

Probability and Statistics

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Unit 2 Linear Regression and Correlation

Students will be able to independently use their learning to analyze bivariate data.

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: #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
- Financial, Economic, Business and Entrepreneurial Literacy
- Civic Literacy
- Health Literacy
- Environmental Literacy

21st Century Skills

Learning and Innovation Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and Career Skills:
 Flexibility and Adaptability
 Initiative and Self-Direction
 Social and Cross-Cultural Skills
 Productivity and Accountability
 Leadership and Responsibility

Enduring Understandings:

Students will understand that . . .

EU 1

- Bivariate data can be represented and analyzed.

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 slope of a linear regression equation be interpreted?
- How can the correlation coefficient of a data set be interpreted?

EU 2

- What is the relevance of the correlation coefficient?
- What is the accuracy of a prediction obtained from a linear regression equation?
- In what ways can mistakes be made using a linear regression equation to make predictions?

Knowledge:

Students will know . . .

EU1

- the difference between the independent and dependent variables.
- the importance of identifying the independent and dependent 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 slope in a linear regression equation
- the relationship of the slope to analyzed data
- whether or not the y-intercept of the linear regression equation is a relevant value

EU 2

- The relationship between the correlation coefficient and the predicatability of the linear regression equation
- the key characteristics of a correlation coefficient
- that the linear regression equation is used to make predictions about the data
- the dangers of extrapolation, causation and confounding/lurking variables

Skills:

Students will be able to . . .

EU1

- establish the independent and dependent variables.
- 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

- 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 independent variable.
- identify possible lurking and confounding variables and discuss their effects on the relationship

Stage 2 – Assessment Evidence

Recommended Performance Tasks: Regression & Correlation College comparison

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

Assessments to include:

- identifying independent/dependent variables
- scatter plots
- correlation coefficient
- linear regression equation
- 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 of the operational cost of airplanes (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: Monopoly and regression (T)
 - Students will analyze the linear association between two variables and interpret the association in the context of a given scenario.
 - <http://education.ti.com/en/timathnspired/us/detail?id=E04653589D754CAF85B04C347A5110E9&sa=44D0E51546AF420EA579740D43F22FC7&t=BB882AF9CFE64956A44C2293970263FD>
- Hula Hoop Activity: Goal is to find an equation that would represent the amount of time, in seconds, that it would take to move a hula hoop from one end of a line to the other with people holding hands and stepping through the hula hoop.

Critical Vocabulary:

- correlation coefficient
- regression
- scatterplot
- independent variable
- dependent variable
- outlier
- influential point
- confounding variable
- lurking variable
- correlation coefficient,
- extrapolation
- causation
- residual
- coefficient of determination

The following are the suggested learning activities in a logical sequence.

Approximate time for completion of unit: 15 days

Student will

- graph and interpret scatter plots using a graphing calculator. (M)
- Ti-Nspire Activity #1 (M,T)
- identify the difference between independent and dependent variables. (M)
- compute the correlation coefficient and coefficient of determination using the graphing calculator (A)
- compute, graph, and interpret the linear regression equation using the graphing calculator (A)
- hula hoop activity (T)
- examine relationships of data through form, direction, and strength using the correlation coefficient and linear regression equation. (M)
- Ti-Nspire Activity #2 (T)
- make predictions using the linear regression equation. (T)
- understand that extrapolation can lead to misleading predictions made by the linear regression equation. (M)
- identify and discuss the dangers of extrapolation, causation, and confounding/lurking variables (M)