# Statistics Curriculum

*This curricula and accompanying instructional materials have been developed to align with the NJSLS and in accordance with the NJ Department of Education's guidelines to include: Curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.*

## About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

The most recent review and revision of the standards occurred in 2014. However, the standards in language arts and math underwent an additional review in 2015 with adoption by the New Jersey State Board of Education in May 2016.

**Lower Cape May Regional School District Statistics Curriculum**

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| **Content Area: Mathematics** | |
| **Course Title: Statistics** | **Grade level: 11th and 12th** |
| **Unit 1: Exploring Data: Describing Patterns and Departures from Patterns** | |
| **Unit 2: Sampling and Experimentation: Planning and Conducting a Study** | |
| **Unit 3: Probability, Random Variables, and Sampling Distributions** | |
| **Unit 4: Statistical Inference: Confirming Models and Testing Hypotheses** | |
| **Unit 5: Review for AP Examination** | |
| **Date Created:** | **Board Approved On:** |
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| **Lower Cape May Regional School District Mathematics Curriculum**<br>**Unit 1 Overview** |
| **Content Area: Mathematics** |

**Unit Title: Exploring Data: Describing Patterns and Departures from Patterns**

**Target Course/Grade Level: Statistics Grade 11 and 12**

**Unit Summary:**

In this unit, students will be able to describe the relationship between two categorical variables. Students will be able to calculate and interpret measures of center in context. Students will be able to make charts and plots of univariate data and describe their characteristics. Students will be able to generate graphs and numerical displays for bivariate data. Students will be able to look at the relationship between two quantitative variables such as correlation and simple linear regression. Students will be able to independently use probability and statistics to represent real world situations and interpret and communicate results, using technology when needed.

**Interdisciplinary Connections:**

NJ student learning standards in mathematics and language arts literacy
Medicine
Sports
Cars
Economy
politics
Post secondary education
Cell phones
Computers and portable electronic devices
Environment
Animals
Assessments
Health and wellness
Automobiles

**21st Century Themes, Skills, and Standards:**
This unit will integrate the 21st Century Life and Career Standards:

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environment, social and economic impacts of decisions.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences.

9.1.12.B.4 Analyze how income and spending plans are affected by age, needs, and resources.

9.1.12.C.6 Explain how predictive modeling determines “credit scores”.

9.1.12.D.4 Assess factors that influence financial planning.

9.1.12.F.2 Assess the impact of emerging global economic events on financial planning.

9.4.12.A.16 Employ critical thinking skills independently and in teams to solve problems and make decisions (i.e., analyze, synthesize, and evaluate).

| Learning Targets | |
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| **CPI #** | **Cumulative Progress Indicators (CPI) for Unit** |
| S-ID.A.1 | Represent data with plots on the real number line (dot plots, histograms, and box plots). |
| 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. |
| 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). |

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| 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. |
| 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. |
| S-ID.B.6 | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>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.*<br>b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.<br>c. Fit a linear function for a scatter plot that suggests a linear association. |
| 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. |
| S-ID.C.8 | Compute (using technology) and interpret the correlation coefficient of a linear fit. |
| S-ID.C.9 | Distinguish between correlation and causation. |
| S-IC.B.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. |
| S-CP.A.4 | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the* |

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| | *probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* |
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| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
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| ● How is the relationship between two categorical variables described?<br>● How is univariate data described?<br>● How are the graphs generated for bivariate data?<br>● How are the relationships between correlation and simple linear regression defined? | ● Making sense of data and how to explore it.<br>● A data set contains information about a number of individuals.<br>● A categorial variable assigns a label that places each individual into one of several groups.<br>● A quantitative variable has numerical values that measure some characteristic of each individual.<br>● Information can be displayed in many ways depending on the information being compared (i.e. pie charts, bar graphs, two-way tables).<br>● Distributions of variables can be displayed in many ways depending on the type of data (i.e. dotplot, stemplot, histograms).<br>● A numerical summary of a distribution should report at least its center and its spread, or variability.<br>● Always plot your data.<br>● We can describe the overall pattern of a distribution by a density curve.<br>● A scatterplot displays the relationship between two quantitative variables measured on the same individuals.<br>● A regression line is a straight line that describes how a response variable y changes as an explanatory variable x changes.<br>● Correlation does not imply causation.<br>● Correlation and regression must be interpreted with caution. |

