NEW MEXICO
Public Education Department

HS: STATISTICS & PROBABILITY – INTERPRETING CATEGORICAL & QUANTITATIVE DATA

Cluster Statement: A: Summarize, represent, and interpret data on a single count or measurement variable

Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
HSS.ID. A.1: Represent data with plots on the real number line (dot plots, histograms, and box plots).	SMP 1: Students can make sense of problems and persevere in solving them by analyzing the data they are given and determining the best method for representing the data (dot plots, histograms, box plots). SMP 3: Students can construct viable arguments by defending their reasoning for their chosen display.	• Summarize data using a dot plot. • Summarize data using a histogram. • Summarize data using a box plot. • Know when each of these is appropriate to be used **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply, Analyze
Standard Text **HSS.ID.A.2: Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.** *Widely Applicable as Prerequisite for a Range of College Majors, Postsecondary Programs and Careers.*	**Standard for Mathematical Practices** SMP 2: Students can reason abstractly and quantitatively by determining the appropriate measure of center or spread to use in describing a data set based on its shape. SMP 3: Students can construct viable arguments by justifying appropriate measures of center based on distribution shape and unusual features.	**Students who demonstrate understanding can:** • Calculate the median, mean, interquartile range, and standard deviation of a set of data. • Identify and describe differences in two sets of data base on these calculations. • Identify and describe the shape of a set of data (skewness, symmetric, bimodal, normal). **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply, Analyze

NEW MEXICO
Public Education Department

<table>
<tr>
<td>Standard Text

HSS.ID.A.3: Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</td>
<td>Standard for Mathematical Practices

SMP 2: Students can reason abstractly and quantitatively by using the center shape and spread of data sets in order to compare them and interpret the meaning of those measures of center and spread within their given contexts.

SMP 6: Students can attend to precision by recognizing and naming different shapes and their characteristics of center, shape and spread.</td>
<td>Students who demonstrate understanding can:
Describe how the presence or removal of an outlier changes the shape, center and spread of a data set.
Explain why some data sets will tend towards skewness (e.g., tests scores with an upper limit that students do well on tend to be left skewed while heights tend to be more normally distributed).
Recognize that the shape of the data is usually connected to the relative positions of the mean and median (e.g., left skewed data has a mean that is lower than the median).
Webb’s Depth of Knowledge: 1-2

Bloom’s Taxonomy:
Understand, Apply, Analyze</td>
</tr>
<tr>
<td><u>Previous Learning Connections</u>
Connect to plotting points on a coordinate grid. (5.G.1-2)
Connect to plotting data on dot plots and boxplot. (6.SP.4)
Connect to describe center and spread in a data distribution. (6.SP.5)</td>
<td><u>Current Learning Connections</u>
Connect to how outliers can affect data and skew data.
Connect to classroom test scores or heights of students (something relevant to them)</td>
<td><u>Future Learning Connections</u>
Connect to using a standard deviation to make conclusions about a set of data. (HSS.IS.4)
Investigate normal distributions within a context. (HSS.IS.4)
Calculate confidence intervals based on a normal curve, mean and standard deviation. (HSS.IC.4)</td>
</tr>
<tr>
<td colspan="3">Clarification Statement
HSS.ID.A.1: Students should not only be able to construct each of these plot types but be able to do so in a way that shows the data in a meaningful way considering things like spread and center. For example, making bins of appropriate width in when making a histogram or appropriate spacing on a number line for a dot plot or a box plot. Students should know that a dot plot is a diagram that represents a data set using dots over the number line. A histogram is a diagram that shows a data set as a series of rectangles that shows how often data occur within a given interval. A box plot, also called a box and whisker plot, is a diagram that shows a data set as a distribution along the number line, divided into four equal parts using the median (the middle data value) and the upper and lower quartiles (median of upper and lower half of data, respectively).
HSS.ID.A.2: Students should use statistics appropriately to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. Students should know that the center of data can give us a good sense of the data set overall. The center of the data is exactly what it sounds like: a representation of the middle of the data, or a typical value. It gives us a good first guess as to where on the number line the data will fall. Students should know the two types of centers of data: mean and median. The mean, or average, is the sum of all the data points divided by the number of data points, while the median is the value that splits the data into two intervals.</td>
</tr>
</table>

- HSS.ID.A.3: Students understand and use the context of the data to explain why its distribution takes on a shape (e.g., Is the data **skewed**? Are there **outliers**?). Students understand that the higher the value of a measure of **variability**, the more spread out the data set is. Measures of variability are **range** (100% of data), standard deviation (68-95-99.7% of data), and interquartile range (50% of data). Students explain the effect of any outliers on the shape, center, and spread of the data sets.

