Unit 1: Organizing Data: Looking for Patterns and Departures from Patterns

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 1**
Length: **9 weeks**
Status: **Published**

Brief Summary of Unit

Exploratory analysis of data makes use of graphical and numerical techniques to study patterns and departures from patterns. Emphasis should be placed on interpreting information from graphical and numerical displays and summarizing it in a clear, concise manner. In this unit, students will be able to make charts and plots (dot plots, box and whisker, stem, histogram, bar, pie charts) of data and describe their characteristics (shape, center, spread, outliers). Students now have a set of graphical and numerical tools for describing distributions. They will continue exploring data on a single quantitative variable in order to estimate the relative locations of the median and mean on a density curve, estimate areas (proportions of values) in a Normal distribution, find the proportion of *z*-values in a specified interval, or a *z*-score from a percentile in the standard Normal distribution, find the proportion of values in a specified interval, or the value that corresponds to a given percentile in any Normal distribution, and determine whether a distribution of data is approximately Normal from graphical and numerical evidence. Students will also be able to generate graphs and numerical displays for bivariate data (scatterplots). Students will be able to look at the relationship between two quantitative variables such as correlation and simple linear regression.

Standards

Analyzing various sets of data will allow students to explore studies about people from different backgrounds. Statistical studies and analysis provides students an opportunity to read about historical statistics about people's cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey's Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

Commission on Holocaust Education

This unit further reflects the goals of the Holocaut Education mandate where students are able to identify and analyze applicable theories concerning human nature and behavior; understand that genocide is a consequence of prejudice and discrimination; understand that issues of moral dilemma and conscience have a profound impact on life; and understand the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

MA.K-12.1	Make sense of problems and persevere in solving them.
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.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.S-ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
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.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.K-12.5	Use appropriate tools strategically.
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.
MA.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.K-12.8	Look for and express regularity in repeated reasoning.
LA.K-12.NJSLSA.L4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
LA.K-12.NJSLSA.L5	Demonstrate understanding of word relationships and nuances in word meanings.
	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.
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TEC.K-12.8.1	All students will use computer applications to gather and organize information and to solve problems.
TEC.K-12.8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment.
WORK.K-12.9.1	All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace.
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Transfer

Graphs and summary statistics can be used to analyze data.

Real life applications are numerous and across many different disciplines.

Essential Questions

- How can describing the center, shape, and spread of a data set be useful in drawing conclusions about a population?
- Why is knowing the variation (standard deviation) of a data set important in summarizing data?
- What is the appropriate graphical display for a set of data?
- How are the measures of center, spread and position used to interpret graphical displays?
- What does the shape of a distribution tell about the data?

- What assumptions can be made from data?
- How can graphical displays be manipulated to present misleading information?
- How can data analysis be used in the areas of science to predict future happenings?

Essential Understandings

- There is a difference between sample statistics and population parameters.
- The distribution of data is important to determine how to analyze the data.
- Describing the variation of data is as important as defining the center of a data set.
- Center and spread are essential to every statistical analysis.
- Deviations in data can have a huge effect on the final results.

Students Will Know

- Key concepts/vocabulary - sample statistic, population parameter, mean, median, range, deviation, variance, standard deviation, quartiles, percentile, interquartile range, outliers, modality, skewedness, normal distribution, uniform distribution, z-score.
- When to use the different types of data displays given different types of data.
- Which displays are best for data sets with particular characteristics.

Students Will Be Skilled At

- Students will be able to describe the relationship between two categorical variables.
- Students will be able to calculate and interpret measures of center and spread in context.

Evidence/Performance Tasks

- Assessments

    - Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments

    - Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments

    - Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from

Big Ideas Math

- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Classwork and homework that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations
- Provide alternative means of assessments for certain students
- Enter data into TI-84.
- Create graphical displays with/without the TI-84.
- Simulate data using the TI-84.
- Interpret graphical displays.
- Calculate measures of center, spread and position with/without TI-84.
- Compare distributions using shape, clusters, outliers and measures of center, spread and position.
- Identify outliers using the 1.5 x IQR method.
- Calculate and graph the least squares regression line without and with the TI-84.
- Calculate the correlation coefficient without and with the TI-84.
- Graph a residual plot.
- Identify influential points.
- Transform data to achieve linearity using logarithmic and power transformations.
- Find articles concerning statistics in newspapers, magazines or on web sites.
- Communicate findings rather than focus on a single answer.

Learning Plan

- Graphical displays of univariate data: dotplot, stemplot, histogram, boxplots
- Interpreting graphical displays: outliers, clusters, gaps, shape
- Measures of center: median, mean, mode
- Measures of spread: range, interquartile range, standard deviation
- Measures of position: quartiles, percentiles, standardized scores (z-scores)
- Comparing distributions of univariate data
- Exploring bivariate data: scatterplots
- Analyzing patterns in scatterplots
- Correlation and linearity
- Least squares regression line
- Residual plots, outliers, influential points
- Transformations to achieve linearity: logarithmic, power
- Exploring categorical data: frequency tables
- Marginal and joint frequencies for two-way tables
- Conditional relative frequencies and association

- Simpson's Paradox

Materials

Core Book List including Practice of Statistics

Supplemental materials: AP Classroom, Khan Academy, Edia, and DeltaMath

- District approved textbook
- Khan Academy
- Supplemental Materials – worksheets, guided notes
- Teacher created activiites
- Teacher created notes
- TI-84 Graphing Calculator

Suggested Strategies for Modifications

Possible accommodations/modification for AP Statistics