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| **Unit Objectives:**<br>***Students will know….*** | **Unit Objectives:**<br>***Students will be able to…...*** |
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| ● constructing and interpreting graphical displays of distributions of univariate data (dotplot, stemplot, histogram, cumulative frequency plot)<br>● summarizing distributions of univariate data<br>● comparing distributions of univariate data (dotplots, back-to-back stemplots, parallel boxplots)<br>● exploring categorical data<br>● Constructing and interpreting graphical displays of distributions of univariate data<br>● Summarizing distributions of univariate data<br>● Normal distribution<br>● exploring bivariate data | ● identify the individuals and variables in a set of data<br>● classify variables as categorical or quantitative<br>● display categorical data with a bar graph<br>● identify what makes some graphs of categorical data deceptive<br>● Calculate and display the marginal distribution of a categorical variable from a two-way table<br>● Calculate and display the conditional distribution of a categorical variable for a particular value of the other categorical variable in a two-way table<br>● Describe the association between two categorical variables by comparing appropriate conditional distributions<br>● Make and interpret dotplots and stemplots of quantitative data<br>● Describe the overall pattern of a distribution and identify any major departures from the pattern<br>● Identify the shape of a distribution from a graph as roughly symmetric or skewed<br>● Make and interpret histograms of quantitative data<br>● Compare distributions of quantitative data using dotplots, stemplots, or histograms<br>● Calculate measures of center<br>● Calculate and interpret measures of spread<br>● Choose the most appropriate measure of center and spread in a given setting<br>● Identify outliers using the 1.5 x IQR rule<br>● Make and interpret boxplots of quantitative data<br>● Use appropriate graphs and numerical |

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| | summaries to compare distributions of quantitative variables<br>● Find and interpret the percentile of an individual value within a distribution of data<br>● Estimate percentiles and individual values using a cumulative relative frequency graph<br>● Find and interpret the standardized score of an individual value with a distribution of data<br>● Describe the effect of adding, subtracting, multiplying by, or dividing by a constant on the shape, center, and spread of a distribution of data<br>● Estimate the relative locations of the median and mean on a density curve<br>● Use the 68-95-99.7 rule to estimate areas in a Normal distribution<br>● Use table A or technology to find (i) the proportion of z-values in a specified interval, or (ii) a z-score from a percentile in the standard normal distribution<br>● Use table A or technology to find (i) the proportion of values in a specified interval, or (ii) the value that corresponds to a given percentile in any normal distribution<br>● Determine whether a distribution of data is approximately normal from graphical and numerical evidence<br>● Identify explanatory and response variables in situations where one variable helps to explain or influences the other<br>● Make a scatterplot to display the relationship between two quantitative variables<br>● Describe the direction, form, and |

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| | strength of a relationship displayed in a scatterplot and identify outliers in a scatterplot<br>● Interpret the correlation<br>● Understand the basic properties of correlation, including how the correlation is influenced by outliers<br>● Use technology to calculate correlation<br>● Explain why association does not imply causation<br>● Interpret the slope and y intercept of a least-squares regression line<br>● Use the least-squares regression line to predict y for a given x<br>● Calculate and interpret residuals<br>● Explain the concept of least squares<br>● Determine the equation of a least-squares regression line using technology or computer output<br>● Construct and interpret residual plots to assess whether a linear model is appropriate<br>● Interpret the standard deviation of the residuals and r2 and use these values to assess how well the least-square regression line models the relationship between two variables<br>● Describe how the slope, y-intercept, standard deviation of the residuals, and r2 are influenced by outliers<br>● Find the slope and y intercept of the least-squares regression line from the means and standard deviations of x and y and their correlation |

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| **Lower Cape May Regional School District Statistics Curriculum**<br>**Unit 2 Overview** |
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| **Content Area: Mathematics** |
| **Unit Title: Sampling and Experimentation** |

**Target Course/Grade Level: Statistics Grade 11 and 12**

**Unit Summary:**

In this unit, students will be able to identify the population and sample in a sample survey. Students will explain how bad sampling leads to bias. Students will distinguish between simple random sample, stratified random sample and cluster sample. Students will distinguish between an observational study and an experiment.

