Unit #12: Statistics

Content Area: **Mathematics**
Course(s):
Time Period: **April**
Length: **1**
Status: **Published**

Unit Overview

Probability and statistics are the mathematics used to understand chance and to collect, organize, describe, and analyze numerical data. From weather reports to sophisticated studies of genetics, from election results to product preference surveys, probability and statistical language and concepts are increasingly present in the media and in everyday conversations. Students need this mathematics to help them judge the correctness of an argument supported by seemingly persuasive data.

All students will develop an understanding of the concepts and techniques of data analysis, probability, and discrete mathematics, and will use them to model situations, solve problems, and analyze and draw appropriate inferences from data.

Enduring Understandings

1. It is necessary to understand Data Analysis, Probability, Statistics, and Discrete Math and data and recognize their importance in preparation for the HSPA test and in the ways they are used and applied in real world situations.

2. Discuss events related to student experiences by conducting surveys and reading graphs of student information.

3. Data can be collected, organized, and displayed in purposeful ways.

4. Various statistical methods can be used to observe, analyze, predict, and make inferences about data.

5. Probability and data analysis can be used to make predictions.

Essential Questions

1) How can the collection, organization and analysis of data be used to answer questions?
2) How can theoretical and experimental probability be used to make predictions and draw conclusions?
3) How can calculators and other technology be used as tools in school and outside of school?
4) Why do we call the variables independent or dependent?
5) What is a reasonable answer for a given scenario?
6) How can we use our math knowledge to justify/ counter a given argument?

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Student Learning Objectives (SLO's)

- Define experiment, outcome, event, probability and equally likely.
- Determine the outcomes and probabilities for experiments.
- Distinguish between an event and an outcome for an experiment.
- Interact with die rolls and spinners to help predict the outcome of experiments.
- Make scatter plots based on data and determine the line of best fit
- Recognize the difference between outcomes that are equally likely and not equally likely to occur.

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
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.
MA.8.SP.A	Investigate patterns of association in bivariate data.
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
MA.8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
MA.8.SP.A.4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Lesson Titles

- Box-and-Whisker plots
- Constructing and analyzing stem and leaf plots
- Constructing circle graphs
- Counting Principle of Multiplication
- Experimental & theoretical probability
- Fairness of games
- Independent/compound events involving probability
- Intro. to bar graphs, scatter plots, histograms, line plots, & circle graphs
- Intro. to expected value
- Measures of central tendency
- Permutations and combinations
- Polls, surveys, & sampling
- Vertex edge graphs

Equity Considerations

LGBTQ and Disabilities Mandate

Students will engage in discussions centered around mathematicians LGBTQ and disabilities population.

STEM

LGBTQ:

Sir Francis Bacon (1561–1626)

Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910)

George Washington Carver (1861-1943)

Sara Josephine Baker (1873-1945)

Alan Turing (1912-1954)

Allan Cox (1926-1987)

Sally Ride (1951-2012)

Ben Barres (1954-2017)

Ruth Gates (1962-2018)

Tim Cook (1960)

Disabilities:

Leonardo da Vinci (1452-1519)- Dyslexia

Isaac Newton (1664-1727)- Epilepsy

Thomas Edison (1847-1931)- Hearing

Charles Darwin (1809-1882)- Stutter, Dyslexia

Alexander Graham Bell (1847-1922)- Deaf

Albert Einstein (1879-1955)- Aspergers

Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)- Schizophrenia

Temple Grandin (1947)- Autism

- Social

Asian American and Pacific Islander Mandate

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/
https://www.ngpf.org/blog/math/math-monday-celebrating-aapi-mathematicians/

Diana Ma is a statistician who has built a career out of her two passions: basketball and math. As a Data Scientist for the Lakers, she works in basketball operations and does analysis involving player evaluation, roster construction, and in-game strategy.

Shakuntala Devi is known as “The Human Computer”, Shakuntala Devi was a famous mathematician who holds the Guinness World Record for the “Fastest Human Computation.” In addition to her computational prowess, Devi was also an outspoken LGBTQ+ advocate, novelist, and political hopeful. Her life story was

adapted into the biopic Shakuntala Devi in 2020.

