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New Mexico Instructional Scope

6th Grade Statistics and Probability Guide

The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

The NMIS is a teacher-influenced tool, designed to provide instructional planning support at the programmatic level for districts and instructional level for teachers. Its foundation stems from the vision and mission of the PED and came into existence to assure that students in NM will be engaged in a culturally and linguistically responsive educational system that meets the social, emotional, and academic needs of ALL students. This is also rooted in the belief that all students must have access to on-grade-level standards, focusing on acceleration. The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

Standards are defined as the most critical prerequisite skills and knowledge. This document is color-coded to reflect both anchor and priority standards. Though previous emphasis was placed on priority standards to address lost learning due to COVID-19, New Mexico teachers should note that moving forward, while priority standards allow for acceleration of learning, all standards should be addressed in instruction throughout the school year.

In this guide you will find:

- A breakdown of each of the grade level standards within the cluster, including:
  - Standards of Mathematical Practice
  - Common Misconceptions
  - Identification of Priority Standards, as identified by NMPED.
  - Level of Rigor Identification
- Sample aligned assessment items
- Suggested Student Discourse Guide
- A multilayered system of supports (MLSS) and culturally and linguistically responsive instruction (CLR) guide

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Key		
	Priority Standard	Priority standards, as identified by NMPED, are denoted with red highlighting. Priority standards are the most critical prerequisite skills and knowledge a student needs. This does not mean that these are only standards required to be taught, just these are the standards that will allow for the acceleration the students of New Mexico need during this time.
	*Conceptual Understanding*	Conceptual Understanding standards help students build a deep understanding of the **how** and **why** of mathematics.
	*Application*	Application standards help students identify the appropriate concepts and skills to tackle **novel real-world problems.**
	*Procedural Skill and Fluency*	Procedural standards help students develop **efficiency** and **accuracy** in computations.

Standards Breakdown

- Develop understanding of statistical variability
  - 6.SP.A.1
  - 6.SP.A.2
  - 6.SP.A.3
- Summarize and describe distributions
  - 6.SP.B.4
  - 6.SP.B.5

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Grade	*CCSS Domain*	*CCSS Cluster*
6	**STATISTICS & PROBABILITY**	**Develop understanding of statistical variability**

Cluster Standard: 6.SP.A.1

Standard	**Standards for Mathematical Practice**
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:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• 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	• 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.
DOK	**Blooms**
1-2	Remember, Understand

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Grade	*CCSS Domain*	*CCSS Cluster*
6	**STATISTICS & PROBABILITY**	**Develop understanding of statistical variability**

Cluster Standard: 6.SP.A.2

Standard	**Standards for Mathematical Practice**
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.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively. • **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• 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	• 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.
DOK	**Blooms**
1-2	Understand, Analyze

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Grade	*CCSS Domain*	*CCSS Cluster*
6	STATISTICS & PROBABILITY	Develop understanding of statistical variability

Cluster Standard: 6.SP.A.3

Standard	Standards for Mathematical Practice
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.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively. • **SMP 6**: Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• 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	• 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.
DOK	**Blooms**
1-2	Understand, Analyze

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 population as a class or school (What are the shoe sizes in my	• 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

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.	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.

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Grade	*CCSS Domain*	*CCSS Cluster*
6	**STATISTICS & PROBABILITY**	**Summarize and describe distributions**

Cluster Standard: 6.SP.B.4

Standard	**Standards for Mathematical Practice**
Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• 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.	• Understand and be able to calculate the measure of center, and the quartile ranges. • Understand 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
DOK	**Blooms**
1-2	Apply, Analyze

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Grade	*CCSS Domain*	*CCSS Cluster*
6	STATISTICS & PROBABILITY	Summarize and describe distribution

Cluster Standard: 6.SP.B.5

Standard	Standards for Mathematical Practice
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.	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 2:** Reason abstractly and quantitatively.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• 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.	• 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 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.
DOK	**Blooms**
2-3	Understand, Apply

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.

Student Discourse Guide

- **Purposeful, rich classroom discourse offers students the opportunity to express their ideas, thinking, and to critique the reasoning of others in a variety of ways (writing, drawing, verbal). Purposeful implementation of classroom discourse allows students to activate funds of knowledge and to refine their mathematical understanding. When students have frequent opportunities for discourse, they find various paths to solutions and reveal knowledge or misunderstandings to educators. The process also allows educators to honor students' culture, lived experiences and evolving math identities.**
- **Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (Michaels, O'Connor, and Resnick, 2008)**

Domain: **Statistics and Probability**	Strand: **Develop understanding of statistical variability**

Suggested Student Discourse Questions

• Can you explain the similarity of how your strategy was similar to other students? • After completing solving the problem, do you think there was another approach that would have been better for solving the problem?	• What real life connections can you think of to associate with statistical variability? • How do you define statistical variability?