**Interdisciplinary Connections:**

NJ student learning standards in mathematics and language arts literacy
Social media and networking
Health and wellness
Nature
Politics
Finance and investments
Television
Assessments
Medicine
Automobiles

**21st Century Themes, Skills, and Standards:**
This unit will integrate the 21st Century Life and Career Standards:

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environment, social and economic impacts of decisions.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.1.12.A.1 Apply critical thinking and problem-solving strategies during structured learning experiences.

9.1.12.B.4 Analyze how income and spending plans are affected by age, needs, and resources.

9.1.12.C.6 Explain how predictive modeling determines "credit scores".

9.1.12.D.4 Assess factors that influence financial planning.

9.1.12.E.4 Evaluate how media, bias, purpose, and validity affect the prioritization of consumer decisions and spending.

9.1.12.F.2 Assess the impact of emerging global economic events on financial planning.

9.4.12.A.16 Employ critical thinking skills independently and in teams to solve problems and make decisions (i.e., analyze, synthesize, and evaluate).

**Learning Targets**

| CPI # | Cumulative Progress Indicators (CPI) for Unit |
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| S-ID.A.1 | Represent data with plots on the real number line (dot plots, histograms, and box plots). |
| 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. |
| S-ID.B.6 | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.<br>d. 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.*<br>e. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.<br>f. Fit a linear function for a scatter plot that suggests a linear association. |
| 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. |
| S-ID.C.8 | Compute (using technology) and interpret the correlation coefficient of a linear fit. |
| S-ID.C.9 | Distinguish between correlation and causation. |
| S-IC.B.3 | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. |
| S-IC.B.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. |
| S-IC.B.6 | Evaluate reports based on data. |
| S-CP.A.1 | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, |

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| | intersections, or complements of other events (“or”, “and”, “not”). |
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| **Unit Essential Questions:**<br>● How can bad sampling lead to bias?<br>● How can one distinguish between the simple random sample, stratified random sample, and cluster sample? | **Unit Enduring Understandings:**<br>● A census collects data from every individual in the population.<br>● Sampling methods are chosen based on the desired population (i.e. sample survey, convenience sample, voluntary response samples, random sampling, simple random sample, stratified random sample, and cluster sample).<br>● We can produce data intended to answer specific questions by observational studies or experiments.<br>● The basic principles of experimental designs are as follows: Comparison, Random assignment, Control, and Replication.<br>● Most statistical studies aim to make inferences that go beyond the data actually produced.<br>● Lack of realism in an experiment can prevent us from generalizing its results.<br>● Studies involving humans must be screened in advance by an institutional review board. |

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| **Unit Objectives:**<br>***Students will know….*** | **Unit Objectives:**<br>***Students will be able to…...*** |
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| ● Overview of methods of data collection (census, sample survey, experiment, and observational study)<br>● characteristics of a well-designed and well-conducted survey or experiment<br>● population, samples, and random selection<br>● sources of bias in sampling and survey<br>● sampling methods, including simple random sampling, stratified random sampling, and cluster sampling<br>● treatments, control groups, experimental units, random assignments, and replication<br>● sources of bias and confounding, including placebo effect and blinding<br>● completely randomized design<br>● randomized block design, including matched pairs design<br>● generalizability of results and types of conclusions that can be drawn from observational studies, experiments, and surveys | ● identify the population and sample in a statistical study<br>● identify voluntary response samples and convenience samples. Explain how these sampling methods can lead to bias.<br>● describe how to obtain a random sample using slips of paper, technology, or a table of random digits<br>● distinguish a simple random sample from a stratified random sample or cluster sample. Give the advantages and disadvantages of each sampling method.<br>● explain how undercoverage, nonresponse, question wording, and other aspects of a sample survey can lead to bias<br>● distinguish between an observational study and an experiment<br>● explain the concept of confounding a how it limits the ability to make cause-and-effect conclusions<br>● identify the experimental units, explanatory and response variables, and treatments in an experiment<br>● explain the purpose of comparison, random assignment, control, and replication in an experiment<br>● describe a completely randomized design for an experiment, including how to randomly assign treatments using slips of paper, technology, or a table of random digits<br>● describe the placebo effect and the purpose of blinding in an experiment<br>● interpret the meaning of statistically significant in the context of an experiment<br>● explain the purpose of blocking in an experiment. Describe a randomized block design or a matched pairs design for an experiment |

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| | | ● describe the scope of inference that is appropriate in a statistical study<br>● evaluate whether a statistical study has been carried out in an ethical manner |
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| **Lower Cape May Regional School District Statistics Curriculum**<br>**Unit 3 Overview** |
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| **Content Area: Mathematics** |
| **Unit Title: Probability, Random Variables, and Sampling Distributions** |

**Target Course/Grade Level: Statistics Grades 11, 12**

**Unit Summary:**

Probability is the mathematics of chance and provides a tool for anticipating what the distribution of data should look like under a given model. Chance behavior is unpredictable in the short run and but has a predictability in the long run. Probability provides a means to examine and describe the long-term regularity of random behavior. However, one must also be prepared to examine the common myths of probability.

