

BIG IDEA: In this chapter, students are building understanding of the surface area and volume of solid figures.

1. Students greatly benefit from exploring models of mathematical concepts, including concepts in geometry. Models for rectangular prisms are common, including cereal boxes, shoe boxes, and most other cardboard box packages.
 - a. Making cuts in a cereal box, but keeping the cardboard in one piece results in a net (as shown on the right).
 - b. The six rectangles that are the faces of the prism can be viewed in such a net.
 - c. When students make a net, they can see that the surface area is the sum of the areas of all the two-dimensional figures that are the faces of the solid figure.
2. Volume is the amount of space an object occupies. Volume is related to the area of the base of a prism. The following ideas help students to build the concepts needed for a solid foundation in geometry understanding.
 - a. Students should have opportunities to observe how volume of a prism changes as the height varies.
 - b. Similarly, students should study how volume changes when the area of the base varies, but the height remains constant.
 - c. This concept can be modeled with cubes. For example, begin with two cubes to represent a prism with a volume of 2 cubic units. Place two more cubes on top of the original two to observe how the volume changes to 4 cubic units. Continue to add cubes to see how the volume is affected.



Adapted from Go Math: Teaching for Depth, pg. 433E.

HMH Professional Development Videos:

[Volume of Rectangular Prisms](#)

Quarter 4 Fluency Resources:

- [Fluency Resources in Go Math](#)
- [Building Fluency Through Word Problems](#)
- [Building Fluency Through Number Talks](#)

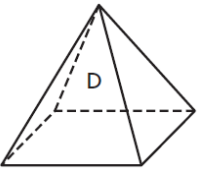
ESSENTIAL QUESTION: How can you use measurements to describe three-dimensional figures?

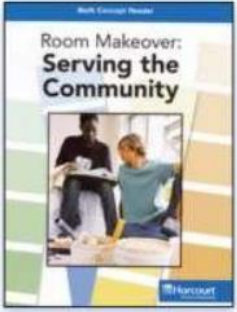
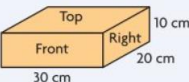
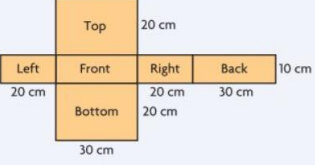
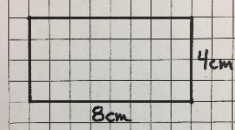
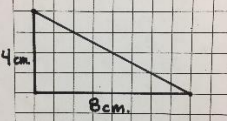
STANDARDS: 6.G.1, 6.G.2, 6.G.4, 6.EE.2c

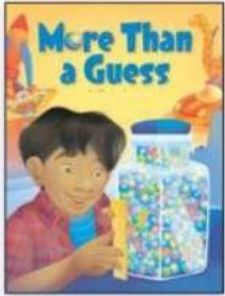
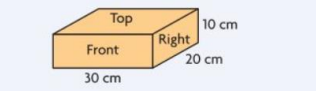
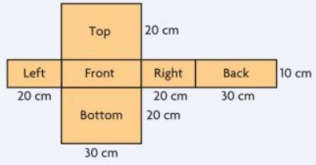
ELD STANDARDS:

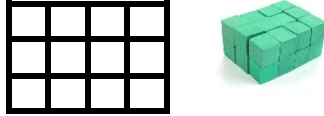
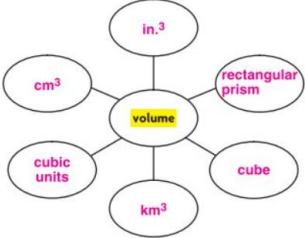
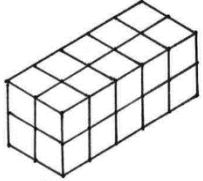
- ELD.PI.6.1-Exchanging information/ideas via oral communication and conversations.
- ELD.PI.6.3-Offering opinions and negotiating with/persuading others.
- ELD.PI.6.5-Listening actively and asking/answering questions about what was heard.

- ELD.PI.6.9- Expressing information and ideas in oral presentations.
- ELD.PI.6.11- Supporting opinions or justifying arguments and evaluating others' opinions or arguments.
- ELD.PI.6.12-Selecting and applying varied and precise vocabulary.

Lesson	Standards & Math Practices	Essential Question	Math Content and Strategies	Models/Tools Go Math! Teacher Resources G6	Connections (ENGAGE prior knowledge)	Vocabulary	Academic Language Support	Journal
11.1	Three-Dimensional Figures and Nets 6.G.4 Companion Pg. 159 MP 1 MP 6	How do you use nets to represent three-dimensional figures?	Explain to students how prisms and pyramids are alike and how they are different: <ul style="list-style-type: none"> • All surfaces of prisms and pyramids are polygons. • Prisms have two congruent parallel bases. • Pyramids have only one base. 	3-D Solids Poster Printable Nets	Draw a rectangle on the board and hold up a rectangular object (tissue box, cereal box, etc.). Ask the students: "How are these two figures different?" -the rectangle is flat, and the tissue box has depth. "How are these two figures similar?"	Solid figure, net	ELD Standards <ul style="list-style-type: none"> • ELD Standards • ELA/ELD Framework • ELPD Framework • ELL Math Instruction Framework • Integrating the ELD Standards into Math 	Identify and draw a net for this solid figure. 