Common Misconceptions

- Students may forget to arrange the data in numerical order before finding key numbers needed for creating a box plot.
- When doing normal distribution calculations, students often report the area to the left of a boundary when they are asked about the area to the right of the boundary.

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 the center, spread and overall shape of the data sets because students need to understand the conceptual knowledge of center and spread in the context of the problems. Students need to interpret the information numerically and graphically.

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

- 6.SP.A.2 and 6.SP.B.5: This standard provides a foundation for work with interpreting the center and spread of the data sets because students use their prior knowledge to compare the center and spread of different data sets and make implication in the context of the problems. 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 representing and interpreting the data set of one variable benefit when learning experiences include ways to recruit interest such as providing contextualized examples to their lives because students represent and interpret data sets of real-life situations. Students understand the application and implication of using math and make connections to their prior experience.

Build

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

- For example, learners engaging with representing and interpreting the data sets of one variable benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as encouraging and supporting opportunities for peer interactions and supports because students use their background knowledge to support their understanding and interpretation of the data set. Students contribute their knowledge and understanding to support their peers to understand the meaning of the shape, center and spread of the data sets through meaningful discourse.

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 interpreting and comparing data sets of one variable benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can 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 interpret the center and spread of the data sets graphically and numerically. Students connect their understanding of the center and spread of data sets in the context of the problems using graphs, charts and math models.

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 interpreting the shape, the center and spread of the data sets in the context of the problems benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing multiple examples of ways to solve a problem because students interpret the center and spread of the data plots graphically and numerically. Students make connections of the information graphically, numerically and verbally in the context of the data.

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 interpreting and comparing the center and spread of the data sets of one variable 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 students use the understanding of center and spread to compare and interpret different data sets to describe the implication of the solutions in the context of the problems.

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 interpretation of the center and the spread of the data sets by clarifying mathematical ideas and/or concepts through a short mini-lesson because students use different measures of center and spread to explain the meaning of center and spread in the context of the data set. Students use the interpretation of center and spread to compare two different data sets.

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 interpreting the center and spread of the data sets graphically and numerically by addressing conceptual understanding because students need to interpret the center and spread of the data sets graphically and numerically. Students interpret and compare the center and spread of 2 data sets graphically. ...

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 the application of and development of abstract thinking skills when studying interpretation of shape, center and spread of data sets because students may predict the impact on shape, center and spread of data sets when the sample changes. Students may justify possible bias of the sampling method by comparing the shape, center and spread of the data.

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?

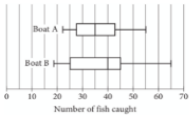
Posing Purposeful Questions: CLRI requires intentional planning around the questions posed in a mathematics classroom. It is critical to consider "who is being positioned as competent, and whose ideas are featured and privileged" within the classroom through both the types of questioning and who is being questioned. Mathematics classrooms traditionally ask short answer questions and reward students that can respond quickly and correctly. When questioning seeks to understand students' thinking by taking their ideas seriously and asking the community to build upon one another's ideas a greater sense of belonging in mathematics is created for students from marginalized cultures and languages. For example, when studying data on a single variable the pattern of questions within the classroom is critical because teachers use open-ended questions to scaffold the information that students can summarize and interpret from the data set. Students explore different perspectives of interpreting the data and its implication.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: https://satsuitequestionbank.collegeboard.org/

Question ID 4170248

Assessment	Test	Cross-Test and Subscore	Difficulty	Primary Dimension	Secondary Dimension	Tertiary Dimension	Calculator
SAT	Math	Problem Solving and Data Analysis	■■□	Problem Solving and Data Analysis	One variable data: Distributions and measures of center and spread	1. Choose an appropriate graphical representation for a given data set.	Calculator

4170248



The box plots above summarize the distribution of the number of fish caught each day on two commercial fishing boats for a season. By how many fish does the median number of fish caught each day on Boat B exceed the median number on Boat A?

Rationale

The correct answer is 5. According to the Boat A box plot, the median number of fish caught on Boat A is 35. According to the Boat B box plot, the median number of fish caught on Boat B is 40. The number of fish by which the median number of fish caught each day on Boat B exceeds the median number on Boat A is $40-35$, or 5.

https://www.insidemathematics.org/sites/default/files/materials/archery.pd

Relevance to families and communities:	**Cross-Curricular Connections:**
During a unit focused on summarizing, representing and interpreting data in a single variable, 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, using data that is relevant to the community and the summary of the data provides useful information to students regarding to their families, culture and community.	Social Studies: In high school the New Mexico Social Studies Standards state students should "explain how to use technological tools to research data, verify facts and information, and communicate findings." Consider providing a connection for students to write a report describing and analyzing a specific set of data.