NEW MEXICO
Public Education Department

6.SP: STATISTICS & PROBABILITY

Cluster Statement: A: Develop understanding of statistical variability.

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.A.1: Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*	SMP 1: Students make sense of problems and persevere in solving them by explain the meaning of statistical questions**.** SMP 2: Students reason abstractly and quantitatively to create a logical representation of the problem. "How does a statistical question anticipate variability?"	• Students will understand that their question promotes an investigation. • Students will understand the difference in quantitative (numerical) data to qualitative(categorical) data. • Students will develop a question that promotes variability in the data. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Remember, Understand
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
6.SP.A.2: Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	SMP 1: Students make sense of problems and persevere in solving them by explain the meaning of statistical questions**.** SMP 2: Students reason abstractly and quantitatively to create a logical representation of the problem. "How does a statistical question anticipate variability?" SMP 8: Students look for and express regularity in repeating reasoning and repeats the process of statistical reasoning in a variety of contexts.	• Be able to collect data by asking a statistical question. • Understand that a collected data set from a statistical question can be described using center, spread and overall shape. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand

<table>
<tr><td>Standard Text

6.SP.A.3: Recognize 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.</td><td>Standard for Mathematical Practices

SMP 1: Students make sense of problems and persevere in solving them by describing the spread and center of the data based on the visual characteristics of the representations.[1]

SMP 2: Students reason abstractly and quantitatively by using quantitative reasoning that entails coherent representation of the single number, not just how to compute them.

SMP 6: Students attend to precision by accurately finding the measure of center and variability with a level of precision appropriate for the given context.</td><td>Students who demonstrate understanding can:
• Find and understand that measures of center (mean/median) summarize a set of data with a single number.
• Find and understand that measures of variation (range/MAD) describe a set of data's variability with a single number.

Webb's Depth of Knowledge: 1-2

Bloom's Taxonomy:
Understand, Analyze</td></tr>
<tr><td><u>Previous Learning Connections</u>
• In Grade 5, learners made line plots to display a data set of measures in fractions of a unit.</td><td><u>Current Learning Connections</u>
• Mean, median, mode and range are new concepts to 6th grade students. Students will create dot plots, histograms and box plots. They will draw inferences and make comparisons between them. Mastery includes finding mean, median, mode and interquartile range.</td><td><u>Future Learning Connections</u>
• In Grade 7, learners build on their understanding of interpreting information about a population by using population samples. In Grade 7, learners begin to look at two separate data sets to make comparisons. In high school, learners interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</td></tr>
<tr><td colspan="3">Clarification Statement:
Students will develop an understanding of statistical thinking. They will learn how to write statistical questions used to survey and collect data. They will study measures of center and variability with newly learned knowledge of mean, median, mode, and range. Students will discover that different ways to measure center produce different values and that interpreting measures of center for the same data develops the understanding of how each measure can change how the data gets interpreted.</td></tr>
<tr><td colspan="3">Common Misconceptions
• Students must shift their thinking from asking their question only about themselves to asking it in a larger population. Students are looking for a question that produces variability in the data. Students may try to ask a question of themselves such as "How big is my shoe size?" instead of asking the question of a larger</td></tr>
</table>

[1] http://mathpractices.edc.org/pdf/Creating_Data_Sets_from_Statistical_Measures.pdf

population as a class or school (What are the shoe sizes in my class? What are the shoe sizes in my school?). In addition, students may try to ask a question that does not produce variability in the data by asking a yes or no question (do you like playing football?) or that provides categorical data (Do you like cats or dogs?). Students may assume that asking someone what zip code they live in is numerical data. This would actually be classified as categorical.

- Students may have issues with the vocabulary word symmetrical. They may have trouble describing data when it is not a traditional visual representation they have studied before (dot plot, histograms, etc.). In addition, students may mix up mean and median and what their purpose is for representing the data set.
- The concept of center, spread, and shape may provide difficult vocabulary for students. As students begin to analyze variability, they may not understand the connection between range, spread, and variability are all the same concept. Students may have trouble calculating mean and median given a histogram or dot plot.
- Students may have trouble connecting that mean is the average, as it has previously been described this way.

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 new mathematical language when studying developing the understanding of statistical variability because students will need to become familiar with ideas around statistical data, measures of central tendency, variability and other new concepts.