				<ul style="list-style-type: none"> Lateral faces of prisms are rectangles, and lateral faces of pyramids are triangles. <p>Show actual models of these solid figures and have students identify them and all their surfaces.</p>		-the tissue box has faces that are rectangles.		<p>Access Strategies</p> <ul style="list-style-type: none"> Organizing Learning for Student Access to Challenging Content Student Engagement Strategies Problem Solving Steps and Approaches <p>Equitable Talk</p> <ul style="list-style-type: none"> Accountable Talk Simply Stated Equitable Talk Conversation Prompts Accountable Talk Posters Five Talk Moves Bookmark Effective Math Talks <p>Cooperative Learning</p> <ul style="list-style-type: none"> Cooperative Learning Role Cards Collaborative Learning Table Mats Seating Chart Suggestions 	
11.2	Investigate – Explore Surface Area Using Nets	<p>6.G.4 Companion Pg. 159</p> <p>MP 1 MP 2 MP 3 MP 4</p>	What is the relationship between a net and the surface area of a prism?	<p>As students study geometry, it is important for them to move from the concrete to the abstract in their reasoning. These two lessons (11.2 & 11.3), when taken together, allow students to apply the patterns they identify during concrete explorations and use them to represent surface area symbolically. Ask questions such as these:</p> <ul style="list-style-type: none"> What do the grid squares on your net represent? What does the total number of grid squares represent? 	<p>3-D Solids Poster Printable Nets Grid Paper-4 per in Grid Paper-5 per in Surface Area Exploration Template Surface Area Exploration</p>	<p>Use the same rectangular object as you did in 11.1. and ask the following questions:</p> <ol style="list-style-type: none"> How many faces does the rectangular prism have? How would you find the area of one face of the figure? <p>Additional Option: Have students build the following rectangular solids, fill out the net template and figure out the surface area. Surface Area Exploration</p>	Surface area, net	<p>Math Word Wall - Grades 3-6</p> <p>Literature</p>  <p><i>Room Makeover: Serving the Community</i> From the <i>Grab-and-Go Differentiated Centers Kit</i> – Students read about using area to find the amount of paint and tile needed for a room.</p>	A tissue box has a length of 4 inches, a width of 4 inches, and a height of 5 inches. Draw a net of the tissue box and find its surface area.
11.3	Algebra – Surface Area of Prisms	<p>6.G.4, 6.EE.2c Companion Pg. 159, 87</p> <p>MP 2 MP 4 MP 8</p>	How can you find the surface area of a prism?	<p>Use a rectangular solid object, such as a tissue box (or cereal box) or one of the nets (linked in the tools section), and have the students help you label the faces. You can have the students draw each piece, one at a time. Then take the object apart and lay it flat as shown.</p>  <p>Figure 1</p>  <p>Figure 2</p>	<p>3-D Solids Poster Printable Nets Grid Paper-4 per in Grid Paper-5 per in Surface Area Exploration Template</p>	<p>Use the same rectangular object you did in 11.1 and ask the following questions:</p> <ol style="list-style-type: none"> How could we find the surface area of this rectangular prism? <p>*Lead the students to create a net by cutting up the box and unfolding it so they can see the net.</p> <p>Additional Option: Review finding area of triangles by using these shapes on grid paper. Ask the students to find the area of each shape and justify their answers.</p>  	Surface area, prism, net	<p>A rectangular prism is 6 feet long, 3 feet wide, and 2 feet high. What is the surface area of the prism?</p>	

11.4	Algebra – Surface Area of Pyramids	6.G.4 , 6.EE.2c Companion Pg. 159, 87 MP 4 MP 5 MP 6	How can you find the surface area of a pyramid?	Students may ask how they can tell when to find the surface area of a figure and when to find the lateral area of a figure. Encourage students to draw nets for the solids in each problem and shade all the faces whose area they need to find. If they shade all the faces, they are finding surface area, but if they shade all the faces except the base(s), they are finding lateral area. Give students several real world examples and guide them to understand when surface area is being asked for and when lateral area is being asked for.	3-D Solids Poster Printable Nets Grid Paper-4 per in Grid Paper-5 per in	Have students tell you what they know about pyramids. Show the pictures below and ask the students: How are the bases of pyramids different from the bases of prisms? -Prisms have two bases while pyramids only have one base.	Surface area, pyramid, net, lateral area, lateral faces	Literature  <i>More Than a Guess</i> From the <i>Grab-and-Go Differentiated Centers Kit</i> –	The Luxor Hotel in Las Vegas is a square pyramid. One of the side lengths of its base is 400 feet and the height of the pyramid is 350 feet. Draw a net and find the surface area of the hotel.
11.5	Investigate – Fractions and Volume	6.G.2 Companion Pg. 157 MP 5 MP 6 MP 7 MP 8	What is the relationship between the volume and the edge lengths of a prism with fractional edge lengths?	Understanding how to find volume when dimensions include fractions enhances students’ ability to reason quantitatively. Provide the following scenario: <ul style="list-style-type: none"> You are packing small gift boxes to ship to family members overseas. You need to know how many of gift boxes will fit in each large shipping box so you can determine how many large shipping boxes to buy. Point out that in order to solve problems such as these, students need to be able to find volume when dimensions include fractions. HMH PD Video: Volume of Rectangular Prisms	3-D Solids Poster Printable Nets Grid Paper-4 per in Grid Paper-5 per in	Use the same rectangular object you did from 11.1 and ask the students the following question: “How could you find the area of the bottom of this prism?” *Might also be helpful to measure the object and figure it out. The object will most likely include fractional lengths, so this will be a good activity to prepare them for the lesson. Additional option: Have the students build a 4 x 3 x 2 rectangular prism using Base 10 unit cubes, like the picture below. Then ask the students the following questions: <ol style="list-style-type: none"> What is the surface area of the figure? What is the volume of the figure? 	Volume, prism, edge lengths	Students read about finding the volume of a jar to guess how many marbles are filling the jar. Math Models: <i>About the Math</i> , pg. 443A  Figure 1  Figure 2	How many cubes with a side length of $\frac{1}{4}$ unit would it take to make a unit cube? Explain how you determined your answer.
11.6	Algebra – Volume of Rectangular Prisms	6.G.2 , 6.EE.2c Companion Pg. 157, 87 MP 2 MP 5	How can you find the volume of rectangular prisms with fractional edge lengths?	Having previously learned about capacity, students might ask about the difference between volume and capacity. Explain that volume usually refers to the amount of space an object occupies, while capacity usually	3-D Solids Poster Printable Nets	Ask the students: “What can you tell me about volume?” “What does volume measure?” “What is the difference between area and volume?” You can use the pictures below to help with the students’ understanding.	Volume, rectangular prism, edge lengths	Vocabulary Builder: <i>Bubble Map</i> – Use a bubble map to review terms associated with volume. Have students draw a bubble map with the word <i>volume</i> in the center. In the surrounding bubbles, include units used in measures of volume as well as figures that have volume.	A shoebox has a length of 13 inches, a width of $9\frac{1}{2}$, and a height $5\frac{1}{2}$. What is the volume of the shoebox?

