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: 6**

6.SP.B Cluster: Summarize and describe distributions.

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.

****This is an ADDITIONAL 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.*

6.SP.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.5 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.

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

Conceptual Understanding	***Procedural Fluency***	***Application***
	Create dot plots, histograms, and box plots from numerical data. **(6.SP.4)**	
Understanding that the number of observations is the sample size. (Example: ten data points is a sample size of ten or n=10). **(6.SP.5a)** Understanding how sample size is represented in a dot plot vs histogram, vs box plot. **(6.SP.5a)**		
Understanding the initial survey question as numerical vs categorical (quantitative vs qualitative) data. (6.SP.5b)	Describe the data by reading the graph's labels (units used). **(6.SP.5b)**	

Understanding the method used to collect the data points (count or measure). **(6.SP.5b)**		
Using the correct context, describe the overall pattern including any striking deviations such as outliers. **(6.SP.5c)**	Compute the measures of center: median and/or mean. **(6.SP.5c)** Compute the measures of variability: interquartile range and/or mean absolute deviation. **(6.SP.5c)**	
Understanding which measure of center (mean/median) or measure of variability can best represent a set of data. **(6.SP.5d)** Understanding how measures of center and variability change the shapes of distribution. **(6.SP.5d)**		

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

1. **Make sense of problems and persevere in solving them.**
2. **Reason abstractly and quantitatively.**
    - Examine patterns in data and draw conclusions from those patterns.
3. **Construct viable arguments and critique the reasoning of others.**
    - Construct arguments using verbal or written explanations for models, graphs, tables and other data displays.
    - Students write and share their own statistical questions that can be used to survey and collect data from classmates. They explain their thinking to others and respond to others' thinking.
4. **Model with mathematics.**
    - Use measures of center and variability and data displays to draw inferences about and make comparisons between data sets.
    - Students choose the most appropriate format for displaying data.
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
    - Students communicate precisely with others and use clear mathematical language when describing and explaining the connections between different representations of data sets.
    - Students use mathematical language when summarizing, describing and reading data from graphs generated by students.
7. **Look for and make use of structure.**
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 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

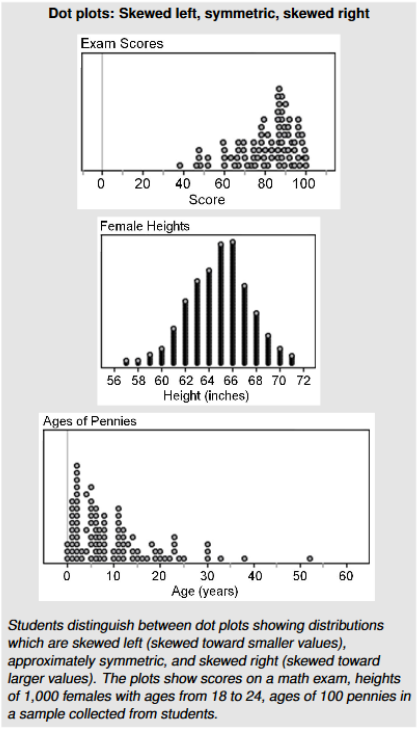
		spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Vocabulary *(Key Terms Used by Teachers and Students in this Cluster):*

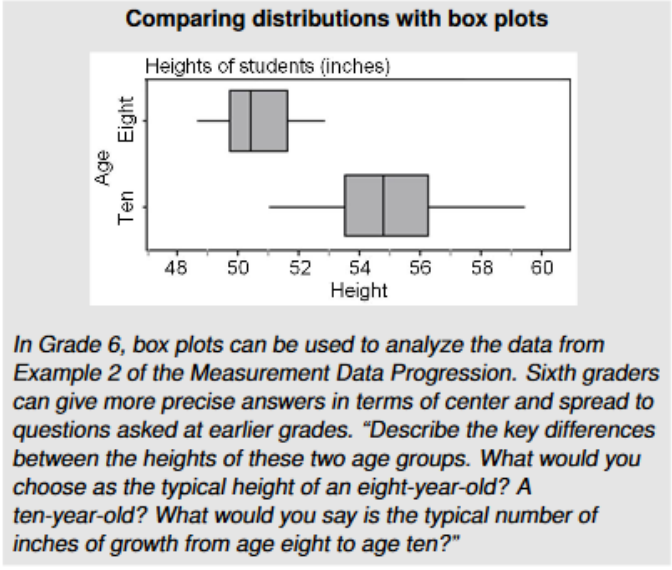
- Box Plot
- Categorical Data
- Data
- Dot Plot
- Histogram
- Interquartile Range
- Mean
- Mean Absolute Deviation
- Measures of Center
- Median
- Mode
- Range
- Sample
- Sample Space
- Statistics
- Statistical Question
- Variability

Relevance, Explanations, and Examples:

In Grade 6, a basis for statistics is built with the foundation of measures of center and measures of variability. Learners will represent data sets through different models such as box plots, histograms, and dot plots. Basic interpretation of the models is done in Grade 6. For the most part, these standards are not picked up again until high school mathematics.



Students distinguish between dot plots showing distributions which are skewed left (skewed toward smaller values), approximately symmetric, and skewed right (skewed toward larger values). The plots show scores on a math exam, heights of 1,000 females with ages from 18 to 24, ages of 100 pennies in a sample collected from students.



In Grade 6, box plots can be used to analyze the data from Example 2 of the Measurement Data Progression. Sixth graders can give more precise answers in terms of center and spread to questions asked at earlier grades. "Describe the key differences between the heights of these two age groups. What would you choose as the typical height of an eight-year-old? A ten-year-old? What would you say is the typical number of inches of growth from age eight to age ten?"

Achievement Level Descriptors

Cluster: **Summarize and describe distributions.**

Concepts and Procedures	**Level 1:** Students should be able to summarize or display numerical data on a number line, in dot plots, and in histograms; find the median of an odd number of data points; and find the mean when data points are nonnegative integers.
	Level 2: Students should be able to calculate mean and median, understand that mean and median can be different or the same, and use the measure of center to summarize data with respect to the context. Threshold: The student who just enters Level 2 should be able to: ● Understand that questions that lead to variable responses are statistical questions and vice versa. ● Identify a reasonable measure of central tendency for a given set of numerical data. ● Find mean and median.
	Level 3: Students should be able to summarize or display data in box plots and find the interquartile range. They should be able to use the interquartile range along with the angle and measures of center to describe overall patterns in a data distribution, such as symmetry and clusters, and any striking deviations. They should also be able to examine a data set in context and explain the choice of the mean or median, as it relates to the data. Threshold: The student who just enters Level 3 should be able to: ● Identify a reasonable center and spread for a given context and understand how this relates to the overall shape of the data distribution. ● Understand that a measure of center summarizes all of its values with a single number. ● Summarize or display data in box plots. ● Find the interquartile range. ● Use range and measures of center to describe the shape of the data distribution as it relates to a familiar context. ● Pose statistical questions.
	Level 4: Students should be able to relate choice of measures of center and variability to the shape of the data distribution in context of the data; find mean absolute deviation and identify outliers with reference to the context of the situation; and predict effects on the mean and median, given a change in data points. Threshold: The student who just enters Level 4 should be able to: ● Predict effects on mean and median given a change in data points. ● Complete a data set with given measures (e.g., mean, median, mode, interquartile range).