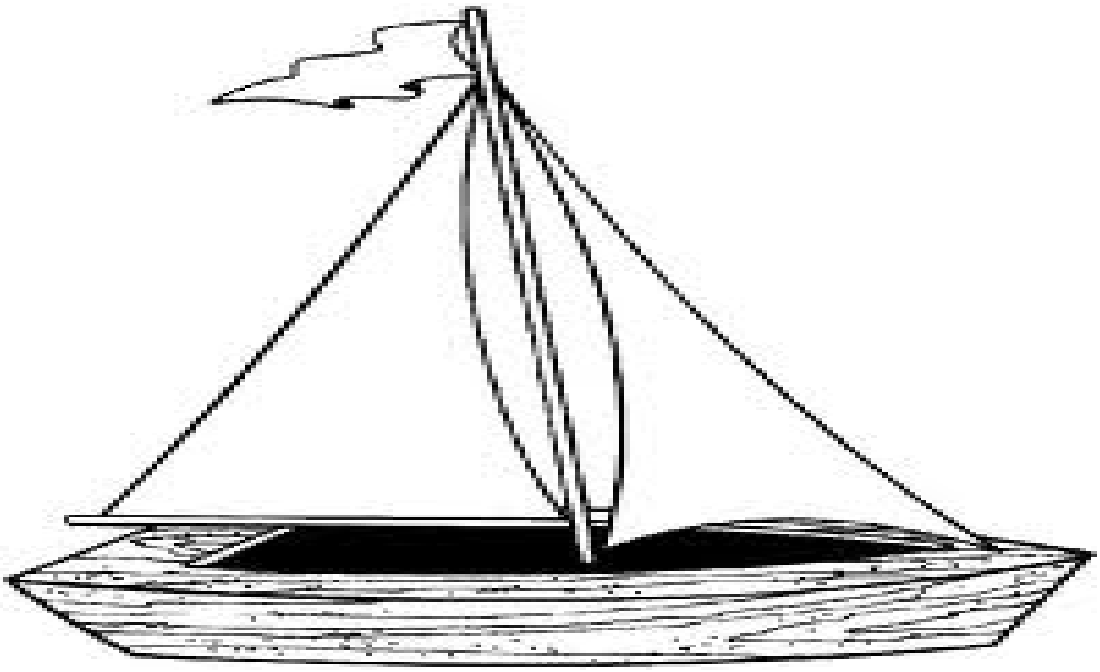
   Measure the length of a brand new pencil using centimeter and inch tiles.

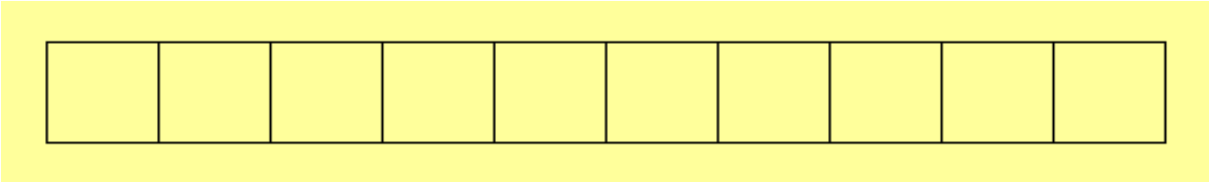
   Record your measurement:

Inches	Centimeters

   Which unit measure has the greater number of units? Explain why?

3. The boat is about _____ squares long. About how many shoes long is the boat? The boat is about _____ shoes long.





4. A couch has four seating cushions. Each cushion is 3-feet long and they are placed next to each other with no gaps or overlaps. How long is the whole couch? Draw a picture of the couch and its four cushions to help you solve the problem.

   Draw your couch:

   The couch is _____ wide.

   a) 12 inches b) 3 yards c) 12 feet d) 3 feet

5. John and Mary had a jumping contest. John jumped 38 inches. Mary jumped 56 inches. How much farther did Mary jump than John? Use the number line to solve.