		MP 6		refers to the amount of a substance a container can hold. HMH PD Video: Volume of Rectangular Prisms					
11.7	Problem Solving – Geometric Measurements	6.G.4 Companion Pg. 159 MP 1 MP 2	How can you use the strategy <i>use a formula</i> to solve problems involving area, surface area, and volume?	Students will be able to use the problem solving skills they learn in this lesson in many real-life applications. Some application and associated supplies are listed below. <ul style="list-style-type: none"> Decorating – paint (area or surface area), carpet or tile (area) Crafts – fabric for sewing (area), gift wrapping (surface area) Landscaping – grass seed (area), mulch (volume) Building – roofing and siding (surface area), concrete (volume) 	3-D Solids Poster Printable Nets	How do you find the volume and surface area of a rectangular prism?  Can you find the volume and surface area of this figure?	Area, surface area, volume, formula, prism, net		A cardboard box has a length of $6\frac{1}{2}$ inches, a width of 5 inches, and a height of $2\frac{1}{2}$ inches. How much wrapping paper is needed to exactly cover the box? *Option: Ask students to also find the volume of the box.

Assessments:

[Go Math Chapter 11 Test](#)

Go Math Chapter 11 Performance Task - [Terry's Workshop](#)

**Common Assignment - Critical Area 4 (*Geometry*) Performance Assessment: [A Home for Amigo](#)

[SBAC Question Index](#)

BIG IDEA: In this chapter, students learn how to organize data into diagrams, charts, and tables and determine appropriate ways of measuring the “average,” or center. Some key ideas to remember when teaching this chapter:

1. Students need to understand that the mean, median, and mode are all “averages” that describe a data set as a whole.
 - a. Approaching the mean, median, and mode not as things to be computed, but as tools that can be used to answer meaningful questions is a strategy to develop deeper understanding of the concepts and help students determine which is the most representative of the average.
 - b. Students need to find the mean, median, and mode of various data sets and compare the utility of the different measures of center. They should ask themselves “which measure of center best represents the data?”
2. Students need to see the mean as an entity itself and a point of balance representative of a data set, instead of just something that is done procedurally to numbers.
 - a. Students should work backward from a mean to possibilities for a data set that could have that mean.
 - b. Students should compare the means of two or more data sets to answer questions.
 - c. Students need to see that very different data sets can have the same mean.
3. Students also need to examine how outliers can affect the data.
 - a. By examining different data sets and how an outlier can affect the three measures of center, students can develop an understanding that an outlier usually does not affect the median or mode, but can have a big effect on the mean.
 - b. Working with data provides an opportunity for students to appropriately use technology, such as a calculator or a spreadsheet, to create tables, compute values, and see how changes in the data affect the values.

Adapted from Go Math: Teaching for Depth, pg. 471E.

HMH Professional Development Videos:

[Measures of Center](#)

ESSENTIAL QUESTION: How can you display data and analyze measures of center?

STANDARDS: 6.SP.1, 6.SP.4, 6.SP.5a, 6.SP.5b, 6.SP.5c, 6.SP.5d

ELD STANDARDS:

ELD.PI.6.1- Exchanging information/ideas via oral communication and conversations.

ELD.PI.6.3- Offering opinions and negotiating with/persuading others.


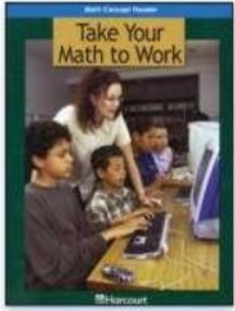

ELD.PI.6.5- Listening actively and asking/answering questions about what was heard.


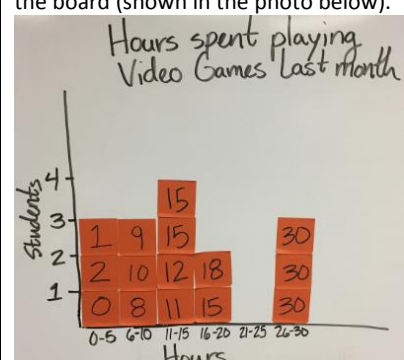
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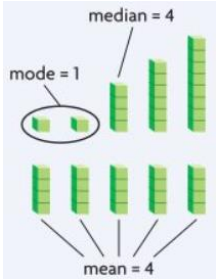
ELD.PI.6.11- Supporting opinions or justifying arguments and evaluating others’ opinions or arguments.

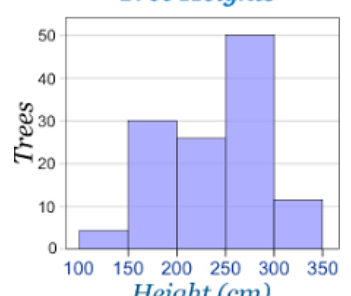
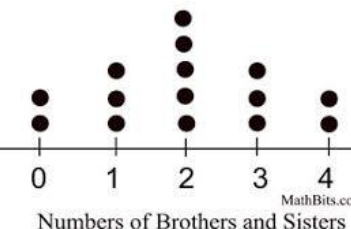
ELD.PI.6.12-Selecting and applying varied and precise vocabulary.