Dr. Kamuela Yong is an associate professor of mathematics at the University of Hawai‘i–West O‘ahu. He is the first Native Hawaiian to earn a Ph.D. in applied mathematics and is the co-founder of the organization Indigenous Mathematicians.

- Social

Climate Change

Students will make connections between math and STEM processes.

Students analyze the melting of the polar ice caps and its effects on the Earth and humanity

How fast are the polar ice caps melting, and why is this rate important to human life on Earth?

https://www.oercommons.org/authoring/7876-climate-change-cross-curricular-math-english-scien/view

https://jancovici.com/en/climate-change/risks/will-oceans-submerge-everything/

- Social

SCI.MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused climate change over the past century.

Inter-Disciplinary Connections

- : Practice formulating complete and grammatically correct responses to open-ended questions.: Practice formulating complete and grammatically correct responses to open-ended questions.
- Have students come up with a game in which they need to calculate the probability of winning. Make them come up with different variations of the game to elicit different outcomes.
- Math, Science, History, Social Studies: Students can research and discuss the mathematical evidence supporting the idea that Gregor Mendel falsified his data (experimental vs. theoretical probability, the reasons he may have falsified the data, the historical implications of his actions, and the effective use of probability to identify false or misleading claims.
- Vocabulary acquisition.

LA.W.8.1.A	Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
LA.L.8.4	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.
SCI.7-8.5.1.8.A.2	Use mathematical, physical, and computational tools to build conceptual-based models and to pose theories.
SOC.6.1.8	U.S. History: America in the World: All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

Anticipatory Set

5-10 minutes Specific Activity based on the day's lesson: could be a video clip, discussion, definition, etc

- Current Event
- Math History
- Relate to prior knowledge
- video clip

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- SWBAT analyze independent/compound and conditional probabilities
- SWBAT construct and analyze box and whisker plots
- SWBAT construct and analyze stem & leaf plots
- SWBAT construct and analyze various graphs (line graph, scatter plot, histograms, bar graphs,line plot, and pie graph)
- SWBAT construct and analyze Venn Diagrams
- SWBAT construct and analyze vertex edge graphs
- SWBAT describe how one variable is dependent upon another
- SWBAT determine a line of best fit for scatter plots
- SWBAT determine a line of best fit for scatter plots
- SWBAT determine if a game is fair and find the expected value of certain situations
- SWBAT determine the measures of central tendency (mean, median, mode, & range) for a set of data
- SWBAT display data using different types of graphs
- SWBAT hypothesize and determine whether an answer is reasonable
- SWBAT to complete probability questions based on simulations
- SWBAT to complete problems on experimental and theoretical probability
- SWBAT understand and calculate problems on combinations and permutations
- WBAT detemine the accuracy & reasonableness of drawn conclusions

Modifications

ELL Modifications

- Collaboration with ELL Teacher
- Frontload information in native language
- Graphic organizers
- Modification plan

- Probability, likelihood, expected value, predicitions, experimental, theoretical, compound probability, independent events, dependent events, sample, population, biased/un-biased, box and whisker, variation, measure of center, median
- Strategy groups
- Teacher conferences
- Using videos, illustrations, pictures, and drawings to explain or clarification

IEP & 504 Modifications

- Break tests down in smaller increments
- Increase one-to-one time
- Modifications & accommodations as listed in the student's IEP
- Modified or reduced assignments
- Prioritize tasks
- Reduce length of assignment for different mode of delivery
- Think in concrete terms and provide hands-on-tasks

G&T Modifications

- creating a math "fun fair" centered around probability
- Self directed lesson for students to calculate the permutations/combinations for a given situation.
- When dealing with compound events give students three or 4 events seperate events instead of just two

Formative Assessment

- Graphic Organizer
- Group Work
- Observation
- PARCC Questions - Probability
- PARCC Questions - Stats
- Senteo
- Think-Pair-Share
- Written Work

Summative Assessment

- Performance Assessment - Design a probability game
- Test - Probability
- Test - Statistics

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Resources & Materials

- Connected Math - Samples and Populations
- Connected Math - What Do You Expect
- Dice
- PMI - Statistics and Probability
- Spinner

Technology

- Chromebook
- Interactive Dice http://www.curriculumbits.com/mathematics/virtual-dice/
- PMI - Statistics and Probability
- Virtual Coin Toss http://www.virtualcointoss.com/

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.2.8	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.