Explain your thinking:

_____

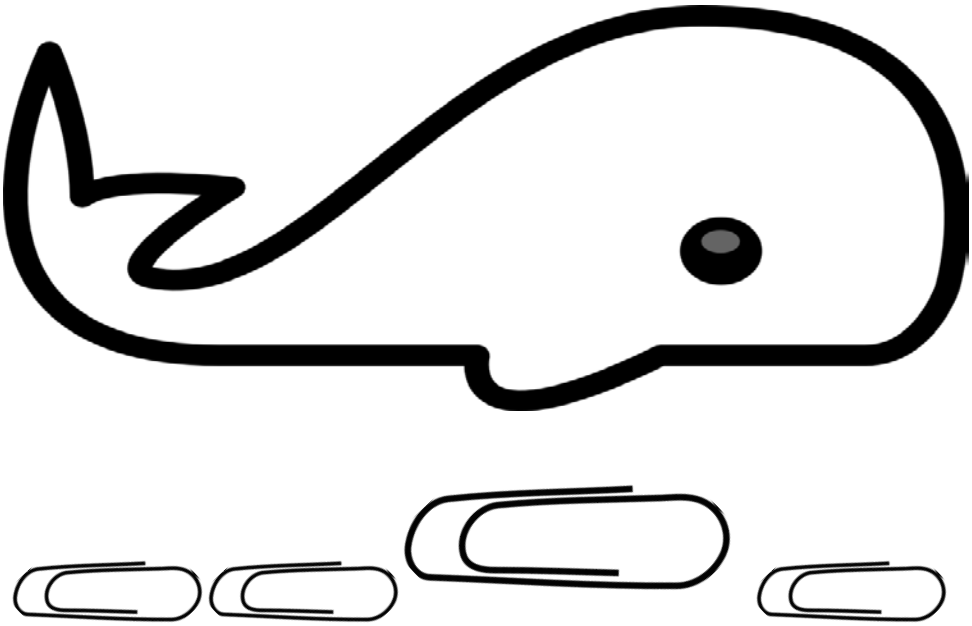
_____

_____

_____

_____

6. Tommy used paperclips to measure the whale. This is what his work looked like.



Tommy said the whale measures four paperclips long. Is his measurement accurate? Why or why not? Explain your thinking.

_____

_____

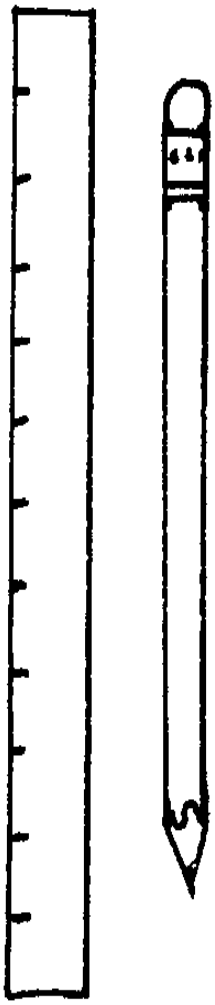
_____

_____

_____

_____

7. What is the measurement of the pencil?



The pencil is _____ units long.

Unit: Second Grade Math

Resources for ELLS

“Clarifying and Explaining My Thinking” Chart

Use this chart to help students identify their level of understanding of a given task or concept. Students may point to the level or use the prompt to explain or ask for clarification.

Level 1	***Level 2***	***Level 3***
“I can do this, but I am not sure how to explain it.”	*“I think I know what this means, but I am not sure.”*	*“I found the right answer, but I can’t explain how.”*
Suggestions or Prompts: • Draw a picture. • Make a model. • Show the steps	Suggestions or Prompts: • Look at the math word wall. • Review your notes. • Ask a friend.	Suggestions or Prompts: • Use a prompt or sentence starter.
This helped!	*This helped a little.*	*This didn’t help.*

