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Ordering and Comparing Length Measurements as Numbers

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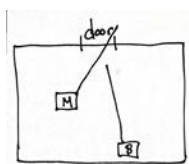
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Grade 1 • Module 3

Ordering and Comparing Length Measurements as Numbers

OVERVIEW

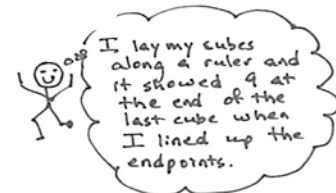
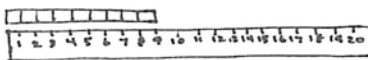
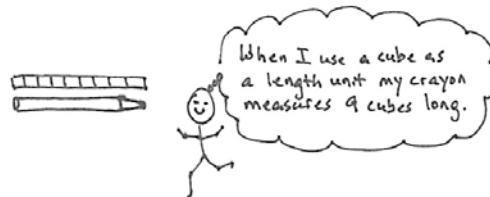
The module opens in Topic A by extending students’ kindergarten experiences with direct length comparison to indirect comparison whereby the length of one object is used to compare the lengths of two other objects (**1.MD.1**). “My string is longer than your book. Your book is longer than my pencil. That means my string is longer than my pencil!” In the topic’s third lesson, students use the same transitivity, or indirect comparison, to compare short distances within the classroom in order to see what the shortest path to their classroom door is, which is helpful to know for lining up and emergencies. Students place one endpoint of a length of string at their desks and see if it reaches the door. After using the same piece of string from two students’ desks, they make statements such as, “Maya’s path is shorter than the string. Bailey’s path is longer than the string. That means Bailey’s path to the door is longer than Maya’s path.”



Topic B takes *longer than* and *shorter than* to a new level of precision by introducing the idea of a *length unit*. Centimeter cubes are laid alongside

the length of an object as students learn that the total number of cubes laid end to end with no gaps or overlaps represents the length of that object (**1.MD.2**). The

progressions document expresses the research indicating the importance of teaching standard units to Grade 1 students *before* non-standard units. Thus, Grade 1 students learn about the centimeter before exploring non-standard units of measurement in this module. Simply lining the cubes up to the ruler allows students to see that they are using units which relate to a tool used around the world. One of the primary ways we recognize standard units is because they are ubiquitous, used on rulers at grandma’s house in the Bronx, in school, and in local shops. Students ask and answer the question, “Why would we use a standard unit to measure?” The topic closes with students measuring and comparing sets of three items using centimeter cubes. They return to the statements of Topic A but now with more sophisticated insights, for example, “The pencil measures 10 centimeters. The crayon measures 6 centimeters. The book measures 20 centimeters. These are ordered from shortest to longest: the crayon, the pencil, the book. The book is longer than the pencil, and the pencil is longer than the crayon, so the book is longer than the crayon” (**1.MD.1**).



Topic C explores the usefulness of measuring with similar units. Students measure the same objects from Topic B using two different non-standard units together, toothpicks and small paper clips, to measure one object and answer the question, “Why do we measure with same-sized length units?” (1.MD.2). They realize that using iterations of the *same* unit will yield consistent measurement results. Similarly, students explore what it means to use a different unit of measurement from their classmates. It becomes obvious to students that if we want to have discussions about the lengths of objects together, we *must* measure with the same units. Students answer the question, “If Bailey uses paper clips and Maya uses toothpicks, and they both measure things in our classroom, will they be able to compare their measurements?” With this new understanding of consistent measurement, Topic C closes with students solving *compare with difference unknown* problems. Students answer such questions as, “How much longer is the pencil than the marker?” using standard units (1.OA.1).

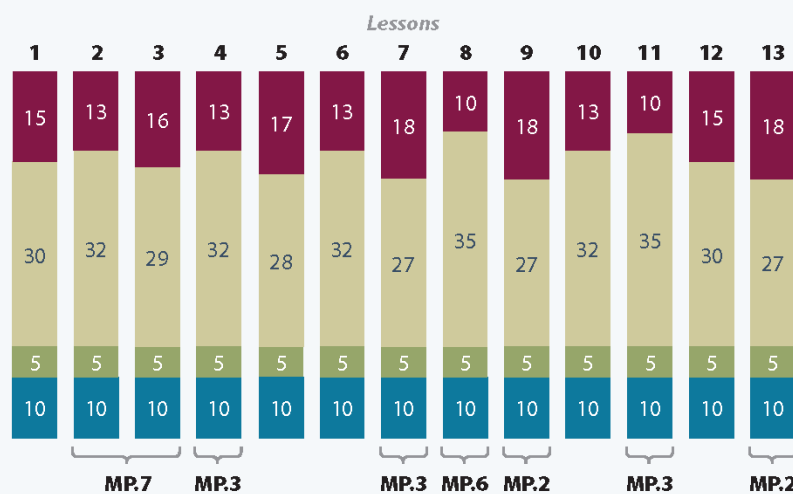
Topic D closes the module as students represent and interpret data (1.MD.4). They collect data about their classmates, and sort that information into three categories. Using same-sized pictures on squares, students represent this sorted data so that they can easily describe and compare the data. Students interpret information presented in the graphs by first determining the number of data points in a given category (e.g., “How many students like carrots the best?”), and then combining categories (e.g., “How many total students like carrots or broccoli the best?”). The module closes with students asking and answering varied questions about data sets, for example, “How many students were polled in all?” (*put together with result unknown*) and, “How many more students preferred broccoli to string beans?” (*compare with difference unknown*) (1.OA.1). The work with units representing data points are an application of their earlier work with length as they observe that each square can be lightly interpreted as a length unit, which helps them analyze the data.



