

Measurement

First Grade

Formative Assessment Lesson

Designed and revised by Kentucky Department of Education Mathematics Specialists
Field-tested by Kentucky Mathematics Leadership Network Teachers

Created for the sole purpose of assisting teachers as they develop student understanding of Kentucky's Core Academic Standard through the use of highly effective teaching and learning.

Not intended for sale.

Measurement**Grade 1**

This Formative Assessment Lesson is designed to be part of an instructional unit. This task should be implemented approximately two-thirds of the way through the instructional unit. The results of this task should then be used to inform the instruction that will take place for the remainder of your unit.

Mathematical goals

This lesson unit is intended to help you assess how well students are able to measure objects using non-standard units of measure and compare three objects according to length. It will help you to identify students who have the following difficulties:

- Students having difficulty comparing and ordering objects.
- Students who are struggling with iterating objects for measurement. (This means that students understand objects must be laid end to end with no gaps or overlaps in order to be accurate.)
- Students who are struggling with idea of conservation of length. (This means that the measurement of the objects length does not change when I move or change the orientation of the object.)

Common Core State Standards

This lesson involves *mathematical content* in the standards from across the grade, with emphasis on:

Measurement and Data 1.MD

- **Measure lengths indirectly and by iterating length units.**

This lesson involves a range of *Standards for Mathematical Practice*, with emphasis on:

2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
6. Attend to precision.

Introduction

This lesson is structured in the following way:

- Before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. You then review their work and create questions for students to answer in order to improve their solutions.
- Students work in small groups on collaborative discussion tasks, organizing cards based on length and utilizing non-standard units of measure. Throughout their work, students justify and explain their decisions to their peers.
- Students return to their original assessment tasks, and try to improve their own responses.

Materials required

Each individual student will need:

- Two copies of the assessment task *Measurement*.

Each small group of students will need the following resources:

- Card Set A
- Card Set B
- Card Set C
- Card Set D
- Chart E and Card Set E

Time needed

Approximately 15 minutes before the lesson (for the individual assessment task), one 40 minute lesson, and 15 minutes for a follow-up lesson (for students to revisit individual assessment task). Timings given are only approximate. All students need not complete all sets of cards activities. Exact timings will depend on the needs of the class.

Before the Lesson

Assessment task: Measurement (15 minutes)

Have students do this task individually in class a day or more before the formative assessment lesson. This will give you an opportunity to assess the work and gain insight to student difficulties. You will be able to target your help more effectively in the follow-up lesson. Depending on your class you can have them do it all at once or in small groups (they should still work individually.)

Framing the pre-assessment:

Give each student a copy of the assessment task *Measurement*

Today we are going to work on a task about length. This task is to help me see ways that I can help you if you are having any problems. You may find some of the questions challenging. If you are not sure about all of your answers, it is okay. We are going to do an activity that will help you improve.

It is important that the students are allowed to answer the questions without your assistance, as far as possible. An exception may be if you want to read any text to the students. But there should be no assistance, guidance, or hints on the mathematical portion.

Students should not worry too much if they cannot understand or do everything, because in the next lesson they will engage in tasks, which should help them. Explain to students that by the end of the next lesson, they should expect to answer questions such as these confidently. This is their goal.

Assessing students' responses

Collect students' responses to the task. Make some notes about what their work reveals about their current levels of understanding. Partner/group students with others who displayed similar errors/misconceptions on the pre-assessment task.

We suggest that you do not score student's work. The research shows that this will be counterproductive, as it will encourage students to compare their scores, and will distract their attention from what they can do to improve their mathematics.

Instead, help students to make further progress by summarizing their difficulties as a series of questions. Some questions in the “Common Issues Chart” may serve as examples. These questions have been drawn from commonly identified student misconceptions. Additional space has been provided in the chart to record any additional misconceptions or noteworthy occurrences.