Included in this unit is an examination of how modeling can be used to estimate probabilities and helpful tools for displaying possible outcomes from a chance process, e.g. Venn diagrams, two-way tables, tree diagrams. In addition, there will be a focus on exploring the connection between probability and inference and thinking critically about statistical and probabilistic issues.

**Interdisciplinary Connections:**

Integrated in this unit are connections :

NJ Student Learning Standards in Mathematics
NJ Student Learning Standards in Language Arts Literacy
NJCCCS in Technology
Social Studies
Science
Medicine
Casino industry
Sports
Business
Credit Scores
Life Insurance

**21st Century Themes, Skills, and Standards:**

This unit will integrate the 21st Century Life and Career Standards:

CRP.1 Act as a responsible and contributing citizen and employee.

Students will work in groups to complete various projects and other assignments thus demonstrating and understanding their obligations and responsibilities of being a member of a community. By working together within the classroom community students will observe how their decisions and actions impact others and the environment around them.

CRP.2 Apply appropriate academic and technical skills.

Students will apply their knowledge and skills acquired through prior experience and education to make connections between abstract statistical concepts and real world applications.

CRP.4 Communicate clearly and effectively and with reason.

Students will communicate thoughts, ideas, and action plans with clarity, using verbal, written, and/or visual methods and maximize use of their own and others' time.

CRP.5 Consider the environmental , social, and economic impact of decisions.

Assigned statistical projects and analyses will emphasize how an individual's decisions and actions positively or negatively impact other people, organizations, or the environment.

CRP.6 Demonstrate creativity and innovation.

Students will be encouraged to share solutions to problems in new and unconventional ways. They will seek new methods, practices, and ideas from a variety of sources and apply those ideas to real life statistical situations and practices.

CRP.7 Employ valid and reliable research strategies.

Students will be discerning in accepting and using new information to make decisions, change practices, or inform strategies. They will use reliable research methods and evaluate the validity of sources when considering the use and adoption of external information and practices.

CRP.8 Utilize critical thinking to make sense of problems and persevere in solving them.

Students will be able to identify a problem, understand the nature of the problem, and devise effective plans to solve the problem They will investigate the root cause of the problem and then carefully consider the options to solve the problem. Once a solution is agreed upon, they will follow through to ensure the problem is solved, whether through their action or the action of others.

CRP.11 Use technology to enhance productivity.

Students will develop their statistical understanding by maximizing the productive value of existing and new technology, including graphing calculators, statistical software, and ChromeBooks. They will understand the risks, personal and organizational, of technology applications, and take actions to prevent or mitigate these risks.

9.1.12.C.6 Explain how predictive modeling determines credit scores.
Students will complete the NJDOE Rutgers Lesson: Know the Score: Credit Score Modeling and Impacts
https://njaes.rutgers.edu/money/pdfs/DoE-Lesson-Plan-3-Credit-and-Debt-Management.pdf

9.1.12.G.3 Compare the cost of various types of insurance (e.g., life, homeowners, motor vehicle) for the same product or service, given different liability limits and risk factors.
Students will use statistical analysis to compare various type of insurance. Resource sites include: http://www.iii.org/fact-statistic/auto-insurance , http://www.ncsl.org/research/health/health-insurance-premiums.aspx , and https://www.nerdwallet.com/blog/insurance/average-life-insurance-rates/

**Learning Targets**

| CPI # | Cumulative Progress Indicators (CPI) for Unit |
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| S-CP.1 | Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events. |
| S-CP.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 uses this characterization to determine if they are independent. |
| S-CP.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*. |

