

Kindergarten: Mathematics Highlight Lesson Unit 3: Exploring Measurement

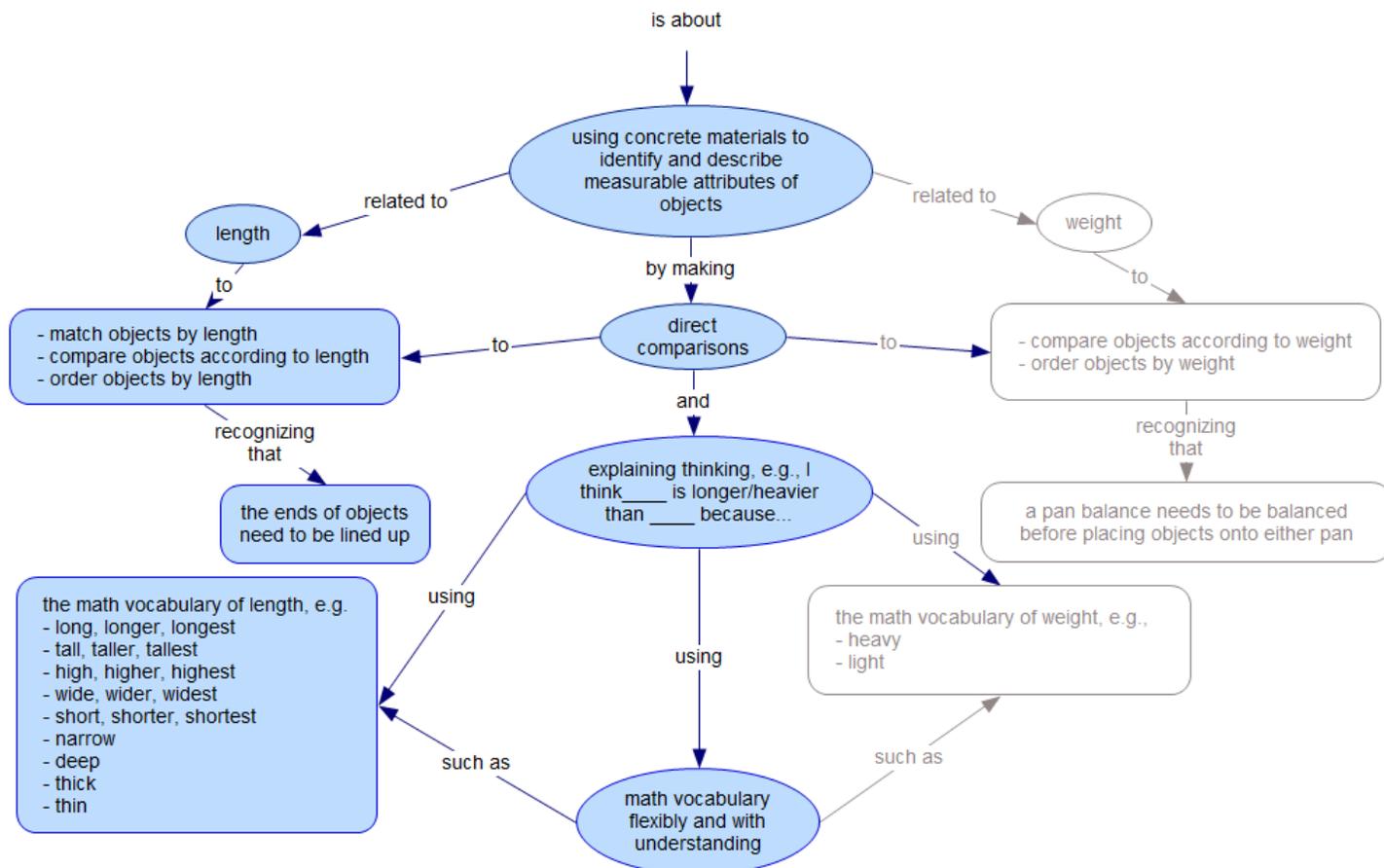
Overarching Question

What does it mean to compare and order objects?

Previous Unit:
Exploring Number

This Unit:
Exploring Measurement

Next Unit:
Data and Data Representation



Focus Questions

1. Why are objects measured?
2. What attributes of an object can be measured?
3. What are different ways objects can be measured?
4. How can I tell which of two objects is longer than the other
5. How can I tell which of two objects is heavier?

Intellectual Processes

Standards for Mathematical Practice

Students will have opportunities to:

- **construct viable arguments and critique the reasoning of others** by explaining how they know that one object is longer (shorter) or heavier (lighter) than the other;
- **model with mathematics** by using concrete objects to compare length or weight;
- **use appropriate tools strategically** to measure specific attributes; and
- **attend to precision** e.g., by lining up end points on objects whose length is being compared or ordered.

Key Concepts

attributes
compare
conservation of length

distance
length
measurable attributes

measure
order
sort
weight

Lesson Abstract:

Kindergarten children learn about linear measurement by making direct comparisons, comparing two objects based on the attribute of length/height. They will describe the relationship between these two objects using the vocabulary of comparison, e.g., longer, taller, higher, shorter, almost the same. They will make connections to their everyday life experiences, such as who is taller, whose shoe is shorter, which block is longer. They make connections to other areas of the curriculum, such as comparing body parts in a My Body unit or the height of plants during a Plants unit. They may order a set of objects by height by comparing two at a time.

In this lesson students will be comparing two strips of paper to determine the longer/shorter strip. The lesson allows the teacher to determine which students

- (1) understand the essential concept that, to compare objects by length, items need to be lined up side by side, the starting/end points evenly lined up.
- (2) have conservation of length, i.e. understand that moving an object relative to another object does not change its length, and
- (3) use the language of comparing length (longer than, shorter than, almost the same length).

Common Core Standards**Kindergarten, Measurement and Data****K.MD.A. Describe and compare measurable attributes.**

- K.MD.A.1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- K.MD.A.2. Directly compare two objects with a measurable attribute in common, to see which object has *more of/less of* the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.

Instructional Resources

- pairs of paper strips, *each pair a different length* by at least one inch, enough for every student to have one strip
 - Use one color for one of the pair, a second color for the other one.
 - Use the same two colors for all the pairs. This will make it easier for students to find a partner. For instance, all students with a brown strip will look for a partner with a red strip.
 - Make all strips the same width (about three inches).
 - Heavy paper will be easier for students to use; may be laminated for future use.

Sequence of Lesson Activities:

Lesson Title: Comparing Lengths

Advanced Preparation:

Students need **many experiences** comparing objects and developing the language of comparing length: long, longer; short, shorter; high, higher; wide, wider; tall, taller.

- To prepare for setting up measuring centers after this lesson, collect a variety of materials whose length can be directly compared (e.g., pencils, crayons, blocks, paper clips, straws, coffee stirrers, toothpicks, linking cubes).

Potential confusions:

- This lesson will provide information about students' understanding of how to compare the length of two items. Comparing the height of two students is cognitively easier than comparing the length of two strips of paper. When comparing the height of two people, the floor automatically provides the even starting point. When comparing lengths of two objects not grounded on the floor, students need to (know to) establish this even starting point to get an accurate measurement or comparison of length.
- Within the context *length*, there are many terms used somewhat interchangeably, sometimes depending on the context, e.g., height, width, thickness. For instance, we may talk about the height of a door, the width of a doorway, and the thickness of a door, all linear measures. It is not important to explain to children when each term is likely to be used, but it is important for students to hear all of them modeled in the context of a related task.
- Some students may say that one strip is *bigger* or *smaller* than the other. These are ambiguous terms that do not indicate that the speaker is talking about the attribute length. If a student provides this description, probe: *What do you mean by bigger/smaller? What other word can you use to describe these strips?, etc.*

Management Tips

- Students need to understand that the strips are math tools and not toys. Take time to model and teach students how to use the paper strips and their purpose (i.e., don't fold the strips).
- Once students find their partner, they need to go to a set location and sit down quietly with their partners.