We suggest that you write a list of your own questions, based on your students’ work, using, but not limited to the ideas that follow. You may choose to write questions on each student’s work. If you do not have time to do this, select a few questions that will be of help to the majority of students. These can be written on the board at the end of the lesson before the students are given the post assessment task.

The solution to all these difficulties is not to identify the solutions for the students, but rather to allow them to explore, discuss, reflect, and refine their understandings.

Below is a list of common issues and questions/prompts that may be written on individual tasks or asked during the collaborative activity to help students clarify and extend their thinking.

Common Issues:**Suggested questions and prompts:**

<p>Students are placing cards in incorrect order. Card set</p>	<ul style="list-style-type: none"> • Tell me about the order you placed your cards. If students put them in the wrong order, but defend it properly this is not an area of concern. The idea here is to establish that they understand ordering objects. • What does shortest mean? What does longest mean? Checking for vocabulary understanding. Students may order things incorrectly due to lack of vocabulary issues as opposed to not understanding the concept.
<p>Students make unreasonably estimates prior to measuring.</p>	<ul style="list-style-type: none"> • Why did you guess this line was ____ blocks long? • Did you use any strategies when you estimated the length of this line?
<p>Students may have used one block and repeatedly scooted it over when measuring. This would most likely yield an incorrect measurement. Students should use multiple blocks end to end to measure.</p>	<ul style="list-style-type: none"> • Show me how you measured the line. Look to see how attentive to detail student is as they move block. • How do you know that your measurement is correct? • Is there a way you kept track when you scooted your block over.
<p>Students use the blocks/paper clips but are not attentive to them being placed end to end.</p>	<ul style="list-style-type: none"> • Did you leave the extra space on purpose? Why? • Do the “gaps/extra space” between the blocks/paper clips affect the measurement?
<p>Students place the staggered lines in incorrect order. Students often think just because the line “sticks out” it must be the longest.</p>	<ul style="list-style-type: none"> • What if we measured these lines which one do you think would take the most blocks/paperclips? Show me. • Have an object handy such as a pencil and move the item around on the student’s desk and ask if the length of the pencil has changed. Isolate one of the lines and move around the same way.
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Suggested lesson outline

Collaborative Activity: Ordering line segments from shortest to longest

Strategically group students based on pre-assessment data into groups of two or three students. With larger groups, some students may not fully engage in the task. Group students with other who displayed similar errors/misconceptions on the pre-assessment task.

Introduce the lesson carefully:

I want you to work as a team. Each time you order your cards explain your thinking clearly to your partner. If your partner disagrees with your placement then challenge him or her to explain why. It is important that you both understand why each card is placed where it is. There is a lot of work to do today and you may not all finish. The important thing is to learn something new, so take your time.

Give each group Place Card A and Card Set A.

Your (the teacher) tasks during the small group work are to make a note of student approaches to the task, and to support student problem solving. As you monitor the work, listen to the discussion and help students to look for patterns and generalizations.

Make a note of student approaches to the task

You can then use this information to focus a whole-class discussion towards the end of the lesson. In particular, notice any common mistakes. Common mistakes are listed on the Common Issues Chart.

Support student problem solving

Try not to make suggestions that move students toward a particular approach to the task. Instead, ask questions to help students clarify their thinking. Encourage students to use each other as a resource for learning.

If one student has placed the cards, challenge their partner to provide an explanation.

If you find students have difficulty articulating their decisions, then you may want to use the questions from the *Common Issues* table to support your questioning.

If the whole class is struggling on the same issue, then you may want to write a couple of questions on the board and organize a whole class discussion.

Place Card Set B

As students finish with matching Card Set A and can explain their thinking, collect Card Set A and give that group Card Set B. This set checks for understanding of unit estimation, iteration of units, and ordering objects by length.

As you monitor the work, listen to the discussion and question students in order to gain insight to their thinking.

How did you make your estimate?

Was your estimation a good guess? How do you know?

Can you show me how you measured?

