Unpacked South Dakota State Mathematics Standards

Purpose: *In order for students to have the best chance of success, standards, assessment, curriculum resources, and instruction must be aligned in focus, coherence, and rigor. Unpacked standards documents are intended to help align instruction to the focus, coherence, and rigor of the South Dakota State Mathematics Standards. The standards have been organized in clusters as they are not so much built from topics, but rather woven out of progressions. Not all content in a given grade is emphasized equally in the mathematics standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. To say that some things have greater emphasis is not to say that anything in the standards can safely be neglected in instruction. Neglecting standards will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.*

Domain: Statistics and Probability	Grade Level: 8th

8.SP.A Cluster: Investigate patterns of association in bivariate data.

Construct scatter plots and interpret patterns focusing on linear association. Construct two-way tables and interpret relationships using relative frequencies.

**This is a SUPPORTING cluster. *Students should spend the large majority of their time (65-85%) on the major work of the grade.* *Supporting* *work and, where appropriate, additional work should be connected to and engage students in the major work of the grade.*

8.SP.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.

8.SP.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 (i.e. line of fit), and informally assess the model fit by judging the closeness of the data points to the line.

8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and the y-intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.SP.4 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 they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Aspects of Rigor: (Conceptual, Procedural, and/or Application)

Conceptual Understanding	*Procedural Fluency*	*Application*
Understand the patterns displayed in a scatter plot such as **(8.SP.1)** ● clustering ● outliers ● positive/negative association ● linear/nonlinear association Identify independent and dependent variables. **(8.SP.1)**	Construct a scatter plot. **(8.SP.1)** Describe the pattern displayed in a scatter plot in terms of **(8.SP.1)** ● clusters ● outliers ● positive/negative associations ● linear/nonlinear associations	Interpret the pattern displayed in a scatter plot (ex: As the hours worked increase, my wages increase). **(8.SP.1)**
Understand that a linear association	Draw a straight line that models the	

is modeled by a straight line. **(8.SP.2)**	linear association. **(8.SP.2)**	
Understand the equation of the linear model is constructed from the trend line (not the individual points of the scatter plot). **(8.SP.3)** Understand how to find slope and y-intercept from a trend line. **(8.SP.3)**	Write the equation of a trend line. **(8.SP.3)**	Interpret the meaning of the slope and y-intercept in the context of the scatter plot. **(8.SP.3)** Use the equation of the trend line to make predictions. **(8.SP.3)**
Understand a single cell in a two-way table represents the intersection of a row and a column. **(8.SP.4)**	Construct a two-way table. **(8.SP.4)** Calculate relative frequencies. **(8.SP.4)**	Use the relative frequencies to make comparisons. **(8.SP.4)**

Enacting the Mathematical Practices - Evidence of Students Engaging in the Practices

1. **Make sense of problems and persevere in solving them.**
    - After using an equation to make a prediction, check the accuracy of the answer on the trend line and vice versa.
    - Use and compute the correct relative frequency to make a comparison from a two-way table.
2. **Reason abstractly and quantitatively.**
    - Interpret the slope and y-intercept represented by a linear association.
3. **Construct viable arguments and critique the reasoning of others.**
    - Critique the trend lines of others and informally assess the accuracy of the trend lines.
    - Construct an argument and explain the reasoning of a comparison from a two-way table.
4. **Model with mathematics.**
    - Roughly fit a line to a scatter plot to make predictions.
5. **Use appropriate tools strategically.**
    - Construct a two-way table to represent categorical data.
6. **Attend to precision.**
    - Use the labels on x- and y-axes to accurately describe and interpret the real-world situation.
7. **Look for and make use of structure.**
    - Describe the patterns displayed in a scatter plot.
    - Describe the relationships displayed in a two-way table.
8. **Look for and express regularity in repeated reasoning.**

Vertical and Horizontal Coherence and Learning Progressions

| *Previous Learning Connections*	*Current Learning Connections*	*Future Learning Connections*
In 5th and 6th grade, learners 1. plot points in a coordinate grid	In 8th grade, learners 1. construct an equation or a function to model a linear relationship and determine/interpret the slope and y-intercept (seen in 8.EE.B and 8.F.B)	In high school, learners 1. compute and interpret the correlation coefficient 2. distinguish between correlation and causation 3. represent two variables on a scatter plot and describe how they are related 4. construct, interpret, and summarize data in a two-way table

- scatter plot
- cluster
- linear association
- negative association
- outlier

- positive association
- trend line
- slope
- *y*-intercept

- categorical variable
- frequency
- relative frequency
- two-way table

Relevance, Explanations, and Examples:

8.SP.1:   Some textbooks may use the term correlation in place of association.
Independent Variable (x-axis): the variable that you CANNOT control (time)
Dependent Variable (y-axis): the variable that you CAN control (distance)

8.SP.2: Linear association with a trend line
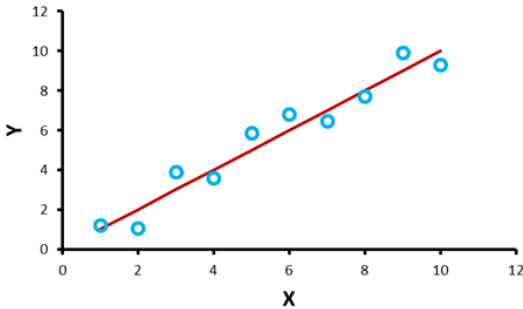
8.SP.4:
Two-Way Table with Relative Frequencies by Rows

	Math	English	Science	Totals
Girls	$\frac{50}{150} = 0.33$	$\frac{40}{150} = 0.27$	$\frac{60}{150} = 0.40$	$\frac{150}{150} = 1.00$
Boys	$\frac{65}{165} = 0.39$	$\frac{30}{165} = 0.18$	$\frac{70}{165} = 0.42$	$\frac{165}{165} = 1.00$
Totals	$\frac{115}{315} = 0.37$	$\frac{70}{315} = 0.22$	$\frac{130}{315} = 0.41$	$\frac{315}{315} = 1.00$

Two-Way Table with Relative Frequencies by Columns

Two-Way Frequency Table

	Spanish	French	German	Total
Boys	10	2	8	20
Girls	15	12	3	30
Total	25	14	11	50

Divide each column entry by that column's total

Two-Way Relative Frequency Table
(with respect to table columns)

	Spanish	French	German	Total
Boys	0.4	0.14	0.73	0.4
Girls	0.6	0.86	0.27	0.6
Total	1.00	1.00	1.00	1.00

Achievement Level Descriptors

Cluster: Investigate patterns of association in bivariate data.

Concepts and Procedures	**Level 1:** Students should be able to investigate a scatter plot for clustering between two quantities and construct a scatter plot from given data.They should be able to construct a two-way frequency table of given categorical data.
	Level 2: Students should be able to investigate a scatter plot for positive, negative, and linear association and informally fit a line to data for a given scatter plot that suggests a linear association.They should be able to calculate frequencies from categorical data in a two-way frequency table.
	Level 3: Students should be able to investigate a scatter plot for patterns such as outliers and nonlinear association. They should be able to write an equation for the trend line or line of best fit for a given scatter plot with a linear association.They should also be able to interpret and use relative frequencies from a two-way table to describe possible association between two variables.
	Level 4: Students should be able to use scatter plots,trend lines, and associations between variables in two-way frequency tables to make predictions in real-world situations.