

01 One-Variable Statistics

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **5 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

This course combines the study of Statistics and Probability with Data Science. The goal is to have students think critically about data in today's data-driven world and understand its role in the 21st Century economy. Furthermore, students will become familiar with the concepts, topics, and techniques used by data scientists and statisticians in their day-to-day work.

Throughout this course, students will engage in project-based observational studies and experiments to develop their understanding of data analysis, sampling, correlation/causation, bias and uncertainty, probability, modeling with data, as well as making and evaluating data-based arguments. Students will also learn about the roles of data scientists, the power of data in society, machine learning, and how data scientists extract knowledge and insights from real-world data.

In this unit students will understand that statistics is a branch of mathematics that involves working with data collection, organization, analysis, interpretation, and presentation.

In applying statistics to a scientific, industrial, or social problem, it is conventional, to begin with a statistical population or a statistical model (such as a chart, table, histogram, box plot, etc.) to be studied.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Essential Questions:

- What are ways to display information in a format that is easy to interpret from facts or categorical data?
- What are ways to display information in a format that is easy to interpret from numerical or quantitative data?
- When is it appropriate to report the mean or the median from a set of quantitative data?

- When is it appropriate to report the standard deviation or the interquartile range from a set of quantitative data?
- How can we determine if numbers that appear to be extremely large or small are actual outliers?

Enduring Understanding

- When data is compiled, there are various ways in which we can display this information in order to grasp a more meaningful and deeper understanding of the findings.
- There are situations in which reporting the center and spread of the data will depend upon whether the patterns of the data are skewed left or right, are uniform, bi modal or follow a roughly normal distribution.

CONTENT AREA STANDARDS

N.RN

A. Extend the properties of exponents to rational exponents

N.Q

A. Reason quantitatively and use units to solve problems

N.CN

A. Perform arithmetic operations with complex numbers

B. Represent complex numbers and their operations on the complex plane

C. Use complex numbers in polynomial identities and equations

N.VM

A. Represent and model with vector quantities

B. Perform operations on vectors

C. Perform operations on matrices and use matrices in applications

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.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.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.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.12.PB.3: Design a personal budget that will help you reach your long-term and short-term financial goals. •
9.1.12.PB.4: Explain how you would revise your budget to accommodate changing circumstances. •
9.1.12.PB.5: Analyze how changes in taxes, inflation, and personal circumstances can affect a personal budget. Money management requires understanding of cash flow systems and business practices. 9.1.12.PB.6: Describe and calculate interest and fees that are applied to various forms of spending, debt and saving.

LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.11-12.SL.11-12.2	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.

TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- In the study of statistics, data consist of individuals and variables that give information about individuals; an individual can be an object or a person; a variable is an attribute, such as a measurement or a label.
- Variables are classified as either categorical or quantitative.
- A histogram is a representation of the distribution of numerical data in one variable; a histogram is an estimate of the probability distribution of a continuous variable.
- A box plot is a representation of the percentile distribution of numerical data in one variable.
- A relative frequency table is a chart showing the popularity or mode of a certain type of data based on the population samples.
- Based on factors such as how data is skewed, one measure of center (mean, median, mode) may be more appropriate or useful than another when describing the data set.

Procedural Knowledge

Students will be able to:

- Identify individuals and variables in a data set.
- Conduct an experiment by collecting data through a poll, display data using a chart.
- Classify variables as categorical or quantitative.
- Create a histogram by hand and by using the graphing calculator.
- Describe a histogram by the shape of the graph (symmetric, skewed left/right, etc.) and identify outliers using the $1.5 \times \text{IQR}$ rule.
- Find and interpret the median of a distribution of quantitative data.
- Calculate the mean and median of a distribution of quantitative data using histograms and boxplots.
- Compare the mean and median and determine the most appropriate measure of center in a given scenario.
- Create and interpret boxplots of quantitative data; find where data lies in terms of

- percentages/percentiles from data set.
- Create a relative frequency graph.

EVIDENCE OF LEARNING

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics
- Performance Based Assessments

Formative Assessments

- Observations
- Task completion
- Student journals and notebooks
- Homework assignments
- Cooperative team work

Summative Assessments

- Project completion
- Task completion on unit assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Statistics and Probability with Applications (High School) Third Edition, Starnes & Tabor, 2016

Digital Launchpad book companion

INTERDISCIPLINARY CONNECTIONS

Educational tech applications

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.