Lesson		Standards & Math Practices	Essential Question	Math Content and Strategies	Models/Tools Go Math! Teacher Resources G6	Connections (ENGAGE prior knowledge)	Vocabulary	Academic Language Support	Journal
12.1	Recognize Statistical Questions	6.SP.1 Companion Pg. 202 MP 1	How do you identify a statistical question?	The key factor in identifying a statistical question is determining whether or not the data can vary. While the question, “How old are the students in the library?” is a statistical question, the question “How old are you?” is not. Though both questions gather information about age, one	Statistical Question Graphic Organizer *This can be used as a graphic organizer (or a poster) for	Display this chart from pg. 485.	Data, statistical question		Write two statistical questions that you could use to gather data about your family. Explain why the questions are statistical.

				anticipates variability in peoples ages. The age of one person at one point in time is static.	students to create examples and non-examples of statistical questions.	 <p>Ask the students: What is the title of the graph? What question is being answered? Can you use the graph to make a prediction?</p>		<p>Literature</p>  <p><i>Take Your Math to Work</i> From the <i>Grab-and-Go Differentiated Centers Kit</i> – Students read about choosing the best graph to represent data and using graphs to analyze data.</p>																																								
12.2	Describe Data Collection	6.SP.5a 6.SP.5b Companion Pg. 210 MP 3 MP 5 MP 6	How can you describe how a data set was collected?	Teachers need to explain that the attributes and number of observations in a data set are often in the labels of the tables and graphs in which the data set is displayed.	Attributes and Measurements Graphic Organizer *This can be used as a graphic organizer (or a poster) for students to create a bank of attributes and units of measurement. Ex: <i>Length, ruler, inches or temperature, thermometer, degrees</i>	Show your students the chart from pg. 479. <table border="1" data-bbox="1365 581 1741 836"> <thead> <tr> <th colspan="4">100-Meter Run Data</th> </tr> <tr> <th>Race</th> <th>Time (sec)</th> <th>Race</th> <th>Time (sec)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>12.8</td> <td>5</td> <td>13.5</td> </tr> <tr> <td>2</td> <td>12.5</td> <td>6</td> <td>13.7</td> </tr> <tr> <td>3</td> <td>12.9</td> <td>7</td> <td>12.6</td> </tr> <tr> <td>4</td> <td>13.4</td> <td></td> <td></td> </tr> </tbody> </table> <p>Ask the students these questions: What can you tell me about this chart? What specific pieces of information can you tell me from this chart?</p>	100-Meter Run Data				Race	Time (sec)	Race	Time (sec)	1	12.8	5	13.5	2	12.5	6	13.7	3	12.9	7	12.6	4	13.4			Data, statistical question	<p>Literature</p> <p><i>The Latest in Recycling</i></p>  <p>From the <i>Grab-and-Go Differentiated Centers Kit</i> – Students read about choosing the best graph to represent data and using graphs to analyze data.</p>	Display this table of data from Reteach pg. R90: <table border="1" data-bbox="2370 609 2612 695"> <thead> <tr> <th colspan="5">Pet Weights (lb)</th> </tr> </thead> <tbody> <tr> <td>5.2</td> <td>8</td> <td>9.5</td> <td>48.4</td> <td>0.9</td> </tr> <tr> <td>4.7</td> <td>10.5</td> <td>32</td> <td>18</td> <td>12</td> </tr> </tbody> </table> <p>Ask the students to find the:</p> <ol style="list-style-type: none"> 1. Attribute 2. Unit of Measure 3. Likely Means of Measurement 4. Number of Observations 	Pet Weights (lb)					5.2	8	9.5	48.4	0.9	4.7	10.5	32	18	12
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12.3	Dot Plots and Frequency Tables	6.SP.4 Companion Pg. 208 MP 4 MP 5 MP 6	How can you use frequency tables and dot plots to display data?	Dot plots, frequency tables, and relative frequency tables help students organize data in meaningful ways. This helps them to apply critical-thinking skills to interpret the data, draw conclusions, and make predictions. These representations of data also lay the groundwork for future concepts, such as box plots and histograms.	Dot Plot Mat Grid Paper-4 per in Grid Paper-5 per in	In previous years, students have been exposed to bar graphs. Ask the students: What is a bar graph? What does it look like? *Show the students the bar graph below and ask the following questions.	Dot plot, frequency, frequency table, relative frequency table	<p>From the <i>Grab-and-Go Differentiated Centers Kit</i> – Students read this book and learn about the importance of recycling and the percent of garbage that is recycled.</p> <p>Model and Discuss: <i>About the Math</i>, pg. 495A</p>	Display this table of data from Reteach pg. R91: <table border="1" data-bbox="2370 1136 2612 1263"> <thead> <tr> <th colspan="4">Produce Sold (pounds)</th> </tr> </thead> <tbody> <tr> <td>15</td> <td>19</td> <td>15</td> <td>16</td> </tr> <tr> <td>20</td> <td>16</td> <td>17</td> <td>20</td> </tr> <tr> <td>11</td> <td>12</td> <td>15</td> <td>20</td> </tr> <tr> <td>15</td> <td>13</td> <td>11</td> <td>15</td> </tr> </tbody> </table> <p>Ask the students to create a dot plot for the data in the table.</p>	Produce Sold (pounds)				15	19	15	16	20	16	17	20	11	12	15	20	15	13	11	15																			
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					 <p>What are some of the features of a bar graph? What does the height of the bar tell you?</p>																													
12.4	Histograms	6.SP.4 Companion Pg. 208 MP 4 MP 6	How can you use histograms to display data?	<p>The standard calls out for students needing to be able to display data on a histogram. Some things to make sure the students are doing properly might be:</p> <ul style="list-style-type: none"> Clearly label graph headings and axes Select appropriate and equal intervals for the data Select and apply appropriate scale for the frequency of the data Accurately determine and draw the height of each bar Explain how the histogram displays the data appropriately 	Grid Paper-4 per in Grid Paper-5 per in	<p>It may be helpful to create a histogram using real data from the students. Here are some questions that might allow you to gather data that can be displayed in a histogram.</p> <ol style="list-style-type: none"> How many hours have you spent playing video games the last month? How many bags of chips have you eaten in the last month? How many books have you read this year? (or use lifetime instead) <p>It may be a good idea to use post-its to have your students write their responses. This makes it easy to collect and organize the data. It might also be a good idea to put the post-its on the whiteboard and stack them on top of each other to create a live histogram on the board (shown in the photo below).</p> 	histogram	<p>Vocabulary Strategies: <i>Describe Data-</i> Have students look through newspapers to identify data sets. Ask students to describe what statistical question might have been asked to gather the data, and have them explain why the question is a statistical question.</p> <p><i>Vocabulary Poster-</i> Have students make a poster containing the definition and examples of a histogram. Have them write the definition and draw an example with the parts of the graph labeled: title, axes, intervals, and frequency. Have students look through newspapers and magazines or use the internet to find example of histograms to include in their posters.</p> <p><i>Vocabulary Book-</i> Have students make a book containing the definition and examples of the term "outlier." Have students title their book and write the definition of outlier on the first page. Then, have student look through newspapers and magazines or use the internet to find examples of outliers in data sets. They should document the data set in their book, identify the outlier, and explain why the</p>	<p>Display this table of data from Reteach pg. R92:</p> <table border="1" data-bbox="2365 584 2607 714"> <thead> <tr> <th colspan="5">Number of Hours of TV Watching per Week</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>14</td> <td>24</td> <td>17</td> <td>10</td> </tr> <tr> <td>21</td> <td>21</td> <td>15</td> <td>20</td> <td>23</td> </tr> <tr> <td>5</td> <td>22</td> <td>19</td> <td>18</td> <td>8</td> </tr> <tr> <td>24</td> <td>19</td> <td>20</td> <td>22</td> <td>24</td> </tr> </tbody> </table> <p>Ask the students to create a histogram to show the data in the table.</p>	Number of Hours of TV Watching per Week					4	14	24	17	10	21	21	15	20	23	5	22	19	18	8	24	19	20	22	24
Number of Hours of TV Watching per Week																																		
4	14	24	17	10																														
21	21	15	20	23																														
5	22	19	18	8																														
24	19	20	22	24																														

