NEW MEXICO
Public Education Department

8.SP: STATISTICS & PROBABILITY

Cluster Statement: A: Investigate patterns of association in bivariate data.

Supporting 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:**
8.SP.A.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	SMP 2: Students reason abstractly and quantitatively by using a table to make predictions about data that is not included in the table SMP 4: Students model with mathematics by choosing appropriate ways to display data. SMP5: Students use appropriate tools to collect data.	• Construct a Scatter Plot using two sets of quantitative data. • Identify outliers and clusters in a scatter plot. • Determine if there is a linear or nonlinear association in a scatter plot; determine if a linear association is positive or negative. • Explain what the different patterns mean in different contexts. • Describe the patterns and associations they see between two quantities. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Apply
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	SMP 3: Students construct viable arguments and critique the reasoning of others: Students can make viable arguments based on the relationships and associations determined in the scatterplot. Students discuss what makes some lines a better fit than others	• Construct a trend line and justify its placement among the data. • Model real-world linear relationships on a graph. • Use a trend line to determine whether a set of paired data has a linear association, nonlinear association or no association. • Determine whether the association is positive or negative, strong or weak. • Justify a fit line is a good fit or not. • Explain orally and/or inwriting the meaning of the fit line and

		its properties in terms of the graph's context. • Formulate an equation of the linear model. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Apply
Standard Text 8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*	**Standard for Mathematical Practices** SMP 2: Students reason abstractly and quantitatively by making sense of abstract situations as they interpret and use the slope, y-intercept and the equation of linear models to make predictions and solve real-world problems. The numerical value of the slope is interpreted in the context of the problem. SMP 6: Students practice using precise wording to describe the positive or negative association between two variables given scatter plots of data.	**Students who demonstrate understanding can:** • Use linear models to make predictions from data in a scatterplot (trend line) in context. • Interpret the slope and intercept for the context. • Write the linear equation. • Analyze and Interpret the meaning of the slope and y-intercept in a linear model from data in a scatterplot. • Make predictions from the line. **Webb's Depth of Knowledge:** 1-3 **Bloom's Taxonomy:** Apply, Analyze
Standard Text 8.SP.A.4: Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not*	**Standard for Mathematical Practices** SMP 1: Students solve problems using a linear model in the context of bivariate data SMP 2: Students explain what different patterns of association mean in specific contexts SMP 3: Students justify, orally and in writing, associations using precise mathematical language SMP 4: Students model with math by using and interpreting two-way frequency tables that represent	**Students who demonstrate understanding can:** • Create two-way frequency tables to display data. • Collect categorical data on two variables • Analyze and Interpret the data in two-way frequency tables. • Calculate relative frequencies and describe possible associations between the variables. **Webb's Depth of Knowledge:** 2-4

they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?	relationships SMP 6: Students solve problems efficiently, accurately, and with the degree of precision appropriate for the context of the problem using precise language. SMP 8: Students understand the broader applications of patterns in bivariate data and see the structure in similar situations.	**Bloom's Taxonomy:** Apply, Create
Previous Learning Connections • In 5th and 6th grade, students learn to plot points in a coordinate grid.	**Current Learning Connections** • In 8th grade, students are able to construct an equation or a function to model a linear relationship and determine/interpret the slope and y-intercept (seen in standards 8.EE.B and 8.F.B)	**Future Learning Connections** • In future courses, students compute and interpret the correlation coefficient and distinguish between correlation and causation. Students will represent two variables on a scatter plot and describe how they are related. They construct, interpret, and summarize data in a two-way table.

Clarification Statement:
Students construct scatter plots and interpret patterns focusing on linear association. They construct two-way tables and interpret relationships using relative frequencies.

Common Misconceptions

- Students may make the error of not reading the plot from left to right; students may interpret a roughly linear relationship will only be will only be shown with data points that fall directly on a line.
- Sometimes when a scatter plot shows no association, students may struggle so they need examples of data that may have no association (length of a person's hair and his or her final grade in mathematics).
- Students may struggle with numbering the axes so that the data is visible, but not misleading.
- Students often think that a line of fit must go through at least some of the data points on the scatter plot.

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 previews new contexts for tasks within the unit when studying patterns of association in bivariate data because students can oftentimes express patterns in data when presented in context versus presented as a scatter plot with an equation. Students can generalize about relationships between categorical data based on experiences and context from their lives prior to introducing the mathematical practices associated with forming these generalizations.

