TEKS Cluster: Data Analysis

8.5 **Proportionality.** The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions.

8.11 **Measurement and data.** The student applies mathematical process standards to use statistical procedures to describe data.

Representation of Data

Supporting Standards

8.11(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data

Non-tested Standards

8.11(C) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected

Interpretation of Data

Readiness Standards

8.5(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions

Supporting Standards

8.5(C) contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation

8.11(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data

8.11(B) determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points

8.11(A)

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data

Stimulus

Word Problem*	Verbal Description*	Chart/Table	Graph*
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

scatterplot*

Interesting Items

8.11(A) 2021 #17

Role in Concept Development

Supports

8.5(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions

Connection/ Relevance

The ability to construct a scatterplot and describe the observed data as linear, non-linear, or no association between bivariate data is the foundation for students to use a trend line to approximate the linear relationship between bivariate sets of data in order to make predictions.

When to Teach

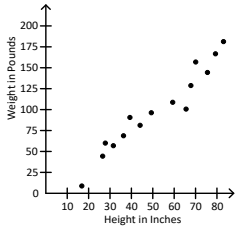
Before/With 8.5(D)

Instructional Implications

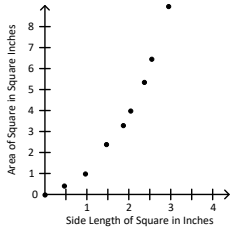
Students should construct scatterplots and describe association such as linear, non-linear, or no association between bivariate data (i.e. data with two variables involved where each axis on a coordinate grid represents one of the two variables).

Instruction should include students describing the association between the bivariate data for a scatterplot in order to answer questions concerning association such as linear, non-linear, or no association between bivariate data. Associations may also be described as positive trend, negative trend, or no trend.

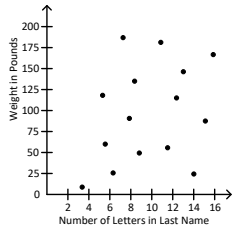
Graph A



Graph B



Graph C



Learning from Mistakes

Students may make the following mistakes:

- Assuming scatterplots that would be categorized as having no correlation can be generalized as linear or non-linear

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

8.11(C) **(C) simulate generating random samples of the same size from a population with known characteristics to develop the notion of a random sample being representative of the population from which it was selected**

Stimulus

Word Problem	Verbal Description	Chart/Table	Graph
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Academic Vocabulary

random sample

Role in Concept Development

Supports

8.11 The student applies mathematical process standards to use statistical procedures to describe data.

Connection/ Relevance

Conducting simulations to generate random samples supports a student's ability to use statistical procedures to describe data.

When to Teach

With 8.11

Instructional Implications

Students simulate generating random samples of the same size from a population with known characteristics. It is important for students to understand that it is sometimes impossible to gather data from an entire population, so the purpose of gathering and using data from random samples of the population is to make inferences and predictions that apply beyond the available set of data.

Instruction should include the design of simulations (with and without technology) and a discussion as to whether or not they are random. Instruction may use a random number generator to perform many simulations using a selected sample size with given conditions.

It is important to remember that when using a random number generator, the students need to "reseed" the random number generator.

Learning from Mistakes

Students may make the following mistakes:

- Assuming any simulation is random if technology is involved
- Thinking that any type of sample, other than random, is representative of a population

8.5(D) Readiness

TEKS Scaffold

TEKS	Student Expectation
8.5(D)	**8.5 Proportionality.** The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to: **(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions**
8.5(C)	contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation (S)

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph*
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

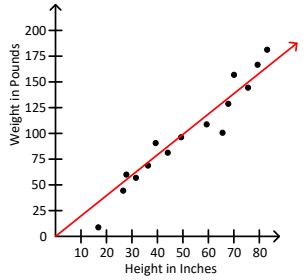
Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Content Builder (see Appendix for Tree Diagram)

- Use a trend line to approximate a linear relationship between bivariate sets of data to make predictions

Instructional Implications

Students should use a trend line (i.e. a line on a scatterplot that indicates the statistical pattern of a set of data) that approximates the linear relationship between bivariate sets of data to make predictions. Using the trend line, predictions may be made concerning the data in the table (e.g., according to the trend line, someone who is approximately 55 inches tall would weigh approximately 110 pounds). Instruction should include experiences where the trend line may or may not go through the origin (0,0) or may or may not extend past the given data points.



Learning from Mistakes

Students may make the following mistakes:

- Thinking a trend line must connect all the points in the data set
- Confusing the *x*- and *y*-intercept to predict data values of a trend line*

Academic Vocabulary

linear relationship
trend* line

Interesting Items

8.5(D) 2023 #28
8.5(D) 2019 #37
8.5(D) 2016 #23

8.5 Proportionality. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

8.5(C) **(C) contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation**

Stimulus

Word Problem	Verbal Description	Chart/Table	Graph*
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

linear relationship*
no association
non-linear relationship

Interesting Items

N/A

Role in Concept Development

Supports

8.5(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions

Connection/ Relevance

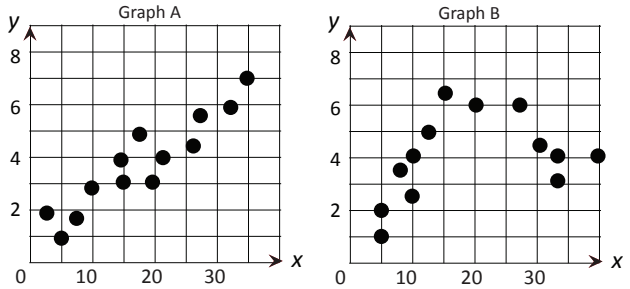
The ability to contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data and that do not suggest a linear relationship using a graphical representation is the foundation for students to use a trend line to approximate the linear relationship between bivariate sets of data in order to make predictions.

