Course: Probability and Statistics **Unit 1:** Collect, Model and Analyze Data	**Year of Implementation:** 2026-2027

Curriculum Team Members: Chrissy Gerber cgerber@lrhsd.org, Megan Laffey mlaffey@lrhsd.org, Stephanie Marshall smarshall@lrhsd.org, Joseph Aromando jaromando@lrhsd.org

Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.state.nj.us/education/cccs/2020/

- **Unit Standards:**
  - ***Content Standards***
    - https://www.nj.gov/education/standards/math/

NJSLS - Making Inferences and Justifying Conclusions [S-IC]

A. Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

NJSLS - Interpreting Categorical and Quantitative Data [S-ID]

A. Summarize, represent, and interpret data on a single count or measurement variable.

1. Represent data with plots on the real number line (dot plots, histograms, and box plots).
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread.
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.

B. Summarize, represent, and interpret data on two categorical and quantitative variables

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.
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
    a. 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. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.
    b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
    c. Fit a linear function for a scatter plot that suggests a linear association.

C. Interpret Linear Models

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
9. Distinguish between correlation and causation.

- ***2020 NJSL Standards: Career Readiness, Life Literacies, and Key Skills Introduction***
  https://www.nj.gov/education/standards/clicks/Docs/2020NJSLS-CLKS.pdf

  - 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions
  - 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

- ***Interdisciplinary Content Standards***
  Computer Science and Design Thinking Introduction
  - 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

  Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

  LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

  Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

  Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage

of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to analyze data to make informed decisions and draw appropriate conclusions.

As aligned with LRHSD Long Term Learning Goal(s): https://www.lrhsd.org/academics/curriculum

The Lenape Regional High School District Math program, in alignment with the New Jersey Student Learning Standards for Mathematics, prepares our students for success in college and their careers. Through completing our coursework, our students will be better able to:

1. Problem-Solving: apply and transfer autonomously and collaboratively mathematical concepts and problem- solving techniques to unfamiliar, varied and real-world situations
2. Reasoning: reason abstractly and quantitatively by applying mathematical representations, symbols and estimation techniques when engaging in problem-solving
3. Critical Thinking: construct and effectively communicate valid conclusions and critique the reasoning of others
4. Modeling: demonstrate mastery of concepts by evaluating models that others have constructed or by creating appropriate models of their own
5. Tools: identify the correct tools to solve problems, if applicable
6. Precision: determine an answer's appropriateness as a means of determining its validity, while using proper mathematical

notation and units
7. Structure: use multiple representations, critical thinking skills, and prior knowledge to solve problems in new situations
8. Patterns: analyze data and recognize patterns in a variety of situations
9. Habits of Mind: approach new situations with curiosity, persistence, resourcefulness, and confidence; take risks, monitor their progress, accept and learn from setbacks, make adjustments, and reflect on their performance.

Enduring Understandings Students will understand that. . .	*Essential Questions*
EU 1 valid data analysis depends on accurate collection methods and appropriate interpretation. *EU 2* data can be collected, organized, and communicated in various ways to reveal patterns, support reasoning, and inform decision-making.	● What makes a data analysis valid and trustworthy? ● How can the careful collection and representation of data help draw reliable conclusions and effective decisions?
Knowledge *Students will know . . .* *EU 1* ● different data collection methods impact the accuracy and reliability of results. (S-IC.A.1-4, S-IC.B.3-4, 9.4.12.IML.4) ● data must be interpreted within context to draw	*Skills* *Students will be able to. . .* *EU 1* ● differentiate between a sample and a population; qualitative and quantitative data; discrete and continuous data; and descriptive and inferential statistics, and justify the appropriate use of each in

meaningful and appropriate conclusions. (S-IC.A.1-4, S-IC.B.3-4, 9.4.12.IML.3) *EU 2* ● data can be displayed in different ways depending on the story that is being told. (S-ID.A.1–3, 8.1.12.DA.5) ● outliers affect measures of center/spread and the shape of a distribution. (S-ID.A.1–3) ● measures of position can tell us where a data value falls relative to the population of data. (S-ID.A.1–3) ● the strength of a relationship between two variables can be described by the correlation coefficient. (S-ID.A.1–3)	various real-world contexts. (S-IC.A.1) ● evaluate and analyze basic sampling techniques—including simple random, systematic, stratified, and cluster sampling—by examining how each can introduce or mitigate sampling bias. (S-IC.A.1, S-IC.B.3, S-IC.B.4) ● critique misleading data representations (e.g., truncated graphs, biased scales) and propose improvements for how data could be better obtained or visualized to accurately reflect context. (S-IC.B.3, S-IC.B.4, 9.4.12.IML.3, 9.4.12.IML.4) ● distinguish between observational and experimental study designs, and between independent and dependent variables, by evaluating how each choice affects the validity of cause-and-effect conclusions. (S-IC.B.3) ● construct concise written analyses that interpret data in context, draw evidence-based conclusions, and use appropriate statistical vocabulary and notation. (S-ID.B.5-6 and S-IC.B.4) *EU 2* ● integrate technology tools such as Desmos, Google Sheets, and AI tools to collect, organize, and display data sets, and evaluate the effectiveness of each tool for a given task. (S-IC.A.1) ● analyze and compare various data displays—including dot plots, histograms, and box plots—to evaluate how effectively each visual represents the distribution, center, and spread of data. (S-ID.A.1–3, 8.1.12.DA.5) ● determine the relative position of a data value within a data set using measures such as percentiles, quartiles, and z-scores, and interpret its meaning in