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

- 5.G.A.2: This standard provides a foundation for work with interpreting values of points in the context of a situation to develop the recognition of patterns between data and scatter plot representations and two way tables because students interpret real word

problems and produce a graph based on information gathered from the problem. This learning is essential when it comes to developing awareness of how real-world information is represented visually and how visual representations relate to each other. 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 investigations of patterns of association in bivariate data benefit when learning experiences include ways to recruit interest such as providing contextualized examples to their lives because when the bivariate data they collect, create scatterplots, create two-way frequency tables and make connections to a linear model is relevant to them they are able to make connections to the standards. When the concepts are relevant to them, they take interest in their learning.

Build

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

- For example, learners engaging with investigations of patterns of association in bivariate data benefit when learning experiences attend to students' attention and affect to support sustained effort and concentration such as creating cooperative learning groups with clear goals, roles, and responsibilities because together students can collect and analyze bivariate data. When making connections to a linear model, students can discuss and defend their choice of the placement of the line of best fit (trend line). Students can collaborate with their group and choose the best representation of the data.

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 investigations of patterns of association in bivariate data benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity can comprehensibility for all learners such as embedding visual, non-linguistic supports for vocabulary clarification (pictures, videos, etc.) because when creating the visual of a scatter plot, two-way table, outliers, clusters and a trend line, students can make connections to the key vocabulary and concepts. Students can create a graphic organizer with visual clues for the key concepts.

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 investigations of patterns of association in bivariate data benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing differentiated feedback (e.g., feedback that is accessible because it can be customized to individual learners) because looking for patterns in bivariate data may be difficult for some students to

internalize. Looking for the best linear model might be difficult for some students to see and apply to making predictions.

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 investigations of patterns of association in bivariate data 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 investigations of patterns of association in bivariate data requires students to organize their data in graphs and tables.

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 patterns of association in bivariate data by examining tasks from a different perspective through a short mini-lesson because interpretation of data, especially using straight lines to model relationships, leaves room for discussion amongst peers for how a student arrives at a particular conclusion. If students are struggling with drawing conclusions, hearing examples and seeing peers model their thinking may help alleviate misconceptions.

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 of recognizing patterns of association in bivariate data by addressing conceptual understanding because many scaffolded skills produce mastery of this cluster. Students need to be able to construct and interpret a scatter plot, describe relationships using statistical jargon, assess model fit, use and interpret equations and read and construct two-way tables. By addressing conceptual understanding of each of these skills, misconceptions can be revealed.

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 patterns of association in bivariate data because data collection is heavily supported in 8th grade Science. Instead of being given a two-way table, students can conduct experiments in connection with NGSS science standards, collect bivariate data, represent that data in a two-way table, and hypothesize correlations between the two variables.

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?

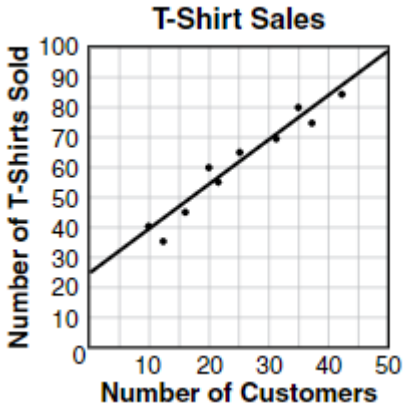
Task: When planning with your HQIM consider how to modify tasks to represent the prior experiences, culture, language and interests of your students to "portray mathematics as useful and important in students' lives and promote students' lived experiences as important in mathematics class." Tasks can also be designed to "promote social justice [to] engage students in using mathematics to understand and eradicate social inequities (Gutstein 2006)." For example, when studying patterns of association in bivariate data the types of mathematical tasks are critical because all students need to make connections to mathematics to make it relevant to them. Teachers can build/bridge various cultures and linguistics behaviors by creating tasks where students collect data that is relevant to them. When students display their data in tables and scatter plots, they can analyze the data and study trends that they relate to their personal lives.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: Cognia Formative Item Set for Grade 8 Statistics and Probability

8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

- Learning Target: I can interpret the line of best fit from a scatterplot of data to make a prediction.
- Webb's Depth of Knowledge: 2

Albert works in a store that sells T-shirts. He made this graph to show the relationship between the number of customers that come into the store each day and the number of T-shirts the store sells that day.



Based on the graph, about how many T-shirts would be sold on a day when 100 customers come into the store?

A. 150
B. 175
C. 200
D. 22

Relevance to families and communities:	**Cross-Curricular Connections:**
During a unit focused on studying patterns of association in bivariate data, 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, having students survey their	Science: Students can conduct experiments in connection with NGSS science standards, collect bivariate data, represent that data in a two-way table, and hypothesize correlations between the two variables.

families, bring back the data and share with the class. The class can then create a two-way frequency table and a scatter plot that represents their data and the classroom's data. They can use the data to see if there is a correlation between their data and the classroom data. (Height and shoe size).	Social Studies: Study trends in overtime such as populations, the stock market or gross domestic product.