Unit 1: Recording and Displaying Data and Descriptive Statistics

Content Area: **Mathematics**
Course(s): **Statistics**
Time Period: **October**
Length: **12 Weeks**
Status: **Published**

Unit Overview

- **This unit will expose students to the variety of ways in which data can be recorded and displayed. They will become aware that certain types of information lend themselves to specific types of graphs. Once the data is organized, students can look for patterns and information.**
- **This unit will explain how to organize data by constructing frequency distributions and how to present data by constructing charts and graphs: histograms, frequency polygons, ogives, bar graphs, pie charts, and stem and leaf plot.Students will become familiar with methods used to display bivariate data which include boxplots and scatterplots.**
- **This unit will show students how to solve and interpret descriptive statistics such as measures of central tendency, measures of variation, and measures of position.**
- **This unit will show students how to utilize calculators to find certain values.**

Transfer

Students will be able to independently use their learning to...

- **Utilize the variety of ways to record, display, and interpret data in life after high school whether it be at a university or college, through career or military training, or in a work environment**

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- The purpose of graphs in statistics is to convey the data to the viewers in pictorial form.
- Organizing and representing data are dependent on the type of data given.
- A correlation coefficient is a numerical measure that determines whether two or more variables are linearly related and determines the strength of the relationship between or among the variables.
- The coefficient of determination is a better indicator of the strength of a linear relationship than the correlation coefficient and the reason why.
- There are several different measures used to describe and summarize data (measures of average or measures of central tendency, measures of variation or measures of dispersion, and measures of position).

Essential Questions

Students will keep considering...

- Is there a difference between looking at tables of numbers and looking at plots or graphs of numbers?
- Can the type of plot influence the conclusions drawn and if so how can this be prevented?
- Is there a difference between skew and outliers?
- Why are outliers important?
- Ideally, how many data points in a set of data are needed to characterize spread?
- What will changing the units of measurement do to measures of spread and central tendency?
- How can categorical data be represented and interpreted?
- Can data sets be added together to obtain a larger sample size and hence more meaningful conclusion?
- How can we establish and quantify a cause and effect relationship between two variables?
- Why is it important to quantify correlation instead of just estimating it by looking at a graph?
- Why would we need to find a mathematical relationship between variables? Isn't correlation enough?
- Would changing the units of the variables affect the R-square value?
- Can a regression equation with a high R-square be inappropriate?

Application of Knowledge and Skill

Students will know...

Students will know...

- The procedure for constructing a frequency distribution
- The three most commonly used graphs in research: histogram, frequency polygon, and ogive (the

cumulative frequency graph) and the other graphs that are often used in statistics: bar graph, time series graph, pie chart, and stem-and-leaf plot.
- If there is a significant relationship between data by utilizing a hypothesis-testing procedure.
- The process of completing a regression analysis.
- The properties and uses of central tendency
- Variance and standard deviation can be used to determine the spread of the data.
- Measures of position are used to locate the relative position of a data value in a data set.

Students will be skilled at...

Students will be skilled at...

- Generating a frequency distribution for raw data.
- Constructing a histogram, frequency polygon, and ogive using a frequency distribution.
- Creating a bar graph, time series graph, pie graph, and stem-and-leaf plot for given data.
- Constructing a scatter plot and boxplot.
- Computing the mean, median, mode, midrange, range, variance, standard deviation, percentile rank, and correlation coefficient.
- Finding the equation of the regression line for a given set of data.
- Calculating the coefficients of determination and nondetermination and the standard error of the estimate.
- Finding a *z*-score.

