NEW MEXICO
Public Education Department

6.SP: STATISTICS & PROBABILITY

Cluster Statement: B: Summarize and describe distributions.

Additional Cluster (Students should spend the large majority of their time (65-85%) on the major work of the grade/course. Supporting work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.)

Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
6.SP.B.4: Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	SMP 1: Students make sense of problems and persevere in solving them by understanding how measures of center and measures of variability are represented by graphical displays and which displays reveal specific information (actual data values, number of data, mean, median, minimum, maximum, shape – symmetrical or skewed, etc.) relating to the data. SMP 2: Students reason abstractly and quantitatively by comparing different types of representations for a given data set noting the advantages and disadvantages for using particular representations.	• Understand and be able to calculate measure of center, and the quartile ranges. • Understand the when it is appropriate to use a dot plot, histogram and box plot. For example, a dot plot will show exact values for each piece of data, but a histogram will show how many pieces of data fell within a specific range. • Create and display data on number lines using dot plots, histograms and box plots.
		Webb's Depth of Knowledge: 1-2
		Bloom's Taxonomy: Apply, Analyze
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
6.SP.B.5: Summarize numerical data sets in relation to their context, such as by: • 6.SP.B.5.A: Reporting the number of observations. • 6.SP.B.5.B: Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.	SMP 1: Students make sense of problems and persevere in solving them by understanding how measures of center and measures of variability are represented by graphical displays and which displays reveal specific information (actual data values, number of data, mean, median, minimum, maximum, shape – symmetrical or skewed, etc.) relating to the data.	• Correlate the number of observations to the sample size. • Express how sample size is represented in a dot plot vs histogram, vs box plot. • Identify the initial survey question as numerical vs categorical (quantitative vs qualitative) data. • Describe the data by reading the graph's labels (units used) • Use the correct context, describe the overall pattern including any

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- 6.SP.B.5.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.
- 6.SP.B.5.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.

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<td>SMP 2: Students reason abstractly and quantitatively by comparing different types of representations for a given data set noting the advantages and disadvantages for using particular representations.</td>
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striking deviations such as outliers.
- Compute the measures of center: median and/or mean.
- Compute the measures of variability: interquartile range and/or mean absolute deviation.
- Express how measures of center and variability change the shapes of distribution.

Webb's Depth of Knowledge: 2-3

Bloom's Taxonomy:
Understand, Apply

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<u>Previous Learning Connections</u>
- In Grade 5, learners made line plots to display a data set of measures in fractions of a unit. They will build upon this skill in 6th grade by summarizing increasingly complex data sets in different contexts.

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<u>Current Learning Connections</u>
- Students will create dot plots, histograms and box plots. They will draw inferences and make comparisons between them. Students will also learn mean, median, mode and interquartile range which will connect in this cluster.

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<u>Future Learning Connections</u>
- In Grade 7, students build on their understanding of interpreting information about a population by using population samples. In Grade 7, students begin to look at two separate data sets to make comparisons. In the high school standards, learners interpret differences in shape, center, and spread in the context of the data sets,

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Clarification Statement:
Students will develop an understanding of statistical thinking. They will use dot plots, histograms and box plots to draw inferences and make comparisons between data sets. Students should recognize that data distribution may not have a definite center and that interpreting those different measures of center can change how data gets interpreted.

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Common Misconceptions
- Students may confuse the different visual representations (dot plot, histogram, number line, and box plots).
- When creating a box plot, students may have difficulty in correctly identifying the lower and upper quartile. Since this is median, it may need to be reinforced that data sets with even values will need to find the mean between the middle two numbers.

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Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*
- For example, some learners may benefit from targeted pre-teaching that rehearses prior learning when studying how to summarize and describe distributions because it

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allows refresher of prerequisite skills needed to be successful in understanding the whole concept like graphing on number lines.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 5.MD.B.2 *Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. 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*. This standard provides a foundation for work with summarizing and analyzing distributions because students are expected to skillfully plot data in fractions on a number line. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Core Instruction

Access

Perception: *How will the learning for students provide multiple formats to reduce barriers to learning, such as providing the same information through different modalities (e.g., through vision, hearing, or touch) and providing information in a format that will allow for adjustability by the user?*

- For example, learners engaging with summarizing and analyzing distributions benefit when learning experiences ensure information is accessible to learners with sensory and perceptual disabilities, but also easier to access and comprehend for many others such as offering alternatives for visual information such as descriptions (text or spoken) for dot plots, histograms, box plots in graphs, videos, or animations; auditory cues for key concepts and transitions in visual information; and vocabulary word wall for key terms because this cluster is loaded with vocabulary words that students may not have a clear comprehension of their meanings. By exposing students with easy access to this information will help students put the pieces together through seeing with visual graphics, hearing with its descriptions, and reading its definitions.

Build

Effort and Persistence: *How will the learning for students provide options for sustaining effort and persistence?*

- For example, learners engaging with summarizing and analyzing distributions benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as providing prompts that guide learners in when and how to ask peers and/or teachers for help because this is a great way to keep the students from interrupting other students and teacher. A class routine on how to ask peers and or/teacher must have been clearly established and practiced in order to support student engagement. The Ask-Three-Before-Me strategy published by John Hopkins University found in: http://olms.cte.jhu.edu/olms2/data/ck/sites/273/files/18047_PT_CoopLearnHB%2025(1).pdf is one way to establish this routine.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling*

to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds).

- For example, learners engaging with summarizing and analyzing distributions benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as embedding support for vocabulary and symbols within the text (e.g., hyperlinks or footnotes to definitions, explanations, illustrations, previous coverage, translations) because it provides opportunities for students to be familiar in modeling the correct usage of statistical vocabulary and terms, thereby helping students correctly integrate these new concepts into their current understanding of numbers.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*

- For example, learners engaging with summarizing and analyzing distributions benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as using social media and interactive web tools (e.g., discussion forums, chats, web design, annotation tools, storyboards, comic strips, animation presentations) because it allows students' expression of their own thinking and creativity.