12.5	Investigate – Mean as Fair Share and Balance Point	6.SP.5c Companion Pg. 210 MP 1 MP 2 MP 8	How does the mean represent a fair share and a balance point?	<p>This lessons allows students to explore with finding the mean using counters. Modeling the process of finding the mean helps students develop an understanding of the concept. Linking the model with the algorithm allows students to gain understanding of the concept instead of just memorizing a procedure.</p> <p>HMH PD Video: Measures of Center</p>	Counters Base-10 cubes Grid Paper-4 per in Grid Paper-5 per in	<p>Write the question on the board:</p> <p>At an orchard, 3 friends pick a total of 120 apples. How many apples should each friend get if they decide to divide the apples evenly? Why do you think this is called a fair share?</p>	Mean, balance point	particular data point is an outlier. Examples could come from temperature ranges, rain or snowfall amount, or retail sales for a particular product.	A student has 3 baskets of strawberries and wants to give the baskets to his friends. The first basket has 8 strawberries, the second basket has 5, and the third basket has 11. Use counters to find the fair share of strawberries in each basket.															
12.6	Measures of Center	6.SP.5c Companion Pg. 210 MP 3 MP 6 MP 7	How can you describe a set of data using mean, median, and mode?	<p>Cubes, counters, or graph paper can be used to help students understand the mean, median, and mode. In the example below, students use cubes to demonstrate their understanding of all three measures of center.</p>  <p>HMH PD Video: Measures of Center</p>	Counters Grid Paper-4 per in Grid Paper-5 per in	<p>Students need to be able to order their data from least to greatest. It might be a good idea to review some of these ideas:</p> <p>Which is greater, 4.7 or 5.8? Explain your reasoning.</p> <p>Which is greater, 8.4 or 3.99? Explain your reasoning.</p> <p>Put in order from least to greatest: 6.2, 4.3, 8.21, 9.8, and 3</p>	Measure of center, mean, median, mode	<p>Display this table of data from Reteach pg. R95:</p> <table border="1" data-bbox="2370 539 2612 630"> <thead> <tr> <th colspan="5">Scores on 20-question Quiz</th> </tr> </thead> <tbody> <tr> <td>15</td> <td>16</td> <td>17</td> <td>13</td> <td>18</td> </tr> <tr> <td>12</td> <td>5</td> <td>14</td> <td>14</td> <td>16</td> </tr> </tbody> </table> <p>Ask students to find the mean, median, and mode for the data set.</p>	Scores on 20-question Quiz					15	16	17	13	18	12	5	14	14	16	
Scores on 20-question Quiz																								
15	16	17	13	18																				
12	5	14	14	16																				
12.7	Effects of Outliers	6.SP.5d Companion Pg. 210 MP 2 MP 3 MP 4 MP 6	How does an outlier affect measures of center?	<p>Students need to understand how an outlier will affect the measures of center. Make sure the students can understand that the outlier is likely to affect the mean more than any other measure of center.</p> <p>HMH PD Video: Measures of Center</p>	Counters Grid Paper-4 per in Grid Paper-5 per in	<p>Put this data up on the board-</p> <p>Seven students were asked the number of siblings they have. This was the data collected: 1, 1, 1, 2, 2, 3, 4 Find the different measures of center.</p> <p>After having the students find the mean, median and mode, ask them: What if we asked an 8th student who had 18 siblings? Now find the mean, median, and mode.</p>	Outlier	<p>Display this table of data from Reteach pg. R95:</p> <table border="1" data-bbox="2370 1133 2612 1198"> <thead> <tr> <th colspan="5">Scores on a Quiz</th> </tr> </thead> <tbody> <tr> <td>15</td> <td>16</td> <td>17</td> <td>13</td> <td>18</td> </tr> <tr> <td>12</td> <td>5</td> <td>14</td> <td>14</td> <td>16</td> </tr> </tbody> </table> <p>Mean: 14 Median: 14.5</p> <p>Ask students the following: 1. Find the outlier. How does this affect the mean?</p>	Scores on a Quiz					15	16	17	13	18	12	5	14	14	16	
Scores on a Quiz																								
15	16	17	13	18																				
12	5	14	14	16																				

