Trigonometry and Statistics

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Chris Foley cfoley@lrhsd.org ext. 8465

Chris Callinan ccallinan@lrhsd.org ext. 8364

Robert Kibler rkibler@lrhsd.org ext. 8583

Mike Spera mspera@lrhsd.org ext. 8340

Unit 7 Linear Regression and Correlation **Level 3** **Approximately 15 days**

Stage 1 – Desired Results

Established Goals

2009 NJCCC Standard(s), Strand(s)/CPI #
(http://www.nj.gov/education/cccs/2009/final.htm)

Common Core Curriculum Standards for Math and English
(http://www.corestandards.org/)**Creating Equations A.CED: #2**
Create Equations that Describe Numbers and Relationships

Interpreting Categorical and Quantitative Data: S.ID: #1-4
Summarize, represent, and interpret data on a single count or measurement variable

Interpreting Categorical and Quantitative Data: S.ID: #5-6
Summarize, represent, and interpret data on two categorical and quantitative variables.

Interpreting Categorical and Quantitative Data: S.ID: #7-9
Interpret linear models

Making inferences and Justifying Conclusions: S.IC: #1,3,6
Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

21st Century Themes
(www.21stcenturyskills.org)

___ Global Awareness
_x__Financial, Economic, Business and Entrepreneurial Literacy
___Civic Literacy
___Health Literacy
___Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x _Information Literacy
___Media Literacy
_x_ICT (Information, Communications and Technology) Literacy

	Life and Career Skills: _x__Flexibility and Adaptability _x__Initiative and Self-Direction ___ Social and Cross-Cultural Skills _x__Productivity and Accountability _x__Leadership and Responsibility
Enduring Understandings: *Students will understand that . . .* *EU 1* • linear bivariate data can be represented and analyzed through correlation and linear regression. *EU 2* • the strength of a linear relationship can be based on the correlation coefficient.	**Essential Questions:** *EU1* • What are the benefits of performing a linear regression analysis? • How can the rate of change determined through analysis of bivariate data be interpreted? *EU 2* • What is the relevance of the correlation coefficient that is determined through analysis of bivariate data? • What is the accuracy of your prediction obtained from your linear regression equation? • What are the faults of predictions based upon the extrapolation of data? • How can causation between two variables be established? • How can outside variables effect the perceived relationship between two variables?

Knowledge: *Students will know . . .*	**Skills:** *Students will be able to . . .*
EU1 • the difference between the explanatory variable and the response variable in bivariate data. • the importance of identifying the explanatory and response variables prior to performing a linear regression analysis. • the graphing calculator can be used to create scatter plots, obtain the correlation coefficients, and obtain linear regression equations. • the meaning of rate of change (slope) of the linear regression equation and how slope relates to the data that is analyzed. • whether or not the constant value (y-intercept) of the linear regression equation is a relevant value.	*EU1* • establish which variable is explanatory and which is the response variable before performing a linear regression analysis. • create a scatter plot using a calculator graphing tool. • determine the domain of the explanatory variable. • utilize the linear regression equation to make predictions within the domain of the explanatory variable. • interpret the meaning of the rate of change between explanatory and response variable. • interpret the relevance of the constant term in the linear regression equation.
EU 2 • the relationship between the correlation coefficient and the predictability of the linear regression equation. • that the correlation coefficient is a value from -1 to 1 that represents the strength of the association between two linearly related variables. • That the linear regression equation is used to make predictions about data based within the domain of the explanatory variable. • the meaning of extrapolation and the problems that may arise from using the linear regression equation to make predictions outside of the domain of the explanatory variable. • that causation cannot be concluded based on the correlation coefficient. • the effects of confounding and lurking variable on the perceived relationship between two variables.	*EU 2* • obtain the correlation coefficient and the linear regression equation using a calculator graphing tool. • assess the predictability of a linear regression equation based on the value of the correlation coefficient. • list concerns that may arise from making predictions about values outside of the domain of the explanatory variable. • identify possible lurking and confounding variables.

Stage 2 – Assessment Evidence

Recommended Performance Tasks: PERFORMANCE TASK – Regression & Correlation

EU 1 - linear bivariate data can be represented and analyzed through correlation and linear regression.