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| S.CP.4 | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. |
| S.CP.5 | Recognize and explain the concepts of conditional pro ability and independence in everyday language and everyday situations. |
| S.CP.6 | Find the conditional probability of A given B as the fraction of B's outcomes that also belongs to A, and interpret the answer in terms of the model. |
| S.CP.7 | Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. |
| S.CP.8 (+) | Apply the general Multiplication Rule in a uniform probability model, P(A and B) =P(A)P(B\|A)= P(B)P(A\|B) and interpret the answer in terms of the model. |
| S.CP.9 (+) | Use permutations and combinations to compute probabilities of compound events and solve problems. |

| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
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| ● How is probability used to simulate events and to make predictions?<br>● How is probability used to anticipate what a distribution should look like?<br>● What are the benefits and feasibility of simulating events opposed to gathering real data?<br>● How can modeling predict the future? | ● Probability is the basis for statistical inference<br>● Regular and predictable patterns only occur in the long run, not in the short run.<br>● Probability is used in many real life situations including sports, games of chance, and healthcare.<br>● Simulations help to estimate probabilities.<br>● Theoretical and experimental probabilities are not the same.<br>● Probability models are useful tools for making decisions and predictions<br>● The Law of Large Numbers is an important concept when simulating probability experiments<br>● The behavior of a random variable is fundamental to understanding probability distributions |

| **Unit Objectives:**<br>***Students will know….*** | **Unit Objectives:**<br>***Students will be able to…...*** |
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| ● Probability as long-run relative frequency<br>● Law of Large Numbers concept<br>● Simulations model chance behavior<br>● Complement rule and addition rule for mutually exclusive events.<br>● Multiplication rule, conditional probabilities, and independence<br>● Discrete random variables and their probability distributions<br>● Binomial and Geometric probability distributions<br>● Simulation of probability distributions, including binomial and geometric<br>● Mean (expected value), variance, and standard deviation of a discrete random variable<br>● Linear transformation of a random variable<br>● Independence versus dependence<br>● Combining independent random variables<br>● Mean, variance, and standard deviation for sums and differences of independent random variables<br>● Mean, variance, and standard deviation of binomial random variables<br>● Parameters and statistics<br>● Biased and unbiased estimators<br>● Relationship between sample size and variability of a statistic<br>● Simulating sampling distributions: sample proportion and sample mean<br>● Interpret a sampling distribution for means<br>● Interpret a sampling distribution for proportions<br>● Central Limit Theorem | ● Determine a probability model for a chance process.<br>● Perform a simulation using the four-step S(state)P(plan)D(do)C(conclude) strategy.<br>● Construct a tree diagram, two-way table, or Venn diagram to model probabilities.<br>● Determine whether two events are independent.<br>● Calculate probability using the complement rule, the addition rule, and multiplication rule.<br>● Calculate conditional probability.<br>● Differentiate between discrete and continuous random variables.<br>● Compute probabilities using the probability distribution of a discrete random variable or certain continuous random variables.<br>● Calculate and interpret the mean (expected value), variance, and the standard deviation of binomial or geometric random variables.<br>● Use the Law of Large Numbers and simulation methods to approximate the mean of a distribution.<br>● Find the probabilities involving the sum or difference of independent normal random variables.<br>● Describe the effect of transforming a random variable by adding or subtracting a constant and multiplying or dividing by a constant.<br>● Determine whether the conditions for using a binomial random variable are met.<br>● Compute and interpret probabilities involving binomial distributions.<br>● Distinguish between a parameter and a |

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| | statistic<br>● Determine whether or not a statistic is an unbiased estimator of a population parameter<br>● Describe the relation between sample size and the variability of a statistic<br>● Calculate, interpret and apply the mean and standard deviation of the sampling distribution of a sample mean.<br>● Calculate, interpret, and apply the mean and standard deviation of the sampling distribution of a sample proportion<br>● Define and establish conditions for the application of the Central Limit Theorem. |
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| **Lower Cape May Regional School District Mathematics Curriculum**<br>**Unit 4 Overview** |
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| **Content Area: Mathematics** |
| **Unit Title: Statistical Inference: Confirming Models and Testing Hypotheses** |

**Target Course/Grade Level: Statistics Grades 11, 12**

**Unit Summary:**

Statistical inference is the process of generalizing the results of a sample to a larger population (or generalizing without cause and effect in case of experiments). Statistical inference guides the selection of appropriate models, draws conclusions about a population based on a sample and analyzes the certainty of those conclusions. Inference from data is thought of as the process of choosing a reasonable model, including a statement in probability language, of how confident one can be about the selection.

**Interdisciplinary Connections:**

Voting and elections
Pollution and auto emissions
Quality control
Cell phones and brain cancer
Teens, adults, and social networking
Health and wellness
Sports
Insurance industry
Finance and investments
Language Arts Literacy
Technology

**21st Century Themes, Skills, and Standards:**

CRP.1 Act as a responsible and contributing citizen and employee.

Students will work in groups to complete various projects and other assignments thus demonstrating and understanding their obligations and responsibilities of being a member of a community. By working together within the classroom community students will observe how their decisions and actions impact others and the environment around them.

CRP.2 Apply appropriate academic and technical skills.

Students will apply their knowledge and skills acquired through prior experience and education to make connections between abstract statistical concepts and real world applications.

CRP.4 Communicate clearly and effectively and with reason.

Students will communicate thoughts, ideas, and action plans with clarity, using verbal, written, and/or visual methods and maximize use of their own and others' time.

CRP.5 Consider the environmental , social, and economic impact of decisions.

Assigned statistical projects and analyses will emphasize how an individual's decisions and actions positively or negatively impact other people, organizations, or the environment.

CRP.6 Demonstrate creativity and innovation

Students will be encouraged to share solutions to problems in new and unconventional ways. They will seek new methods, practices, and ideas from a variety of sources and apply those ideas to real life statistical situations and practices.

CRP.7 Employ valid and reliable research strategies.

Students will be discerning in accepting and using new information to make decisions, change practices, or inform strategies. They will use reliable research methods and evaluate the validity of sources when considering the use and adoption of external information and practices.

CRP.8 Utilize critical thinking to make sense of problems and persevere in solving them

Students will be able to identify a problem, understand the nature of the problem, and devise effective plans to solve the problem They will investigate the root cause of the problem and then carefully consider the options to solve the problem. Once a solution is agreed upon, they will follow through to ensure the problem is solved, whether through their action or the action of others.

CRP.11 Use technology to enhance productivity.
Students will develop their statistical understanding by maximizing the productive value of existing and new technology, including graphing calculators, statistical software, and ChromeBooks. They will understand the risks, personal and organizational, of technology applications, and take actions to prevent or mitigate these risks.

9.2.12.C.1 Review career goals and determine steps necessary for attainment.
Students will examine and explore various careers through unit projects and problems.

9.3.12.BM.1 Utilize mathematical concepts, skills, and problem solving to obtain necessary information for decision-making in business. Students will analyze statistical tests and models, as they apply to various business-related issues, and make and statistically support solutions to those issues.

9.3.12.FN.1 Utilize mathematical concepts, skills, and problem solving to obtain necessary information for decision making in the finance industry.
Students will analyze statistical tests and models, as they apply to various finance industry issues, and make and support solutions to those issues.

**Learning Targets**

| CPI # | Cumulative Progress Indicators (CPI) for Unit |
|---|---|
| S-IC.1 | Understand statistics as a process for making inferences about population parameters based on a random sample from that population. |
| S-IC.2 | Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. |

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| S-IC.3 | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. |
| S-IC.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. |
| S-IC.5 | Use data from randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. |
| S-IC.6 | Evaluate reports based on data. |
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| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
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| ● How is statistical inference used to make conclusions from data?<br>● How much evidence do you need to gather before you can make a reasonable conjecture?<br>● How can a sample size be determined for a study that would place the results within a specified error range?<br>● How are confidence intervals and significance tests used in scientific experiments?<br>● How can one prepare for errors from significance tests?<br>● What inference can be made from the slope of a linear regression line? | ● A confidence interval provides a range of plausible values for a characteristic of a population.<br>● Inference leads to many real life decisions.<br>● Error analysis is a critical component of hypothesis testing.<br>● Accurate analysis depends on the quality of the data. |
| **Unit Objectives:**<br>***Students will know….***<br>● Estimating population parameters and margins of error<br>● Properties of point estimators, including unbiasedness and variability<br>● Logic, meaning, and properties of confidence intervals<br>● Meaning of confidence level<br>● Large sample confidence intervals for a proportion and for a difference between two proportions<br>● Confidence intervals for a mean and | **Unit Objectives:**<br>***Students will be able to…...***<br>● Explain in nontechnical language the meaning of confidence statements in statistical reports<br>● Use the Four Step Process (State, Plan, Do, Conclude) to construct and interpret a confidence interval<br>● Interpret a confidence level in context<br>● Find the sample size required to obtain a confidence interval with a specified margin of error<br>● Explain how the t distribution is different from the Normal distribution |