									2. If the 11 th score was 25, how would that affect the mean?
12.8	Problem Solving – Data Displays	6.SP.4 Companion Pg. 208 MP 1 MP 4 MP 5	How can you use the strategy <i>draw a diagram</i> to solve problems involving data?	This lesson requires students to use data from lists and tables to create dot plots and histograms. They then use their displays to answer statistical questions. Students expand on their problem solving skills by incorporating diagrams in to their solution and using them to analyze data and support their findings. <ul style="list-style-type: none"> • Can the same data be displayed in a histogram and a dot plot? <i>Yes, the same data can be displayed in both.</i> • What information can you get from a dot plot that you cannot get from a histogram? <i>A dot plot includes all of the actual data values, but a histogram only tells you how many values fall into given intervals.</i> 	Counters Grid Paper-4 per in Grid Paper-5 per in	Compare and contrast a dot plot and a histogram. Have the students describe the important features of each as you show the two examples below. <p style="text-align: center;"><i>Tree Heights</i></p>   <p style="text-align: center;">MathBits.com</p> <p style="text-align: center;">Numbers of Brothers and Sisters</p> <p>Have the students brainstorm some reasons you may want to use a dot plot over a histogram and vice versa.</p>	Diagram, frequency table, histogram, dot plot		The following data shows the number of field goals that were made in each of the 10 football games last Sunday: 2, 3, 2, 5, 6, 2, 2, 3, 4, 3 Make a data display and use it to show which number is the mode.

Assessment:

[Go Math Chapter 12 Test](#)

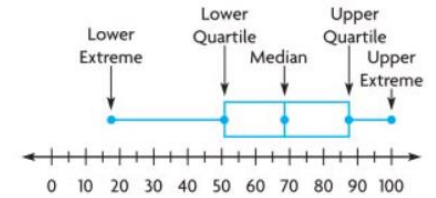
Go Math Chapter 12 Performance Task - [Monique's Survey](#)

[SBAC Question Index](#)

BIG IDEA: In this chapter, students work with 2 big ideas: creating box plots and understanding measures of variability.

Box plots can be useful because they give a visual as well as numeric information about the data. They give measures of center (medians) and measures of variability (spread) of the data. In order to draw a box plot, students must be able to order the data and determine many values.

- They show the greatest and least values in the data set, four smaller groups of values, called quartiles, and the median.
- The vertical sides of the box are the lower quartile, median, and upper quartile.
- The median is the line through the center box; and the lower and upper quartiles are the medians for the sets of data from the least and greatest values respectively to the median.
- The quartiles and the median divide the box plot into fourths.
- Drawing box plots on graph paper will help students make accurate displays of the data



Previously, students have described, analyzed, and drawn conclusions about data in terms of central values or measures of center (mean, mode, and median). There are times when central measures do not describe what the data “looks like.”

- Reporting that the mode is 0 for the set {0, 0, 15, 30} may not be useful in many real world situations.
- Measures of variability describe the distribution or spread of data and help us analyze it.
- One way to contrast the two types of measures is that “...a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.” (NGA Center/CCSSO, 2010, p. 45)

Adapted from Go Math: Teaching for Depth, pg. 513E.

ESSENTIAL QUESTION: How can you describe the shape of a data set using graphs, measures of center, and measures of variability?

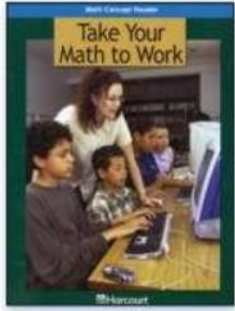
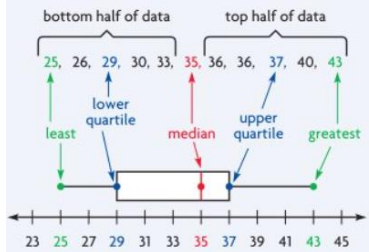
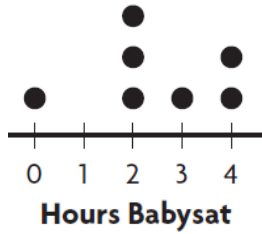
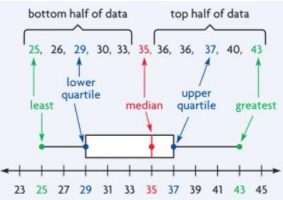
STANDARDS: 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5c, 6.SP.5d

ELD STANDARDS:

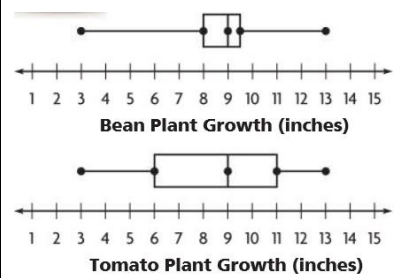
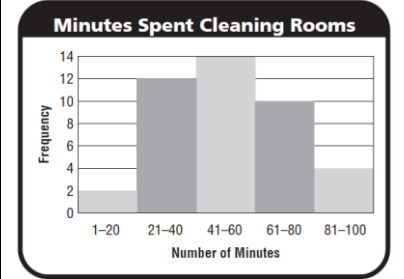
- ELD.PI.6.1- Exchanging information/ideas via oral communication and conversations.
- ELD.PI.6.3- Offering opinions and negotiating with/persuading others.
- ELD.PI.6.5- Listening actively and asking/answering questions about what was heard.

- ELD.PI.6.9- Expressing information and ideas in oral presentations.
- ELD.PI.6.11- Supporting opinions or justifying arguments and evaluating others’ opinions or arguments.
- ELD.PI.6.12- Selecting and applying varied and precise vocabulary.

Lesson	Standards & Math Practices	Essential Question	Math Content and Strategies	Models/Tools Go Math! Teacher Resources G6	Connections (ENGAGE prior knowledge)	Vocabulary	Academic Language Support	Journal
13.1 Patterns in Data	6.SP.5c Companion Pg. 210 MP 5 MP 7 MP 8	How can you describe overall patterns in a data set?	In this lesson, students learn how to describe data based on a data display, such as a dot plot or a histogram. This enables students to make generalizations about data beyond just reading specific data points from the graph. Students develop skills to identify peaks in data, which helps them understand more about measures of center. They also learn about gaps in data and symmetry. Students will apply this information later in the chapter as they learn how	Grid Paper-4 per in Grid Paper-5 per in	Display the following graph from pg. 518. Ask the students the following questions:	Dot plot, histogram		A histogram that shows the ages of students at a library has intervals 1-5, 6-10, 11-15, 16-20, and 21-25. There is a peak at 11-15 years and the graph is symmetric. Sketch what the histogram could look like.

				to choose and apply appropriate measures of center and variability, identify misleading statistics, and describe distributions.		What can you tell me about the features of the graph? What specific information can you give me about bobcats' weights?		Literature  <i>Take Your Math to Work</i> From the <i>Grab-and-Go Differentiated Centers Kit</i> – Students read about choosing the best graph to represent data and using graphs to analyze data.	
13.2	Box Plots	6.SP.4 Companion Pg. 208 MP 3 MP 4 MP 6	How can you use box plots to display data?	Box plots help visualize the variability of data. The variability of the data describes how spread out the data values are. The longer the box in relation to the whole plot, the more varied the data. If the box is short compared with the whole plot, the data values are concentrated and less varied. 	Box Plot Mat Grid Paper-4 per in Grid Paper-5 per in	Write this data set on the board: 54, 44, 42, 71, 34, 50 Ask the students these questions: 1. What is the median of a data set? 2. What steps would you take to find the median of this data set? 3. What is the least value of this data set? 4. What is the greatest value of this data set? *These questions will help highlight the information needed to create box plots	Lower quartile, upper quartile, box plot, median		Draw a box plot to display this data: 81, 22, 34, 55, 76, 20, 56.
13.3	Investigate – Mean Absolute Deviation	6.SP.5c Companion Pg. 210 MP 4 MP 6 MP 8	How do you calculate the mean absolute deviation of a data set?	Students can use counters to make a dot plot to help them understand mean absolute deviation. Mean absolute deviation is a value that describes how much data deviates from the mean. The greater the mean absolute deviation, the more varied the data. A dot plot provides students with a concrete way of visualizing how to find the mean absolute deviation. To make the model, draw a number line (or use the Box Plot Mat) and use the counters to make a dot plot of a data set. Circle the mean on the number line. Use counters to represent data values, and count to find the distance between each counter and the mean. Write that distance under each counter. Then find the mean of the distances. This value is the mean absolute deviation.	Box Plot Mat Grid Paper-4 per in Grid Paper-5 per in Counters	Ask the students: How do you find the mean of a data set? How would you find the mean of a data set on a dot plot? Show the students this portion of a dot plot from pg. P206:  Hours Babysat Have the students find the mean of the data set in the dot plot.	Mean absolute deviation, define the word “deviate” and use it in different situations	 <i>About the Math</i> , pg. 519A <i>About the Math</i> , pg. 523A Data set: 0, 2, 2, 3, 3, 4, 5, 5 Mean = 3 $\frac{3 + 1 + 1 + 0 + 0 + 1 + 2 + 2}{8} = 1.25$ The mean absolute deviation is 1.25.	Make a dot plot of the following data. Use the dot plot to find the mean absolute deviation: 10, 10, 11, 12, 13, 13, 15.

				<p>Data set: 0, 2, 2, 3, 3, 4, 5, 5 Mean = 3</p> <p>$3 + 1 + 1 + 0 + 0 + 1 + 2 + 2 = 1.25$ 8</p> <p>The mean absolute deviation is 1.25.</p>				<p>them to make a semantic map, like the one shown below for <i>data distribution</i>.</p>															
13.4	Measures of Variability	<p>6.SP.5c Companion Pg. 210</p> <p>MP 1 MP 7 MP 8</p>	How can you summarize a data set by using range, interquartile range, and mean absolute deviation?	In this lesson, students learn how to calculate the range and interquartile range. These two measures, along with the mean absolute deviation, help to quantify how concentrated or spread out data are. A box plot is a useful tool to help students understand these concepts. It gives the students a good picture of the variability and spread of the data, along with the range and interquartile range.	<p>Box Plot Mat Grid Paper-4 per in Grid Paper-5 per in</p>	<p>Let's review some key ideas from this chapter:</p> <ol style="list-style-type: none"> How can you find the mean absolute deviation of a data set? What does it describe? <p>Using this same dot plot from the <i>Connections</i> piece for 13.3, have the students find the mean absolute deviation.</p> <p>Hours Babysat</p>	Measure of variability, range, interquartile range, mean absolute deviation	Find the range, interquartile range, and mean absolute deviation for this data set: 41, 45, 60, 61, 61, 72, 80.															
13.5	Choose Appropriate Measures of Center and Variability	<p>6.SP.5d Companion Pg. 210</p> <p>MP 1 MP 2 MP 3</p>	How can you choose appropriate measures of center and variability to describe a data set?	<ul style="list-style-type: none"> It is important to explain to the students that all measures of center can be used to describe a set of data, but one may be more appropriate because it gives a better description of the data values. Demonstrate how an outlier can cause the mean to be higher or lower than most of the data values. Help them understand that in this situation, the mean would be misleading; leading readers to think the data values are typically higher or lower than they truly are. 	<p>Box Plot Mat Grid Paper-4 per in Grid Paper-5 per in</p>	<p>Show the students the box plot from pg. P230 and ask the following questions:</p> <p>School A</p> <p>Number of Students in a Class</p> <ol style="list-style-type: none"> What specific information can you tell me about the box plot? What specific information can you tell me about the number of students in a class at School A? 	Measure of center, mean, median, mode, measure of variability, range, interquartile range	<p>Display this table of data from Reteach pg. R95:</p> <table border="1"> <thead> <tr> <th colspan="5">Scores on 20-question Quiz</th> </tr> </thead> <tbody> <tr> <td>15</td> <td>16</td> <td>17</td> <td>13</td> <td>18</td> </tr> <tr> <td>12</td> <td>5</td> <td>14</td> <td>14</td> <td>16</td> </tr> </tbody> </table> <p>Decide which measure of center best describes the data set. Explain your reasoning.</p>	Scores on 20-question Quiz					15	16	17	13	18	12	5	14	14	16
Scores on 20-question Quiz																							
15	16	17	13	18																			
12	5	14	14	16																			