EU 2 - the strength of a linear relationship can be based on the correlation coefficient.

Baseball is known as America's favorite pastime. The game is built on statistics and are kept for every aspect of the game from number of wins a team records in a given year to the amount of homeruns a player hits in day games when the temperature is greater than 80 degrees. Sabermetrics however, starting with Bill James in the 1970's, have begun to look at a statistics differently than a "baseball purist" does using statistics to make predictions about a player's potential and how to maximize the returns on their investments.
In this task, two students will research baseball statistics to determine if there is a relationship between 2 variables of the game. The question you will be analyzing is: Can I use variable 1 to make an accurate prediction about variable 2.
Here is an example:

Question:	Can the number of runs a team scores in a given season be predicted based on the number of walks then earn during that season?
Data:	Obtained from www.espn.com
Correlation:	r = +0.60
Equation:	predicted number of runs = 234.26 + 0.384(number of walks)

TASK

- Decide to either focus on team statistics or player statistics
- Determine 3 relationships (questions) that needs to be analyzed
- Research the data using the resources
- For each of the three questions, create a scatter plot and determine the correlation and linear regression equation
- Write a 1 paragraph synopsis for each question
- Write a conclusion paragraph about baseball statistics and their ability to be used for predictions

All other specifications and requirements are to be determined by the classroom teacher.

Other Recommended Evidence: *Tests, Quizzes, Prompts, Self-assessment, Observations, Dialogues, etc.*

- Assessment
  - identifying explanatory/response variables
  - scatter plots
  - correlation coefficient
  - linear regression equation

- Assessment
  - predictions based on the linear regression equation
  - identifying lurking/confounding variables
  - causation
  - extrapolation

- Cumulative Linear Regression Unit Assessment

- Assessed elements from the performance task

- Other teacher-graded evaluations

Stage 3 – Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:

- TI-Nspire Activity #1: Linear Modeling (M,T)
  - Students will use a moveable line to find a line of fit for a data set.
  - Students will interpret the slope and y-intercept of the equation of their line of fit.
  - Students will make predictions using their line of fit.
  - Students will use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept (CCSS).
  - Students will model with mathematics (CCSS Mathematical Practice).
  - Students will use appropriate tools strategically (CCSS Mathematical Practice).
    http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=17260

- TI-Nspire Activity #2: Linear Modeling (M,T)
  - Students will recognize that the correlation coefficient describes the strength and direction of the linear association between two variables.
  - Students will recognize that when two variables are highly linearly correlated, their correlation coefficient will be close to -1 or 1 , and when they have little correlation, the correlation coefficient will be close to 0.
  - Students will recognize that two variables with a high correlation coefficient might have a scatterplot that displays a nonlinear pattern.
  - Students will recognize that correlation is not affected by the choice of x or y, that is, by the choice of which variable is explanatory and which is response.
  - Students will make sense of problems and persevere in solving them (CCSS Mathematical Practices).
  - Students will reason abstractly and quantitatively (CCSS Mathematical Practices)
    http://education.ti.com/calculators/downloads/US/Activities/Detail?ID=16928

Critical Vocabulary:

correlation
regression
scatterplot
independent variable
dependent variable
outlier
influential point
confounding variable
lurking variable
correlation coefficient
extrapolation
causation

Below is the suggested sequence of learning activities and number of days for the Trigonometry and Statistics class. Adjustments should be made accordingly for other levels.

Approximate time for completion of unit: 18 Days
Student will

- graph scatter plots of bivariate data using a graphing calculator.
- Ti-Nspire Activity #1 (M,T)
- identify the difference between explanatory and response variables. (M)
- compute the correlation coefficient using the graphing calculator (A)
- compute the linear regression equation using the graphing calculator (A)
- examine relationships of data through form, direction, and strength using the correlation coefficient and linear regression equation. (M)
- Ti-Nspire Activity #2 (M,T)
- make predictions using the linear regression equation. (M,T)
- understand that extrapolation can lead to misleading predictions made by the linear regression equation. (M)