Internalize

Executive Functions: *How will the learning for students support the development of executive functions to allow them to take advantage of their environment?*

- For example, learners engaging with summarizing and analyzing distributions benefit when learning experiences provide opportunities for students to set goals; formulate plans; use tool and processes to support organization and memory; and analyze their growth in learning and how to build from it such as providing graphic organizers and templates for data collection and organizing information because students will have an opportunity to always go back to the graphic organizers and templates that will help them internalize the information as they keep coming back.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on summarizing and analyzing distributions by providing specific feedback to students on their work through a short mini lesson because it enhances students' learning and achievement. The authentic, immediate feedback to students' work when provided at the real-time is as powerful as catching misconception or misunderstanding that needs fixed.

Re-teach (intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit on summarizing and organizing distributions by confronting student misconceptions because it allows teachers to start by asking students what they think, acknowledge the process and confront them with facts. Students be clarified when confused with the concept of "mean absolute deviation" and "mean"; not be clear about the differences between bar graphs and histograms.

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?

- For example, some learners may benefit from an extension such as open-ended tasks linking multiple disciplines when studying how to summarize and analyze distributions because it provides the students with opportunities to explore and present their individual creativity. For instance, the open-ended task could be an example from Illustrative mathematics found in: http://tasks.illustrativemathematics.org/content-standards/6/SP/B/4/tasks/2047.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?
Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

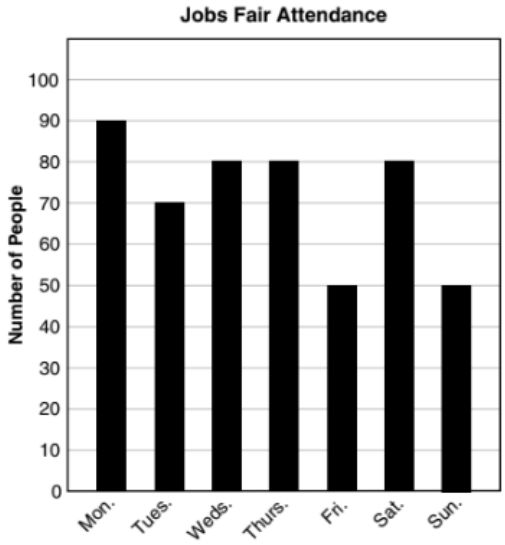
Eliciting and Using Evidence of Student Thinking: Eliciting and using student thinking can promote a classroom culture in which mistakes or errors are viewed as opportunities for learning. When student thinking is at the center of classroom activity, "it is more likely that students who have felt evaluated or judged in their past mathematical experiences will make meaningful contributions to the classroom over time." For example, when studying summarize and describe distributions eliciting and using student thinking is critical because it allows for teachers to gather authentic information through formative and summative assessments that can be used to further support students' learning. During aggressive monitoring in the classroom, teachers listen carefully to student thinking and make note of which ideas to bring to the forefront of whole class discussions. It is helpful to create opportunities for students to share their thinking about distributions, their choice of measures of center and variability with their peers directly.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: Cognia Testlet for Grade 6 Statistics & Probability

6.SP.B.5: Summarize numerical data sets in relation to their context, such as by: 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.

- Learning Target: I can use a bar graph to answer questions about a data set.
- Webb's Depth of Knowledge: 2
- This type of assessment question requires students to apply their knowledge of histograms and to understand the concept of mean and median to determine the solutions to part a-c. Part A will inform the teacher if a student understands how to read a histogram visually in order to calculate the total number of people who attended the fair. Part B will inform the teacher if the student can read the histogram visually in order to collect the data needed and then if they understand how to find the mean of a data set and can round the total accurately. Part C also requires a student to be able to read a histogram visually and apply that knowledge to calculate the median. A student also needs to know how to determine the median of a data set.

1. A school held its annual Jobs Fair. The number of people that attended each day of the fair is represented in this graph.



a. What is the total number of people that attended the job fair?

b. What is the **mean** number of people per day that attended the job fair, rounded to the nearest whole number? Show your work or explain how you know.

c. What is the **median** number of people per day that attended the job fair? Show your work or explain how you know.

Relevance to families and communities:

During a unit focused on how to summarize and describe distributions, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, learning about the different ways data collection is used in the home and community can a be a great way to connect school tasks with home tasks.

Cross-Curricular Connections:

Science:

- Students will develop a question that they can study in regards to kinetic energy and possibly how temperature changes They will be able to look at data sets to determine the trends in the data. Specifically, students can see different results by the transfer of kinetic energy. Students can analyze the data set finding the mean, median, mean absolute deviation AND describe what these values mean in the context of the situation. (MS-PS3-4, Energy) https://www.nextgenscience.org/pe/ms-ps3-4-energy

English:

- RST.6.8.3- following precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- RST.6.8.4- demonstrating the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grade 6-8 texts and topics.

	• RST.6.8.7- distinguish among facts, reasoned judgment based on research findings, and speculations in a text. • SL.6.1- engage effectively in a range of collaborative discussions (one-on-one, in groups and teacher-led) with diverse partners on grade 6 topics, texts, and issues building on other's ideas and expressing their own clearly. Social Studies: CCSS.ELA-LITERACY.RH.6-8.6/CCSS.ELA-LITERACY.RH.6-8.7-Students can conduct a question based on a question that relates to math (i.e. what is the average household income?). This data produces quantitative data and the measures of center and shape can be analyzed.