Unit 2: Data Analysis

Content Area: **Mathematics**
Course(s): **Practical Math (as per IEP)**
Time Period: **2 marking periods**
Length: **20 weeks**
Status: **Published**

Unit Overview

Students will be introduced to statistics and probability. The students will become aware of the different elements involved in statistical sampling and simulation. Students will also be exposed to uses and misuses of statistics. They will analyze a statistical survey, graph, or report and derive conclusions about the sampling method.

Transfer

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

- Relate statistics terminology to real life problems/applications
- Apply the concepts to complete real world problems

Meaning

Understandings

Students will understand that...

- There are different reasons for studying statistics.
- There are uses and misuses of statistics.
- The way real world data is collected may yield misleading results
- There are different methods to obtaining samples and different techniques used in simulations.
- You can use probability to evaluate outcomes of decisions

Essential Questions

Students will keep considering...

- What are data and how are they measured?
- How can data be represented efficiently and effectively?
- How can different measures be used to interpret and compare sets of data?
- How are samples selected?
- Can bad data be corrected with good statistical analysis?
- How can statistics be misused?

Application of Knowledge and Skill

Students will know...

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- How to describe various types of graphs and data displays.
- When it might be most appropriate to use mean, median, or mode to describe a measure of central tendancy.
- What is meant by correlation and causation
- The two major areas of statistics are descriptive and inferential and what is included in each area.
- Data can be classified as qualitative or quantitative.
- The four basic methods to obtaining samples: random, systematic, stratified, and cluster.
- The two types of statistical studies: observational and experimental studies.
- To question or examine the results of research studies and surveys for misuse or misrepresentation.

Students will be skilled at...

Students will be skilled at...

- Determining if a variable is qualitative or quantitative.
- Determining if a sample is random, systematic, stratified, cluster, or convenience
- Concluding if a study is observational or experimental
- Calculating mean, median, mode, and range of data sets.
- Distinguishing between correlation and causation
- Interpreting linear models
- Defining and distinguishing independent and dependent variables

- Determining if events are mutually exclusive

Academic Vocabulary

Line graph

Slope

Constant

Y-intercept

Coefficients

Mean

Median

Mode

Range

Independent Variable

Dependent Variable

Quantitative variable

Qualitative variable

Frequency

Mutually exclusive

Cluster sample

Continuous variables

Control group

Convenience sample

Discrete variables

Experimental study

Explanatory variable

Independent variable

Outcome variable

Population

Random sample

Random variable

Sample

Stratified sample

Systematic sample

Variable

Biased sample

Sequence sampling

Simulation technique

Unbiased sample

outcome

probability

probability experiment

event

Learning Goal 1 (Level of Difficulty 3: Analysis)

SWBAT interpret linear models.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.S-ID.C	Interpret linear models

Target 1 (Level of Difficulty 2: Comprehension)

SWBAT interpret the slope and intercept of a linear model in context.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
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.

Target 2 (Level of Difficulty 3: Analysis)

SWBAT distinguish between correlation and causation.

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.S-ID.C.9	Distinguish between correlation and causation.

Target 3 (Level of Difficulty 3: Analysis)

SWBAT explain how statistics can be used and misused.

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

Learning Goal 2 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain different sampling methods.

- incorporate discussions about the importance of including options other than male and female when asking about gender
- https://www.glsen.org/blog/how-do-we-make-math-class-more-inclusive-trans-and-non-binary-identities

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Target 1 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain random sampling.

MA.7.SP.A.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
MA.7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.

Target 2 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain systematic sampling.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Target 3 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain stratified sampling.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Target 4 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain cluster sampling.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Target 5 (Level of Difficulty 2: Comprehension)

SWBAT understand and explain convenience sampling.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Learning Goal 3 (Level of Difficulty 2: Comprehension)

SWBAT summarize data using measures of central tendency.

MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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.

Target 1 (Level of Difficulty 2: Comprehension)

SWBAT calculate the mean given a set of data.

MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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.

Target 2 (Level of Difficulty 2: Comprehension)

SWBAT calculate the median given a set of data.

MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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.

Target 3 (Level of Difficulty 2: Comprehension)

SWBAT calculate the mode and midrange given a set of data.

MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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.

Target 4 (Level of Difficulty 3: Analysis)

SWBAT discuss why one measure of central tendency might be better than another given a set of data.

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.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.

Learning Goal 4 (Level of Difficulty 3: Analysis)

SWBAT use probability to evaluate outcomes of decisions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.S-MD.B	Use probability to evaluate outcomes of decisions

Target 1 (Level of Difficulty 1: Retrieval)

SWBAT define independent and dependent events.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.S-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Target 2 (Level of Difficulty 2: Comprehension)

SWBAT distinguish between dependent and independent events.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.S-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Target 3 (Level of Difficulty 3: Analysis)

SWBAT determine if two events are mutually exclusive.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.S-CP.A.3	Understand the conditional probability of A given B as $P(A\ and\ B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

Formative Assessment and Performance Opportunities

Class participation, classwork/homework, class openers and closures, group work, presentations, projects, student-teacher discussions

Summative Assessment

Tests, quizzes, end of unit assessment, projects

21st Century Life and Careers

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.

Accommodations and Modifications

- Follow IEPs and 504 Plans
- Use of multiplication charts and calculators
- Differentiate instruction (number of problems, difficulty of problems, etc)
- Connect lessons to real-world situations as much as possible
- Incorporate hands-on lessons (ex: have students create, give, and analyze surveys using the different sampling methods)

Unit Resources

Learning Goal 1: SWBAT interpret linear models.

- https://www.khanacademy.org/math/statistics-probability/displaying-describing-data

Learning Goal 2: SWBAT understand and explain different sampling methods.

- https://www.khanacademy.org/math/statistics-probability/sampling-distributions-library
- https://www.albert.io/learn/statistics-and-probability/sampling-from-populations/topic-summary

Learning Goal 3: SWBAT summarize data using measures of central tendency.

- https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-data-statistics
- https://www.khanacademy.org/math/statistics-probability/summarizing-quantitative-data
- https://www.albert.io/learn/statistics-and-probability/describing-data/topic-summary

Learning Goal 4: SWBAT use probability to evaluate outcomes of decisions.

- https://www.khanacademy.org/math/statistics-probability/probability-library

Interdisciplinary Connections

Learning Goal 1: SWBAT use different sampling methods to conduct research in real-world context

Project Idea: Students will conduct surveys about Sociology related topics and analyze data

TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.