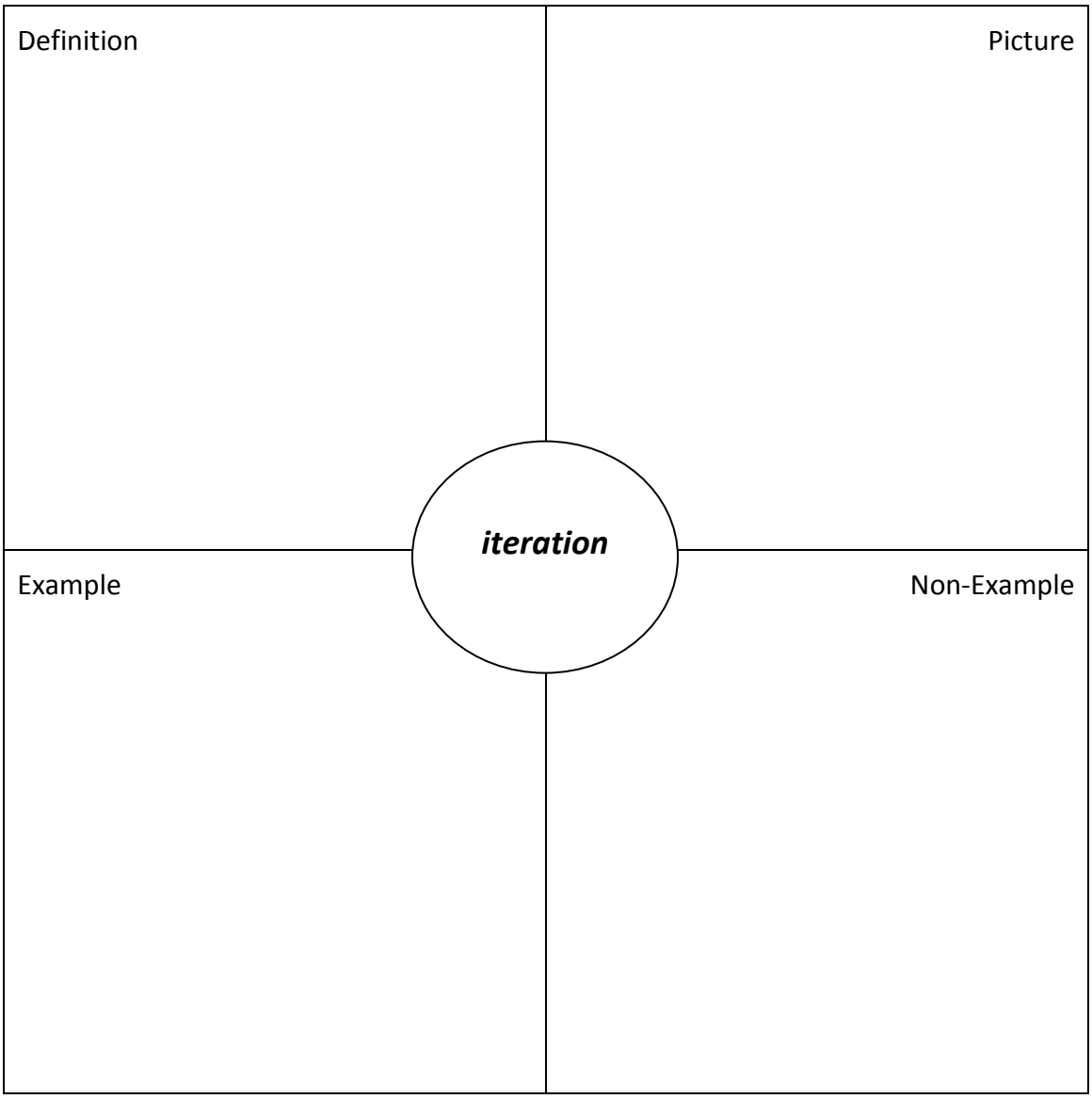
“Answering Questions” Chart

Use this chart to help students understand the type of question that is being asked. It also provides a model using prompts and sentence frames for students to craft their responses.

Question Word	**What It Means**	**Sample Questions**	**Sample Responses**
What?	*to define*	*What is measurement?*	*_____ is* *for example ...*
How?	*to explain*	*How do you find the length of something?*	*You can find the length by _____.*
Why?	*to give a reason*	*Why is there a difference?*	*Because …*

Frayer Model

Use the Frayer Model to help students learn new content vocabulary. When they use the Frayer Model, students think about the Tier 3 vocabulary that was used throughout the lesson and any other vocabulary you feel that your students need further engagement with. Model with the word ***iteration***.



Vocabulary Development Graphic Organizer

Word/Term:

Math Definition:

My Definition:

Example:

Non-Example:

Picture: