

Grade 6 Mathematics Item Specification C1 TJ

<p>Claim 1: Concepts and Procedures Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.</p>	
<p>Content Domain: Statistics and Probability</p>	
<p>Target J [a]: Summarize and describe distributions. (DOK Levels 1, 2)</p> <p>Tasks for this target will ask students to create number lines, dot plots, histograms, and box plots. The reporting of quantitative measures (median and/or mean, interquartile range and/or mean absolute deviation) may be included in these tasks or delivered as separate tasks.</p> <p>Other tasks for this target will ask students to match the shape of a data distribution to its quantitative measures.</p>	
<p>Standards: 6.SP.B, 6.SP.B.4, 6.SP.B.5</p>	<p>6.SP.B Summarize and describe distributions. 6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots. 6.SP.B.5 Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.</p>
<p>Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 5.MD.B, 5.MD.B.2 7.SP.B, 7.SP.B.3, 7.SP.B.4</p>	<p>Related Grade 5 Standards 5.MD.B Represent and interpret data. 5.MD.B.2. Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots. <i>For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.</i></p> <p>Related Grade 7 Standards 7.SP.B Draw informal comparative inferences about two populations. 7.SP.B.3 Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. <i>For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.</i> 7.SP.B.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. <i>For example, decide whether the</i></p>

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	<i>words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade book.</i>
DOK Levels:	1, 2
Achievement Level Descriptors:	
<p>RANGE Achievement Level Descriptor (Range ALD)</p> <p>Target J: Summarize and describe distributions.</p>	<p>Level 1 Students should be able to summarize or display numerical data on a number line, in dot plots, and in histograms; find the median of an odd number of data points; and find the mean when data points are nonnegative integers.</p>
	<p>Level 2 Students should be able to calculate mean and median, understand that mean and median can be different or the same, and use the measure of center to summarize data with respect to the context.</p>
	<p>Level 3 Students should be able to summarize or display data in box plots and find the interquartile range. They should be able to use the interquartile range along with the angle and measures of center to describe overall patterns in a data distribution, such as symmetry and clusters, and any striking deviations. They should also be able to examine a data set in context and explain the choice of the mean or median, as it relates to the data.</p>
	<p>Level 4 Students should be able to relate choice of measures of center and variability to the shape of the data distribution in context of the data; find mean absolute deviation and identify outliers with reference to the context of the situation; and predict effects on the mean and median, given a change in data points.</p>
Evidence Required:	<ol style="list-style-type: none"> 1. The student displays numerical data on line plots, dot plots, histograms, and box plots. 2. The student summarizes numerical data sets by describing the nature of the attribute under investigation, including how it was measured, its units of measurement, and number of observations. 3. The student summarizes numerical data sets by determining quantitative measures of center (median and/or mean) and variability (interquartile range, range, and/or mean absolute deviation). 4. [Retired Evidence Required statement] 5. [Retired Evidence Required statement]
Allowable Response Types:	Multiple Choice, single correct response; Multiple Choice, multiple correct response; Equation/Numeric; Drag and Drop; Hot Spot; Matching Tables
Allowable Stimulus Materials:	number line diagrams, dot plots, histograms, box plots
Construct-Relevant Vocabulary:	variability, interquartile range, range, mean absolute deviation, outliers, center, spread, mean, median, shape (pertaining to statistics such as gap, cluster, peak, skew, bell curve, and uniform distribution)
Allowable Tools:	Calculator
Target-Specific Attributes:	

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<p>Non-Targeted Constructs:</p>	
<p>Accessibility Guidance:</p>	<p>Item writers should consider the following Language and Visual Element/Design guidelines¹ when developing items.</p> <p>Language Key Considerations:</p> <ul style="list-style-type: none"> • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references <p>Visual Elements/Design Key Considerations:</p> <ul style="list-style-type: none"> • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics <p>Items are selected for a student’s test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.²</p>
<p>Development Notes:</p>	<p>In Grade 6, the focus on assessment for the SP standards should be in Claim 4. The most important concept is distribution, which is a foundational idea for all future statistical work. Other concepts include shape, center, and spread of a distribution (not the more technical details often associated with those).</p>

¹ For more information, refer to the General Accessibility Guidelines at: <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf>

² For more information about student accessibility resources and policies, refer to http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

Task Model 1

Response Types:
Drag and Drop,
Hot Spot, Multiple
Choice, single
correct response

DOK Level 2

6.SP.B.4

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Evidence Required:

1. The student displays numerical data on line plots, dot plots, histograms, and box plots.

Tools: Calculator

Accessibility Note:

Hot Spot items are not currently able to be Brailled. Minimize the number of items developed to this TM.

Prompt Features: The student is prompted to generate line plots, dot plots, histograms, or box plots that represent a set of numerical data.

Stimulus Guidelines:

- If used, context should be familiar to students 11 to 13 years old.
- Numbers in the data set should be whole numbers.
- Vertical axis for histograms should be in one-unit increments.
- Item difficulty can be adjusted via these example methods:
 - Students create line plot/dot plot/histogram that corresponds to a given data set.
 - Students select/create box plot that corresponds to given data set.

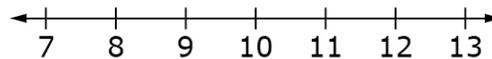
TM1a

Stimulus: Students create a dot plot given a data set.

Example Stem: The ages of 9 students in a summer camp are shown.

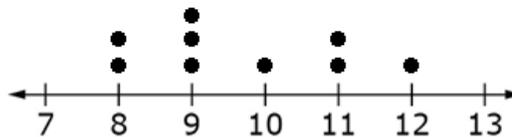
10	11	12
9	8	9
11	9	8

Click above the number line to create a dot plot for the data set.



Interaction: The student is given a labeled number line. Student uses the Hot Spot tool to click spaces above the number line to create a dot plot.

Rubric: (1 point) Student correctly creates a dot plot to represent the data (see below).



Response Type: Hot Spot

Task Model 1

Response Types:
Drag and Drop,
Hot Spot, Multiple
Choice, single
correct response

DOK Level 2

6.SP.B.4
 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Evidence Required:
 1. The student displays numerical data on line plots, dot plots, histograms, and box plots.

Tools: Calculator

Accessibility Note:
 Hot Spot items are not currently able to be Brailled. Minimize the number of items developed to this TM.

TM1b

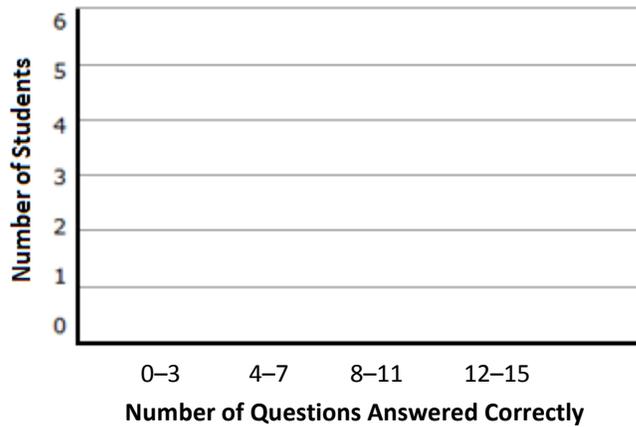
Stimulus: Students create a histogram given a data set.

Example Stem: The numbers of test questions answered correctly by 9 students are shown.

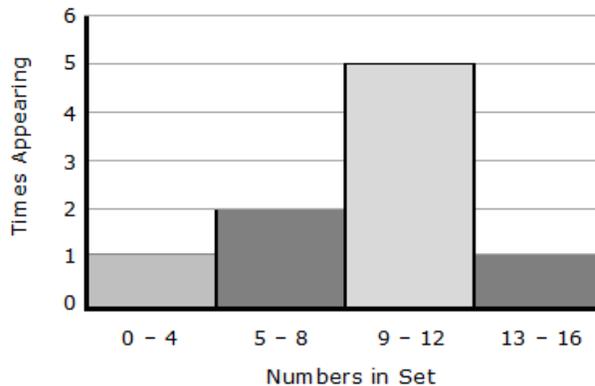
10	11	2
9	15	9
7	4	8

Click within the graph area to create a histogram for the data set.

Interaction: The student is given a graph with both axes labeled. Hot Spot tool is used to click unit squares on the graph to shade in and create a histogram.



Rubric: (1 point) Student correctly creates a histogram to represent the data (see below)



Response Type: Hot Spot

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Task Model 1

Response Types:
Drag and Drop,
Hot Spot, Multiple
Choice, single
correct response

DOK Level 2

6.SP.B.4
 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Evidence Required:
 1. The student displays numerical data on line plots, dot plots, histograms, and box plots.

Tools: Calculator

Accessibility Note:
 Drag and Drop items are not currently able to be Brailled. Minimize the number of items developed to this TM.

TM1c

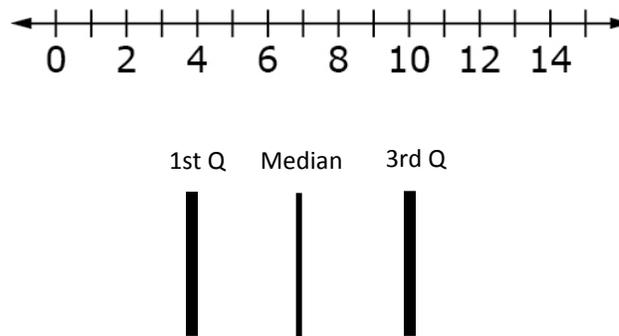
Stimulus: Students create a box plot given a data set.

Example Stem: The numbers of test questions answered correctly by 9 students are shown.

10	11	12
9	15	9
7	4	8

The vertical line segments represent the 1st quartile (1st Q), median, and the 3rd quartile (3rd Q) of the data set.

Drag each line segment to the correct location on the number line.



Interaction: The student is given a number line and a palette at the bottom of the screen. The palette contains three images of line segments labeled "1st Q," "Median," and "3rd Q." Students use the drag-and-drop tool to place the line segments in the appropriate place on the number line. Snap-to feature should be used at each tick mark on the number line.

Rubric: (1 point) Student places the three line segments in the correct locations on the number line.

Response Type: Drag and Drop

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Task Model 1

Response Types:
Drag and Drop,
Hot Spot, Multiple
Choice, single
correct response

DOK Level 2

6.SP.B.4

Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Evidence Required:

1. The student displays numerical data on line plots, dot plots, histograms, and box plots.

Tools: Calculator

TM1d

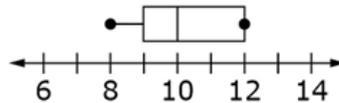
Stimulus: Students identify the box plot that represents a given data set.

Example Stem: The ages of 9 students in a summer camp are shown in this frequency table.

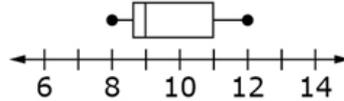
Age	Frequency
8	2
9	3
10	1
11	2
12	1

Which box plot correctly displays the data shown in the table?

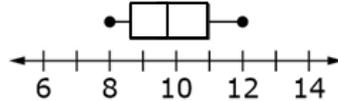
A.



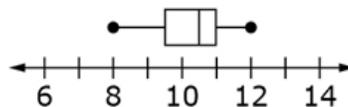
B.



C.



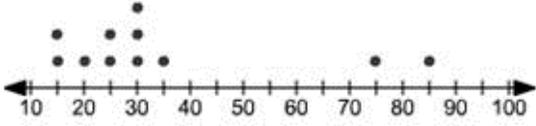
D.



Answer Choices: Answer choices will be box plots. Distractors will include incorrectly calculating the median, upper and lower quartile, and/or misrepresenting the data on a box plot.

Rubric: (1 point) The student selects the correct box plot (e.g., B).

Response Type: Multiple Choice, single correct response

<p>Task Model 2</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 1</p> <p>6.SP.B.5a, 6.SP.B.5b Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.</p> <p>Evidence Required: 2. The student summarizes numerical data sets by describing the nature of the attribute under investigation including how it was measured, its units of measurement, and number of observations.</p> <p>Tools: Calculator</p>	<p>Prompt Features: The student is prompted to summarize numerical data sets by writing how it was measured, its units of measurement, or number of observations.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> Context should be familiar to students 11 to 13 years old. Data set may be presented as a: <ul style="list-style-type: none"> table line/dot plot histogram Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> Students give the number of observations that corresponds to a given data set. Students describe how the attribute of a given data set is measured and the unit of measurement used. <p>TM2</p> <p>Stimulus: The student is presented with a set of numerical data.</p> <p>Example Stem: Ted surveyed his neighbors to see how much money they spent on gasoline each week. The results are in the dot plot shown.</p> <div style="text-align: center;">  </div> <p>Enter the total number of people Ted surveyed.</p> <p>Rubric: (1 point) Student enters correct value (e.g., 11).</p> <p>Response Type: Equation/Numeric</p>
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<p>Task Model 3</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 2</p> <p>6.SP.B.5c Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</p> <p>Evidence Required: 3. The student summarizes numerical data sets by determining quantitative measures of center (median and/or mean) and variability (interquartile range, range, and/or mean absolute deviation).</p> <p>Tools: Calculator</p>	<p>Prompt Features: The student is prompted to write quantitative values for the measures of center (median or mean) or variability (interquartile range) for a given numerical data set.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • Context should be familiar to students 11 to 13 years old. • Data set may be presented as a: <ul style="list-style-type: none"> ○ list ○ table ○ line/dot plot ○ box plot • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ Students find the range/median for a data set (odd number data set for median). ○ Students find the mean/median for a data set (even number data set for median). <p>TM3a Stimulus: The student is presented with a set of numerical data.</p> <p>Example Stem 1: Sophia surveyed her friends to see how many minutes they studied for their math test last evening. The results are in this list.</p> <p style="text-align: center;">10, 15, 20, 15, 35, 25, 20, 30, 25</p> <p>Enter the mean of the data.</p> <p>Rubric: (1 point) Student gives the correct mean of the data. Students' answers should be within an acceptable range (e.g., 21.6–22).</p> <p>Response Type: Equation/Numeric</p> <p>Example Stem 2: Avery surveyed her friends to see how many minutes they studied for their math test last evening. The results are shown in the frequency table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Minutes</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>10</td> <td style="text-align: center;"> </td> </tr> <tr> <td>15</td> <td style="text-align: center;"> </td> </tr> <tr> <td>20</td> <td style="text-align: center;"> </td> </tr> <tr> <td>25</td> <td style="text-align: center;"> </td> </tr> <tr> <td>30</td> <td style="text-align: center;"> </td> </tr> <tr> <td>35</td> <td style="text-align: center;"> </td> </tr> </tbody> </table> <p>Enter the median of the data.</p> <p>Rubric: (1 point) Student gives the correct median of the data (e.g., 20).</p> <p>Response Type: Equation/Numeric</p>	Minutes	Frequency	10		15		20		25		30		35	
Minutes	Frequency														
10															
15															
20															
25															
30															
35															

<p>Task Model 3</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 2</p> <p>6.SP.B.5c Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.</p> <p>Evidence Required: 3. The student summarizes numerical data sets by determining quantitative measures of center (median and/or mean) and variability (interquartile range, range, and/or mean absolute deviation).</p> <p>Tools: Calculator</p> <p>Version 3 Update: Removed example stem 2 from TM3b and retired TM3c, TM4, and TM5.</p>	<p>Prompt Features: The student is prompted to write quantitative values for the measures of variability (interquartile range) for a given numerical data set.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • Context should be familiar to students 11 to 13 years old. • Data set may be presented as a: <ul style="list-style-type: none"> ○ list ○ table ○ line/dot plot ○ box plot • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ The data set has an odd amount of numbers. ○ The data set has an even amount of numbers. ○ Student finds the interquartile range. <p>TM3b Stimulus: The student is presented with a set of numerical data.</p> <p>Example Stem: Avery surveyed her friends to see how many minutes they studied for their math test last evening. The results are shown in the frequency table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Minutes</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>10</td> <td> </td> </tr> <tr> <td>15</td> <td> </td> </tr> <tr> <td>20</td> <td> </td> </tr> <tr> <td>25</td> <td> </td> </tr> <tr> <td>30</td> <td> </td> </tr> <tr> <td>35</td> <td> </td> </tr> </tbody> </table> <p>Enter the interquartile range of the data set.</p> <p>Rubric: (1 point) Student enters the correct interquartile range of the data (e.g., 15).</p> <p>Response Type: Equation/Numeric</p>	Minutes	Frequency	10		15		20		25		30		35	
Minutes	Frequency														
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