Selecting and Setting Up a Mathematical Task	
<p>By the end of this lesson what do you want your students to understand, know, and be able to do?</p> <p>In what ways does the task build on students' previous knowledge?</p> <p>What questions would you ask to help students access their prior knowledge?</p>	<p>By the end of this lesson, students will be able to</p> <ul style="list-style-type: none"> determine whether two strips of paper are longer than, shorter than, or almost the same as, showing how they made the determination and describe – in a complete sentence -- the difference (e.g., <i>My strip is shorter than Mary's strip.</i>) <p>Students have had much experience in kindergarten sorting and classifying objects by various attributes. Some of these attributes are measurable (e.g., length, weight, etc.), others are not (e.g., color, shape, buttons with two holes/four holes). This lesson isolates one attribute, length, and sets up a task that gives students experience comparing the length of two objects.</p> <p>Have two students stand next to each other without moving. Ask students to compare the two students. Students are likely to bring up numerous attributes that are alike or different. When someone notes that one of the students is <i>taller/shorter</i> than the other, ask them how they know that. Ask if any students in the class are (almost) <i>the same height</i>. Check to see if any students have another idea, then move into the lesson. This is an opportunity to notice whether students use the terms “bigger” or “smaller” to compare height and to model the more specific mathematical language <i>taller, shorter</i> or <i>almost the same height</i>.</p>
Launch:	
<p>How will you introduce students to the activity so as to provide access to all students while maintaining the cognitive demands of the task?</p>	<p>Have students sit in a circle in the gathering area so that they can all see you. Say,</p> <ul style="list-style-type: none"> <i>We're going to play a game today called "Find Your Partner." You're going to need very sharp ears right now, because I'm going to tell you how to find your partner. You will need very sharp eyes, because you are going to look for a partner with a strip of paper the same length as yours. (Hold up one of the strips.) Finally, you're going to have to have very sharp brains, because I'm going to ask you to explain why you chose the partner you chose.</i> <p>Call up the same two students whose heights you compared in the last activity. Have the shorter student (Student A) stand on a chair (carefully) next to the other student (Student B) who remains standing on the floor. Say,</p> <ul style="list-style-type: none"> <i>Oh look. We thought Student B was taller than Student A, but we were wrong. Student A is really taller than Student B, right?</i> <p>Play devil's advocate as students try to explain to you why Student A is not really taller than Student B. Build on that to make the claim that both students have to be standing on the floor in order to compare their heights.</p> <p>Go on to demonstrate how to compare two lengths of paper. Model the task by taking two strips the same length and lining them up against a flat surface (e.g., a book) so that the end-points match.</p> <ul style="list-style-type: none"> <i>Are these strips the same length?</i>  <p>Now line up the same strips this way: </p> <ul style="list-style-type: none"> <i>Isn't the bottom strip longer than the top strip?</i> <p>Many kindergarteners are not likely to have established conservation of length yet. They may not understand if an object is moved, its length does not change. In other words, they may see the bottom strip as the same length in the first example, but the bottom strip as longer in the second example. If a student doesn't point this out, you can move the bottom strip back to show that the start-points have to be even in order to compare lengths. This is an important concept for this lesson, but it's not a concept that all students will master in one lesson. Many first graders still struggle with this concept.</p>

<p>What will be heard that indicates that the students understood what the task is asking them to do?</p>	<p>Now model with a student how they are going to find a partner with a strip of paper that is the same length.</p> <ul style="list-style-type: none"> <i>Your partner will have a strip that is a different color than your strip. If you have a red strip, you will be looking for a partner with a brown strip. If you have a brown strip, you will look for a partner with a red strip. Your partner will have a strip the same length as yours.</i> <p>Provide a demonstration of you having strips that are different lengths and a demonstration of having strips the same length, emphasizing lining up the start-point. Show where you and your partner will sit quietly when you have found each other, waiting for other students to find their partner.</p> <ul style="list-style-type: none"> <i>What questions do you have?</i> <i>What is the first thing you will do? (Get a strip of paper.)</i> <i>What will you do next? (Look for a partner with a strip of paper the same length as mine.)</i> <i>How will you know if it is the same length? (Both ends need to match/be even.)</i> <i>What will you do when you find your partner? (Sit quietly together and watch other students look for their partner)</i> <p>Students will find partners that meet the criteria defined by the task. Students will describe why their partner meets those criteria, using the language of comparison.</p>
---	--