Distribution of Instructional Minutes

This diagram represents a suggested distribution of instructional minutes based on the emphasis of particular lesson components in different lessons throughout the module.

- Fluency Practice
- Concept Development
- Application Problems
- Student Debrief



MP = Mathematical Practice

Focus Grade Level Standards

Represent and solve problems involving addition and subtraction.¹

- 1.OA.1** Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem. (See Glossary, Table 1.)

Measure lengths indirectly and by iterating length units.

- 1.MD.1** Order three objects by length; compare the lengths of two objects indirectly by using a third object.
- 1.MD.2** Express the length 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. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.*

Represent and interpret data.

- 1.MD.4** Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Foundational Standards

- K.CC.5** Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.
- K.CC.6** Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies. (Include groups with up to ten objects.)
- K.CC.7** Compare two numbers between 1 and 10 presented as written numerals.
- K.MD.1** Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- K.MD.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.*

¹ The balance of this cluster is addressed in Module 2.

Focus Standards for Mathematical Practice

- MP.2 Reason quantitatively and abstractly.** Students describe and compare lengths using *longer than* and *shorter than*, and numerically represent relationships among and between lengths. This takes place within the context of comparing sets within data collection as well as comparing objects with different length units. For example, students compare the number of peers who enjoy one hobby with the number of peers who enjoy a different hobby. Students also compare the length of one object, in centimeter cubes, with the length of a second object, in centimeter cubes.
- MP.3 Construct viable arguments and critique the reasoning of others.** Students describe and explain their process of finding accurate length measurements and challenge each other to measure precisely.
- MP.6 Attend to precision.** Students use measuring tools such as centimeter cubes precisely and explain precisely the cause of errors in using the tools.
- MP.7 Look for and make use of structure.** Students use transitivity, indirect comparison, to compare multiple objects. "My string is longer than the pencil. My string is shorter than the book. That means my book is longer than my pencil." In this case, the students use the string as the structure to compare the book and the pencil.

Overview of Module Topics and Lesson Objectives

| Standards | Topics and Objectives | Days |
|------------------|---|------|
| 1.MD.1 | <p>A Indirect Comparison in Length Measurement</p> <p>Lesson 1: Compare length directly and consider importance of aligning endpoints.</p> <p>Lesson 2: Compare length using indirect comparison by finding objects <i>longer than</i>, <i>shorter than</i>, and <i>equal in length to</i> that of a string.</p> <p>Lesson 3: Order three lengths using indirect comparison.</p> | 3 |
| 1.MD.1 1.MD.2 | <p>B Standard Length Units</p> <p>Lesson 4: Express the length of an object using centimeter cubes as length units to measure with no gaps or overlaps.</p> <p>Lesson 5: Rename and measure with centimeter cubes, using their standard unit name of centimeters.</p> <p>Lesson 6: Order, measure, and compare the length of objects before and after measuring with centimeter cubes, solving <i>compare with difference unknown</i> word problems.</p> | 3 |



| Standards | Topics and Objectives | Days |
|---|---|-----------|
| 1.OA.1 1.MD.2 | <p>C Non-Standard and Standard Length Units</p> <p>Lesson 7: Measure the same objects from Topic B with different non-standard units simultaneously to see the need to measure with a consistent unit.</p> <p>Lesson 8: Understand the need to use the same units when comparing measurements with others.</p> <p>Lesson 9: Answer <i>compare with difference unknown</i> problems about lengths of two different objects measured in centimeters.</p> | 3 |
| 1.OA.1 1.MD.2 1.MD.4 | <p>D Data Interpretation</p> <p>Lessons 10–11: Collect, sort, and organize data, then ask and answer questions about the number of data points.</p> <p>Lessons 12–13: Ask and answer varied word problem types about a data set with three categories.</p> | 4 |
| | End-of-Module Assessment: Topics A–D (assessment ½ day, return ½ day, remediation or further applications 1 day) | 2 |
| Total Number of Instructional Days | | 15 |

Terminology

New or Recently Introduced Terms

- Centimeter (standard length unit within the metric system)
- Centimeter cube (pictured right)
- Length unit (measuring the length of an object with equal-sized units)



Familiar Terms and Symbols²

- Less than
- Longer than
- More than
- Shorter than

² These are terms and symbols students have seen previously.

Suggested Tools and Representations

- Centimeter cubes
- Centimeter rulers (simply for the purpose of naming the centimeter)
- String lengths of about 25 centimeters

Scaffolds³

The scaffolds integrated into *A Story of Units* give alternatives for how students access information as well as express and demonstrate their learning. Strategically placed margin notes are provided within each lesson elaborating on the use of specific scaffolds at applicable times. They address many needs presented by English language learners, students with disabilities, students performing above grade level, and students performing below grade level. Many of the suggestions are applicable to more than one population. The charts included in Module 1 provide a general overview of the lesson-aligned scaffolds, organized by Universal Design for Learning (UDL) principles. To read more about the approach to differentiated instruction in *A Story of Units*, please refer to “How to Implement *A Story of Units*.”

Assessment Summary

| Type | Administered | Format | Standards Addressed |
|-------------------------------|---------------|----------------------------------|--------------------------------------|
| End-of-Module Assessment Task | After Topic D | Constructed response with rubric | 1.OA.1 1.MD.1 1.MD.2 1.MD.4 |

³ Students with disabilities may require Braille, large print, audio, or special digital files. Please visit the website, www.p12.nysed.gov/specialed/aim, for specific information on how to obtain student materials that satisfy the National Instructional Materials Accessibility Standard (NIMAS) format.