Place Card Set C

As students finish working with Card Set B and can explain their thinking, collect Card Set B and give that group Card Set C. This set checks for understanding of unit estimation, iteration of units, ordering objects by length, and conservation* of length. This structure is viewed to be more difficult do to the nature of the units used. Linking cubes provides more structure because they can be locked together. Paper clips require more attention to precision and deepen the focus on unit iteration.

Conservation of length means that when I move an object its length does not change.

As you monitor the work, listen to the discussion and question students in order to gain insight to their thinking.

How did you make your estimate?

Was your estimation a good guess? How do you know?

Why did you order your lines in this manner?

Can you show me how you measured?

Place Card Set D

As students finish working with Card Set C and can explain their thinking, collect Card Set C and give that group Card Set D. This set checks for understanding of conservation of measurement. This structure is considered more difficult because it removes the structure of asking for unit measurement. Students become more likely to order the objects incorrectly because they do not have the measurement to assist them in their thinking.

As you monitor the work, listen to the discussion and question students in order to gain insight to their thinking.

How did you decide which order to put the lines?

If students are incorrect and continue to have issues, you may want to provide them with linking cubes/paper clips to measure and check their work again.

Chart E and Place Card Set E

As students finish working with Card Set D and can explain their thinking, collect Card Set D and give that group Chart E Card Set E. This card sets attempts to explore the idea transitivity. To fully understand if a student understands transitivity, a teacher will have to question and listen to student reasoning. The objects listed are intended to refer to “real life” objects. It is recommended that the teacher obtain a real broom to display in front of the class to make the “benchmark” object consistent for the whole class. Do not assume a student has placed a card incorrectly without asking for reasoning first. Example, a student places the car to be shorter than the broom. When questioned, the student explains the car as one that looks like one of his toys at home and his toy car is shorter than the broom. The key hear is for students to be able to defend their answers correctly.

Taking two class periods to complete all activities

If you have to divide the lesson into two class periods, you may want to have a way for students to save the work they have done with the place card sets. You may have each group tape the cards down with on their place cards. You may choose to have them do this even if you are not dividing up the class period just to use as a visual during the class discussion.

Sharing Work

As students work through their card sets and hit road blocks, you may want to give them the opportunity to compare their work with another group and have each of them explain and defend their thinking.

Extension activities

Students who finish quickly can be given additional blank cards for Chart E. The teacher will challenge the student to create additional cards that represent items that are shorter or longer than the broom.

Plenary whole-class discussion (10 minutes)

Conclude the lesson by discussing and generalizing what has been learned. The generalization involves first extending what has been learned to new examples, and then examining some of the conclusions students came up with. Allow groups to bring up some of their work samples and share their thinking.

To focus your students, refer to the common issues chart. Use the questions which reflect the greatest need(s) of your students. You may choose to share these aloud with the whole group, ask them of individuals as you move around the room, or work with small groups.

Improving individual solutions to the assessment task (10 minutes)

Give the students a new copy of the original task, measurement

Think about what you have learned during this lesson. Using what you have learned try to improve your work.

MEASUREMENT

NAME _____

1. Circle the line that is the shortest.



2. Using your linking cubes measure this line.



_____ linking cubes

3. Using paper clips measure this line.



_____ paper clips

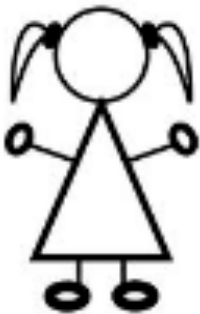
4. Circle which line is longer



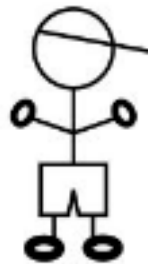
5. Draw two things that are longer than you.

6. Draw two things that are shorter than you.

7. You will do these questions one-on-one with each student and record his/her responses. Using the images below follow these directions. Cover up Julie and ask the student who is taller Tina or Bob? Then cover up Tina show Julie. Now ask student who is shorter, Bob or Julie? Leaving Tina covered now pose the question, is Julie taller or shorter than Tina? How do you know?



Tina



Bob



Julie