				<ul style="list-style-type: none"> Also explain how the mode only describes the data values that occur most often and doesn't represent all data values. 																	
13.6	Apply Measures of Center and Variability	6.SP.3 Companion Pg. 205 MP 4 MP 6 MP 7	What do measures of center and variability indicate about a data set?	<p>This lesson is to help students begin to evaluate and compare different sets of data. Comparing measures of center and variability is an introduction to statistical analysis. Explain that analyzing data can lead to predictions or drawing conclusions based on the data collected. For example:</p> <ul style="list-style-type: none"> Knowing the median temperature and interquartile range of two areas can help you draw conclusions regarding how the two climates compare. Understanding the measure of center and variability allows scientists to determine the relationship between two or more events. 	Box Plot Mat Grid Paper-4 per in Grid Paper-5 per in	<p>Show the box plots for pg. 540 and ask the students the following questions:</p>  <ol style="list-style-type: none"> What can you tell me about the graphs? Now compare and contrast the two graphs. How are they the same? How are they different? 	Measure of center, mean, median, mode, measure of variability, range, interquartile range		<p>Compare the data:</p> <table border="1" data-bbox="2365 243 2607 341"> <thead> <tr> <th colspan="3">Daily High Temperatures (°F)</th> </tr> <tr> <th></th> <th>Mean</th> <th>Interquartile Range</th> </tr> </thead> <tbody> <tr> <td>City 1</td> <td>60</td> <td>7</td> </tr> <tr> <td>City 2</td> <td>70</td> <td>15</td> </tr> </tbody> </table> <p>*Students should be able to be able to articulate that City 2 is typically warmer than City 1, and City 2's temperature also varies more than City 1.</p>	Daily High Temperatures (°F)				Mean	Interquartile Range	City 1	60	7	City 2	70	15
Daily High Temperatures (°F)																					
	Mean	Interquartile Range																			
City 1	60	7																			
City 2	70	15																			
13.7	Describe Distributions	6.SP.2 Companion Pg. 203 MP 1 MP 3 MP 6	How can you describe the distribution of a data set collected to answer a statistical question?	<p>Remember, this standard calls out for students being able to describe a statistical distribution by its center, spread, and its overall shape. Students need to understand that graphing can allow you to see the "big picture" of a data set.</p> <ul style="list-style-type: none"> Visually representing a set of data can help identify where most of the data occurs. This is important when the data clusters are not reflected in the measures of center. The distribution of graphed data shows the overall shape of the data set. 	Box Plot Mat Dot Plot Mat Grid Paper-4 per in Grid Paper-5 per in	<p>Display the graphs from pg. R103 and E103 and ask the students the following questions:</p> 	Distribution, statistical question, cluster, gap, peak, symmetry	<p>Using the "Minutes Spent Cleaning Rooms" chart from the Connections column, ask the following question:</p> <p>James claims that the median is a good description of the data set, but the mode is not. Does his statement make sense? Explain.</p>													

						<p>Please examine the two graphs for the following questions:</p> <ol style="list-style-type: none"> Are there any clusters? Are there gaps in the data? Are there peaks in the data? Does the graph have symmetry? 												
13.8	Problem Solving – Misleading Statistics	6.SP.2 Companion Pg. 203 MP 1 MP 3 MP 6	How can you use the strategy <i>work backward</i> to draw conclusions about a data set?	Students need to be able to look at a set of data and make conjectures based on the overall shape and distribution of the data. In this lesson, students look at data and use key indicators (measures of center and variability) to make judgments about a data set.	Box Plot Mat Dot Plot Mat Grid Paper-4 per in Grid Paper-5 per in	<p>Display this chart and ask the students the following questions.</p> <table border="1"> <thead> <tr> <th colspan="5">Time Marissa spent playing video games this week (hrs)</th> </tr> </thead> <tbody> <tr> <td>13</td> <td>2</td> <td>2</td> <td>1</td> <td>2</td> </tr> </tbody> </table> <p>Jose claims that Marissa usually spends 4 hours a day playing video games.</p> <ol style="list-style-type: none"> Do you agree with Jose’s claim? Have evidence to support your position. If you disagree, how did Jose probably come to his conclusion? <p>*Although the mean of the data is 4 hours, Marissa only played for 4 hours 1 out of 5 days in the week. This should illustrate the idea of <i>misleading statistics</i> and help students see that statistics can be described to help support a claim, but it may not always tell the whole story.</p>	Time Marissa spent playing video games this week (hrs)					13	2	2	1	2	Distribution, statistical question	<p>Give the students this question from Reteach pg. R104:</p> <p>Mack says he typically spends 4 hours per week practicing his piano. For the past 6 weeks, he has practiced from 1, 1, 1, 2, 10, and 9 hours. Do you agree with Mack? Explain.</p>
Time Marissa spent playing video games this week (hrs)																		
13	2	2	1	2														

Assessments:

[Go Math Chapter 13 Test](#)

Go Math Chapter 13 Performance Task - [On the Radar](#)

[SBAC Question Index](#)