Supporting Students' Exploration of the Task:

<p>What questions will be asked to focus students' thinking?</p>	<p>Task 1</p> <p>Distribute a strip of paper to each student. Make sure that there is a matching pair for each length you distribute. If there is an odd number of students in the room, plan on being a partner yourself.</p> <ul style="list-style-type: none"> <i>Each of you has a strip of paper. Someone else in this room has a strip of paper that is the same <u>length</u> as your strip. When I tell you to begin, you are to find a partner who has a strip the same <u>length</u> as your strip. You'll need to work slowly and carefully to make sure you are lining up the starting point evenly. Remember, your partner will have a strip that is a different color than your strip.</i> <i>How will you know if your strips of paper are the same length?</i> To the student who explains: <i>Show us what you mean.</i> <p>You may need to ask more than one student to answer if nobody has shown or talked about how one end of each strip needs to be even to an end of the other strip before they can begin to compare.</p> <p>Give your directions again; then ask two students to repeat them. When you are satisfied that they understand the task, tell them to begin looking for their matching partner.</p> <p>When all students have a partner, bring the class together for a discussion. Ask a student what he can say about his strip and that of his partner. How would he compare them? Have students turn and talk to their partner about how they knew that their strips were <i>(almost) the same length</i>. Call on several students: ask them to share what their partner said. Listen for them to say that both ends of their strips lined up evenly.</p> <p>As a closing question, ask</p> <ul style="list-style-type: none"> <i>So what do we know about the length of two objects if both ends of the objects line up evenly? (They are [almost] the same length.)</i>
--	---

<p>How will you extend the task to provide additional challenge?</p>	<p>Task 2 A follow-up task is to distribute Set A strips to half the class and Set B to the other half. Ask the students with Set A to find someone in the "Set B group" with a different length strip. Pull the class together for a discussion and have students turn and describe how the length of their strip <i>compares</i> with the length of their partner's strip, e.g., "My strip is shorter than ____'s strip." Ask partners to <i>show</i> how they know that one strip is longer/shorter than the other strip. This task will take less time, but there is more room for error, as students must establish a common starting-line, but will have different ending points.</p> <p>Task 3 A task that would fit into a center once students demonstrate they understand the concepts addressed in the first two tasks is to find objects in the room that are</p> <ul style="list-style-type: none"> • longer than my strip • shorter than my strip • almost the same length as my strip <p>In a center, they have</p> <ul style="list-style-type: none"> • strips of paper to choose for comparison • a recording sheet for recording their findings <p>Task 4 Have students draw a picture of their two objects and write a sentence that compares them, e.g., ____ is longer than _____. ____ is shorter than _____. ____ and ____ are almost the same length. Depending on the amount of scaffolding students need, you may choose to provide paper strips with similar "sentence starters" that they can glue under their picture or students may simply write about their picture using their own language, but incorporating "longer than," "shorter than," or "almost the same length."</p>
<p>Summary:</p>	
<p>What specific questions will be asked so that students make connections between the different strategies that are presented?</p> <p>What will be seen or heard that indicates all students understand the mathematical ideas you intended them to learn?</p>	<p>To bring closure to the lesson, ask questions like</p> <ul style="list-style-type: none"> • <i>When we compare the length of two objects, what do we need to do?</i> • <i>How can I tell if this ____ is longer than this ____?</i> • <i>What are some words we use to compare the length of two different objects?</i> • <i>Hold up two strips that are not the same length. What would you say if I said these are the same length? How could you show me and explain to me why I am wrong?</i> <p>Students will be able to</p> <ul style="list-style-type: none"> • determine whether two strips of paper are longer than, shorter than, or almost the same as, showing how they made the determination and • describe – in a complete sentence -- the difference (e.g., <i>My strip is shorter than Mary's strip.</i>)