Academic Vocabulary

Bar Graphs

Categorical Frequency Distribution

Class, Class Boundaries, Class Midpoint, Class Width

Cumulative Frequency, Cumulative Frequency Distribution

Frequency, Frequency Distribution, Frequency Polygon

Grouped Frequency Distribution, Ungrouped Frequency Distribution

Data, Data Sets, Data Value

Dependent and Independent Variable

Quantitative Variables

Qualitative Variables

Statistic

Variable

Descriptive Statistics

Histogram

Lower Class Limit, Upper Class Limits

Ogive

Open-Ended Distribution

Pareto Chart

Pie Graph

Raw Data

Relative Frequency Graph

Stem and Leaf Plot

Time Series Graph

Adjusted R^2

Coefficient of determination

Correlation

Correlation coefficient

Extrapolation

Negative Relationship

Positive Relationship

Regression

Regression Line

Residual

Residual Plot

Scatterplot

Simple Relationship

Mode, Bimodal, Unimodal, Modal Class

Boxplot

Coefficient of Variation

Data Array

Decile

Empirical Rule

Exploratory Data Analysis

Five-Number Summary

Interquartile Range

Mean, Weighted Means

Median

Midrange

Skewed Data

Outlier

Parameter

Percentile

Quartile

Range

Statistic, Resistant Statistic

Standard Deviation

Symmetric Distribution

Variance

Z- Score

Learning Goal 1.1

To choose and create an appropriate data display to represent given data

Target 1.1.1--(Level of Difficulty: 2 Comprehension)

SWBAT:

- Organize data using a frequency distribution
- Represent data in frequency distributions graphically using histograms, frequency polygons and ogives

---

MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.K-12.4	Model with mathematics.
MA.S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Target 1.1.2--(Level of Difficulty: 2 Comprehension)

SWBAT:

- Represent data using bar graphs, Pareto charts, time series graphs and pie charts
- Draw and interpret a stem and leaf plot

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.S-ID.B.5	Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends

	in the data.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target 1.1.3--(Level of Difficulty: 3 Analysis)

SWBAT:

- Draw a scatterplot for a set of ordered pairs
- Compute the correlation coefficient
- Test the hypothesis H_o: $\rho = 0$

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.K-12.6	Attend to precision.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.
MA.S-ID.C.9	Distinguish between correlation and causation.

Target 1.1.4--(Level of Difficulty: 3 Analysis)

SWBAT:

- Compute the equation of the regression line

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.K-12.6	Attend to precision.

MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
MA.K-12.7	Look for and make use of structure.

Target 1.1.5--(Level of Difficulty: 3 Analysis)

SWBAT:

- Compute the coefficient of determination, r^2
- Compute the standard error of the estimate

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.6	Attend to precision.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.K-12.7	Look for and make use of structure.

Learning Goal 1.2

To summarize data using measures of central tendency, measures of variation, and measures of position

Target 1.2.1--(Level of Difficulty: 2 Comprehension)

SWBAT:

- Summarize data, using measures of central tendency, such as mean, median, mode, and midrange

MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target 1.2.2--(Level of Difficulty: 3 Analysis)

SWBAT:

- Describe data, using measures of variation, such as range, variance and standard deviation
- Compare two variations using formulas for the coefficient of variation.
- Use the "range rule of thumb" to approximate standard deviation.
- Use Chebyshev's Theorem to specify the proportions of the spread in terms of the standard deviation

MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.A.2	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target 1.2.3--(Level of Difficulty: 4 Knowledge Utilization)

SWBAT:

- Identify the position of a data value in a data set, using various measures or position, such as percentiles, deciles and quartiles
- Define the term outlier and develop a strategy to check data sets for outliers.
- Use a formula to compute z-scores.

MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

Target 1.2.4--(Level of Difficulty: 3 Analysis)

SWBAT

- Use the techniques of exploratory data analysis, including boxplots and five-number summaries, to discover various aspects of data

MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Summative Assessment

- Date Project - Unit Test #2 (uses units 1 & 2)
- Quizzes

21st Century Life and Careers

CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.

Technology

TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

Formative Assessment and Performance Opportunities

- Application
- Classwork
- Closures/exit tickets
- Cooperative groups (centers, jigsaw activities)
- Do nows
- Excel
- graphing calculators
- Homework
- Participation/discussion
- Problem Based Learning

- Reading
- Teacher directed Q & A
- Teacher Observation
- Whitebaord/communicator responses

Differentiation / Enrichment

- 504 accommodations
- Challenge problems
- Extending the concepts problems
- heterogeneous grouping
- IEP's
- projects
- scaffolding questions
- small group instruction
- use of technology

Unit Resources

.

- • Textbook: Elementary Statistics: A Step by Step Approach by Bluman, 8th Edition, Publisher McGraw- Hill, Copyright 2012
- EXCEL
- nctm website
- Ti 83/84 graphing calculator

Proficiency Scale