Domain: **Statistics and Probability**	Strand: **Summarize and describe distributions**

Suggested Student Discourse Questions

• Explain why you chose a particular type of graph to display your data? • What are the advantages and disadvantages of using a particular graph to display different types of data?	• What information from your real-life would you like to see visualized in this type of distribution? • What is the difference between mean, median, mode, range, and quartile?

ASSESSMENT GUIDE

- Develop understanding of statistical variability
- Summarize and describe distributions

Grade	*CCSS Domain*	*CCSS Strand*
6	Statistics and Probability	Develop understanding of statistical variability

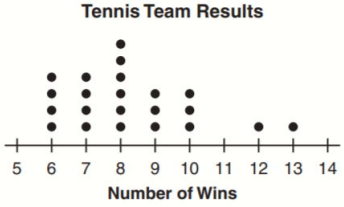
Sample Task #1 (Constructed Response)

Lisbeth owns a bookstore. She sold 87, 94, 91, and 84 books on the first 4 days of this week. Lisbeth wants to have a mean of 90 books sold after 5 days.

What is the **least** number of books Lisbeth can sell on day 5 to have a mean of 90 books sold?

Sample Task #2 (Multiple Choice)

This dot plot shows the number of wins by each player on a tennis team last season.



Which statement about the dot plot is true?

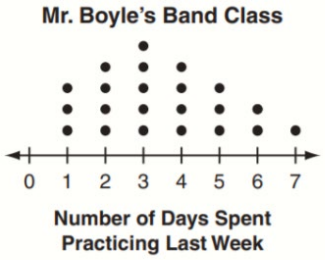
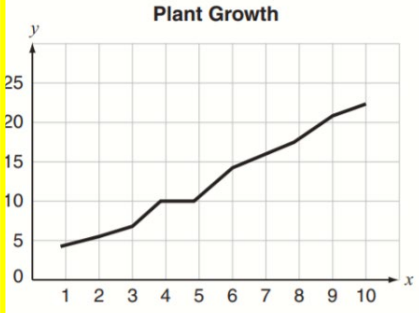
Ⓐ The spread of the data is 9 wins.

Ⓑ The data is clustered around 8 wins.

Ⓒ The tennis team has a total of 7 players.

Ⓓ The center of the data is between 9 and 10 wins.

Grade	*CCSS Domain*	*CCSS Strand*
6	Statistics and Probability	Summarize and describe distributions

Sample Task #1 (Constructed Response)
. The dot plot shows the number of days that 22 students in Mr. Boyle's band class practiced at home last week.    Mr. Boyle wants to display the data as a box plot. At what values would the box begin and end on Mr. Boyle's box plot?
Sample Task #2 (Multiple Choice)
. Marie made this line graph to represent the growth of a plant over time.    Which label is most appropriate for the vertical axis? Ⓐ Time (weeks) Ⓑ Types of Plants Ⓒ Number of Plants Ⓓ Height (centimeters)

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MLSS AND CLR GUIDE

- Develop understanding of statistical variability
- Summarize and describe distributions

CCSS Domain	*CCSS Cluster*
Statistics and Probability	**Develop understanding of statistical variability**

Culturally and Linguistically Responsive Instruction

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-moleculesorganisms-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	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative*	• Tasks: The type of mathematical tasks and instruction students receive provides the foundation for students' mathematical learning and their mathematical identity. Tasks and instructions that provide greater access to mathematics and convey the creativity of mathematics by allowing for multiple solution strategies and development of the standards

	stereotypes regarding the mathematical abilities of students of marginalized cultures and languages? • *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?*	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.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• In Grade 5, learners made line plots to display a data set of measures in fractions of a unit.	• 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.	• 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).

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*

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.
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 in 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.
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited 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.
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	
Essential Question	***Examples***
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.

CCSS Domain	***CCSS Cluster***
Statistics and Probability	**Summarize and describe distributions**

Culturally and Linguistically Responsive Instruction

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 regard 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.

Validate/Affirm/Build/Bridge	• *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?* • *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, summarizing, and describing 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.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• 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.	• 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.	• 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,

Suggested Instructional Strategies		
Pre-Teach		
Level of Intensity	***Essential Question***	***Examples***
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 3 allows refresher of prerequisite skills needed to be successful in understanding the whole concept like graphing on number lines.
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.*
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited 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 in real-time is as powerful as catching misconception or misunderstanding that needs fixed.
Intensive	What assessment data will help identify content needing	For example, some students may benefit from intensive extra time during and after a unit on summarizing and

	to be revisited for intensive interventions?	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 are clarified when confused with the concept of "mean absolute deviation" and "mean"; not be clear about the differences between bar graphs and histograms.
Extension		
Essential Question		***Examples***
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/contentstandards/6/SP/B/4/tasks/2047