• correlation does not imply causation and be aware of the dangers of extrapolation. (S-ID.A.1–3, S-ID.B.5, S.ID-C.7-9)	context. (S-ID.A.1–3) • evaluate the shape and spread of a data distribution to justify which measures of central tendency (mean, median, mode) and variability (range, IQR, standard deviation) best describe the data. (S-ID.A.2) • analyze the impact of outliers on summary statistics and graphical representations, and explain how they influence conclusions drawn from the data. (S-ID.A.3) • identify the shape of a data distribution (e.g., symmetric, skewed, uniform, bimodal), and interpret how the distribution affects statistical analysis and conclusions. (S-ID.A.1–3) • utilize technology to perform linear regression and generate equations that model real-world data, then make predictions within the domain of the explanatory variable. (S-ID.B.6c, S-ID.C.7–8) • interpret the slope and y-intercept of a linear regression equation and assess their relevance and meaning within the context of the data set. (S-ID.C.7) • describe the direction, form, and strength of a regression relationship shown in a scatterplot, and justify the appropriateness of using a linear model. (S-ID.B.6, S-ID.C.8)
Stage Two - Assessment	
Other Evidence:	

- Classroom Summarizers
- Independent Practice
- Self Assessments
- Classroom Assessments

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and Career Readiness, Life Literacies, and Key Skills (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = Career Readiness, Life Literacies, and Key Skills*

- Sunflower Activity - Random Sampling (A, M, EU 1)
- M & M Activity - Biased Sampling (A, M, EU 1)
- Wald's Bullet Hole Problem - Representative Sampling (T, EU 1)
- San Antonio Household Income - Sampling Methods (M, EU 1)
- Slow Reveal Chipotle Activator - Skewed Distribution (M, EU 2)
- Memory Game Activator - Experimental Design (M, EU 1)
- Misleading Graphs DESMOS Activity (T, EU1)
- Tongue Twister Activity (M, EU 2)
- Hula Hoop Activity (T, EU 2)
- Barbie Bungee Activity (T, EU 2)

Suggested Sequence of Learning Activities

- Sunflower Activity - Random Sampling (A, M, EU 1)
- M & M Activity - Biased Sampling (A, M, EU 1)
- Wald's Bullet Hole Problem - Representative Sampling (T, EU 1)
- Determine the difference between a population and a sample (M, EU 1)
- Sampling techniques / Develop a simple random sample that represents the population (A, EU 1)

- San Antonio Household Income - Sampling Methods (M, EU 1)
- Establish the independent and dependent variables (A, EU 1)
- Identify and describe the appropriate shape of data distributions. (A, EU 2)
- Slow Reveal Chipotle Activator - Skewed Distribution (M, EU 2)
- Recognize the difference between qualitative and quantitative data. (A, EU 1)
- Recognize the difference between a discrete and continuous data. (A, EU 1)
- Memory Game Activator - Experimental Design (M, EU 1)
- Compare and contrast the difference between observational and experimental designs. (A, EU 1)
- Organize data into frequency distributions (grouped/ungrouped) (A, EU 2)
- Graph data: histograms, pie-charts, stem and leaf plots (A, EU 2)
- Determine the appropriate measure of central tendency and variation that should be used to describe a data set based on the distribution. (A, M, EU 2)
- Identify the position of data value in a data set using various measures of position: z-score, coefficient of variation, and percentile rank. (A, EU 2)
- Find the five-number-summary to create boxplots, calculate the interquartile range and test for outliers. (A, EU 2)
- Identify misleading data and consider how the data can be better represented or obtained. (M, EU 2)
- Misleading Graphs DESMOS Activity (T, EU1)
- Create (using technology) and analyze scatter plots. (A, M, EU 2)
- Determine the domain of the explanatory variable. (A, M, EU 2)
- Utilize the linear regression equation to make predictions within the domain of the explanatory variable. (M, EU 2)
- Interpret the meaning of the rate of change between explanatory and response variable. (M, EU 2)
- Interpret the relevance of the constant term in the linear regression equation. (M, EU 2)
- Obtain the correlation coefficient and the linear regression equation using a calculator graphing tool. (A, M, EU 2)
- Tongue Twister Activity (M, EU 2)
- Discuss the difference between correlation and causation. (A, M, EU 2)
- Assess the predictability of a linear regression equation based on the value of the correlation coefficient. (M, EU 2)
- List concerns that may arise from making predictions about values outside of the domain of the independent variable. (M, EU 2)
- Identify possible lurking and confounding variables and discuss their effects on the relationship. (M, EU 2)
- Hula Hoop Activity (T, EU 2)
- Barbie Bungee Activity (T, EU 2)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Collect, Model, and Analyze Date	48
2	Probability	53
3	One - Sample Inferential Statistics	21
4	Two - Sample Inferential Statistics	13

Instructional Materials

- *TI-Nspire*
- *Desmos*
- *https://www.amstat.org/whats-going-on-in-this-graph*
- *https://slowrevealgraphs.com/*
- *Math Medic*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.