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

- 5.MD.B.2: This standard provides a foundation for work with developing the understanding of statistical variability because it focuses on 5th grade work that students have done using line plots to organize data and then fraction operations to interpret and solve problems with the data. 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

Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with developing understanding of statistical variability benefit when learning experiences include ways to recruit interest such as creating socially relevant tasks because as students work to recognize and understand statistical questions, including using measures of center and variability to describe them, this can easily be done by creating questions and data sets that are socially relevant to them therefore creating interest and connections with the content.

Build

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

- For example, learners engaging with developing understanding of statistical variability benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as generating relevant examples with students that connect to their cultural background and interests because as students identify with their community this will foster collaboration and connection with other students.

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 developing understanding of statistical variability benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as making explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams because students can represent statistical data in many different ways. For example, calculating measures of center and variability, displaying data in number plots and graphs, and summarizing data in both words and verbally to form a convincing argument.

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 developing understanding of statistical variability benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing different approaches to motivate, guide, feedback or inform students of progress towards fluency because students are able to describe statistical data in several ways and this allows for students to make decisions about which strategies to use to achieve their goal. They can also use relevant and interesting data for their statistical analysis as this easily lends itself to student choice and multiple representations.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*

- For example, learners engaging with developing understanding of statistical variability benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as providing explicit, supported opportunities to generalize learning to new situations (e.g., different types of problems that can be solved with linear equations) because as students recognize and understand what statistical data is and how it can be modeled, situations can be created to allow students to analyze relevant data and decide how to appropriately model it using measures of center and variability.

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 developing the understanding of statistical variability by clarifying mathematical ideas and/or concepts through a short mini-lesson because as students use statistical data to solve problems, they will need practice and clarification on using measures of central tendency and variability to decide how to most effectively describe the data. This could be done in small groups using protocols to examine data and present appropriate data to answer a question.

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 developing the understanding of statistical variability by confronting student misconceptions because there are so many new concepts in this cluster that looking at common misconceptions could help students avoid confusion. For example, students need to be clear on the difference between statistical data and categorical data and understand that only statistical data allows the use of measures of central tendency and variability to describe the data.

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 developing the understanding of statistical variability because this cluster lends itself to using data from many sources. Students do not have to gather the data as they will in 7th grade but could use data from a current science or social studies concept to develop these skills.

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?

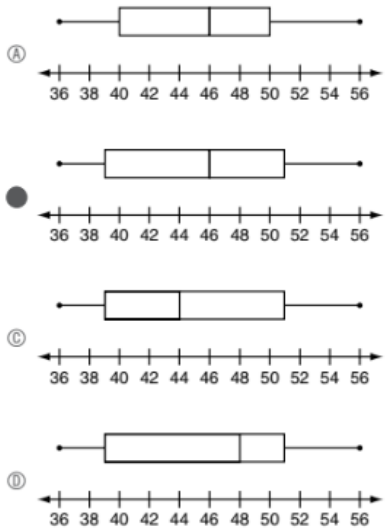
Tasks: The type of mathematical tasks and instruction students receive provides the foundation for students' mathematical learning and their mathematical identity. Tasks and instruction that provide greater access to the mathematics and convey the creativity of mathematics by allowing for multiple solution strategies and development of the standards for mathematical practice lead to more students viewing themselves mathematically successful capable mathematicians than tasks and instruction which define success as memorizing and repeating a procedure demonstrated by the teacher. For example, when studying the development in the understanding of statistical variability the types of mathematical tasks are critical because students can use data that is relevant to their home, school or social culture when working with statistical variability. The power in connecting mathematics to student's personal experiences and culture can easily be accessed through choosing (or even better, allowing students to choose) topics and statistical questions that are relevant and meaningful on a personal level. As mathematics becomes more personal, students can begin to identify as a mathematician.

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

. Look at this data set.

40, 36, 48, 52, 50, 44, 38, 56

Which box plot represents the data?



Relevance to families and communities:

During a unit focused on the development in the understanding of statistical variability, 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, students can collect or use statistical data that answers relevant questions related to their family and community culture.

Cross-Curricular Connections:

Science:
Students can answer a question regarding their experiment by collecting data. This data can be displayed in different ways in addition to students finding the measures of center (mean and median) and describing the shape of the data. (MS-LS1-4, From Molecules to Organisms: Structures and Processes)
https://www.nextgenscience.org/pe/ms-ls1-4-molecules-organisms-structures-and-processes

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: • RH.6-8.1-Students can apply their knowledge of center and shape of the data to answer questions regarding different graphs that are presented. This data that is collected and analyzed can help to answer a larger question surrounding the data set.