When to Teach

Before/Prerequisite to 8.5(D)

Instructional Implications

Instruction should include graphical representations of bivariate sets of data (data with two variables involved where each axis on a coordinate grid represents one of the two variables) in order to contrast between bivariate sets of data that suggest a linear relationship and bivariate sets of data that do not suggest a linear relationship.



Through the use of graphs, students are able to visualize the bivariate sets of data that suggest a linear relationship (e.g., Graph A represents a linear relationship between *x* and *y*) and those that do not (e.g. Graph B represents a non-linear relationship between *x* and *y*). Instruction should include discussions that have students write statements contrasting the differences between the graphical representations.

Learning from Mistakes

Students may make the following mistakes:

- Overgeneralizing scatterplot correlations as those which will appear in an ascending or descending linear representation; assuming scatterplots would not be categorized as having a correlation when the data appears as a horizontal linear representation*

8.11(A)

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data

Stimulus

Word Problem*	Verbal Description*	Chart/Table	Graph*
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

correlation*/trend
positive linear association*
non-linear association*/ relationship*
negative linear association*
no association*

Interesting Items

8.11(A) 2021 #17

Role in Concept Development

Supports

8.5(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions

Connection/ Relevance

The ability to construct a scatterplot and describe the observed data as linear, non-linear, or no association between bivariate data is the foundation for students to use a trend line to approximate the linear relationship between bivariate sets of data in order to make predictions.

When to Teach

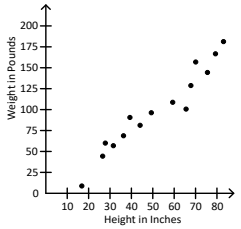
Before/With 8.5(D)

Instructional Implications

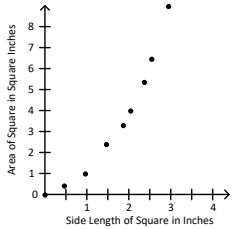
Students should construct scatterplots and describe association such as linear, non-linear, or no association between bivariate data (i.e. data with two variables involved where each axis on a coordinate grid represents one of the two variables).

Instruction should include students describing the association between the bivariate data for a scatterplot in order to answer questions concerning association such as linear, non-linear, or no association between bivariate data. Associations may also be described as positive trend, negative trend, or no trend.

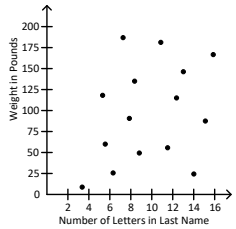
Graph A



Graph B



Graph C



Learning from Mistakes

Students may make the following mistakes:

- Assuming scatterplots that would be categorized as having no correlation can be generalized as linear or non-linear

8.11(B)

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

(B) determine the mean absolute deviation and use this quantity as a measure of the average distance data are from the mean using a data set of no more than 10 data points

Stimulus

Word Problem*	Verbal Description	Chart/Table*	Graph
Equation/ Expression	Ordered Pairs	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

mean absolute deviation*

Interesting Items

8.11(B) 2022 #30

Role in Concept Development

Supports

8.11 The student applies mathematical process standards to use statistical procedures to describe data.

Connection/ Relevance

Determining the mean absolute deviate supports a student's ability to use statistical procedures to describe data.

When to Teach

With 8.11

Instructional Implications

Students should determine the mean absolute deviation (i.e. a measure averaging the absolute value of the differences between each data point and the mean value of the data set) using a data set.

Instruction should include a data set (no more than 10 data points) where students calculate:

- the mean average
- the absolute value of the difference between each data value and the mean (absolute deviation from the mean)
- the mean average of these absolute value differences

Mean absolute deviation is used to describe the variability of a data set. Instruction should include students comparing the mean absolute deviation to the mean of a data set. Students should generalize that the closer the mean absolute deviation is to zero, the less variability exists in the data set.

Refer to the table at right that represents a set of ten math grades for a student.

Data Value	Absolute Deviation from the Mean
64	$\|64 - 83.7\| = \|-19.7\| = 19.7$
79	$\|79 - 83.7\| = \|-4.7\| = 4.7$
90	$\|90 - 83.7\| = \|6.3\| = 6.3$
84	$\|84 - 83.7\| = \|0.3\| = 0.3$
92	$\|92 - 83.7\| = \|8.3\| = 8.3$
83	$\|83 - 83.7\| = \|-0.7\| = 0.7$
81	$\|81 - 83.7\| = \|-2.7\| = 2.7$
100	$\|100 - 83.7\| = \|16.3\| = 16.3$
94	$\|94 - 83.7\| = \|10.3\| = 10.3$
70	$\|70 - 83.7\| = \|-13.7\| = 13.7$
Sum = 837	Sum = 83
Mean Score = 837 ÷ 10 = 83.7	
Mean Absolute Deviation = 83 ÷ 10 = 8.3	

Learning from Mistakes

Students may make the following mistakes:

- Calculating the mean instead of the mean absolute deviation
- Not identifying absolute value as a positive value
- Forgetting to divide the sum of the absolute values from the mean by the total number of items in the data set