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| for a difference of between two means (paired and unpaired)<br>● Confidence interval for the slope of a least-squares regression line<br>● Tests of significance: null and alternative hypotheses; p-values, one- and two-sided tests<br>● Large sample test for a proportion and for a difference between two proportions<br>● Large sample test for a mean and a difference between two means (paired and unpaired)<br>● Chi-square test for goodness of fit, homogeneity of proportions, and independence (one- and two- tables)<br>● Type I error, Type II error, and Power of a significance test<br>● Normally distributed data: t-distribution<br>● Single sample t procedure<br>● Two sample (independent and matched pairs) t procedures<br>● Test for the slope of a least-squares regression line | ● State the null hypothesis and the alternative hypothesis in a testing situation<br>● Explain the meaning of the P-value in non-technical language<br>● Calculate and analyze a Type I error and a Type II error and the power of a significance test<br>● Calculate the z statistic and the P-value for a one- and a two-sided test<br>● Decide when a problem requires an inference about a mean or comparing two means<br>● Recognize from the design of a study when one-sample, matched pairs, or two-sample procedures are needed<br>● Perform a t-test for the hypothesis of a population mean for one- and two-samples<br>● Perform confidence intervals and tests of significance on matched pairs data<br>● Recognize when a problem requires inference about a proportion or comparing two proportions<br>● Use a z value to give a confidence interval and significance test for a population proportion, either one-sample or two- sample<br>● State the null and alternative hypotheses and compute expected counts for a Chi-square test for goodness of fit<br>● Calculate the chi-square statistic, degrees of freedom, and P-value for a Chi-square test<br>● Interpret Chi-square tests for independence<br>● Calculate the confidence interval about a regression slope<br>● Perform a linear regression t-distribution significance test on the |

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| | | slope of a regression line<br>● Use the TI-84 for confidence intervals and significance tests<br>● Analyze computer output for confidence intervals and significance tests |
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| **Lower Cape May Regional School District Mathematics Curriculum**<br>**Unit 5 - Overview** |
|---|
| **Content Area: Mathematics** |
| **Unit Title: Test Review for AP Examination** |
| **Target Course/Grade Level: Statistics Grades 11, 12** |

**Unit Summary:** Students may be eligible to receive college credit for a 3 or better on the AP Statistic Examination. Review and preparation for the exam are imperative for success. Students must know how the exam is organized, types of questions they might encounter, and how it is being scored.

**Interdisciplinary Connections:**
NJ Student Learning Standards in Mathematics
NJ Student Learning Standards in Language Arts Literacy
NJCCCS in Technology

**21st Century Themes, Skills, and Standards:**

CRP.1 Act as a responsible and contributing citizen and employee.
Students will work in groups to complete various projects and other assignments thus demonstrating and understanding their obligations and responsibilities of being a member of a community. By working together within the classroom community students will observe how their decisions and actions impact others and the environment around them.

CRP.2 Apply appropriate academic and technical skills.
Students will apply their knowledge and skills acquired through prior experience and education to make connections between abstract statistical concepts and real world applications.

CRP.4 Communicate clearly and effectively and with reason.
Students will communicate thoughts, ideas, and action plans with clarity, using verbal, written, and/or visual methods and maximize use of their own and others' time.

CRP.5 Consider the environmental , social, and economic impact of decisions.
Assigned statistical projects and analyses will emphasize how an individual's decisions and actions positively or negatively impact other people, organizations, or the environment.

CRP.6 Demonstrate creativity and innovation
Students will be encouraged to share solutions to problems in new and unconventional ways. They will seek new methods, practices, and ideas from a variety of sources and apply those ideas to real life statistical situations and practices.

CRP.7 Employ valid and reliable research strategies.
Students will be discerning in accepting and using new information to make decisions, change practices, or inform strategies. They will use reliable research methods and evaluate the validity of sources when considering the use and adoption of external information and practices.

CRP.8 Utilize critical thinking to make sense of problems and persevere in solving them
Students will be able to identify a problem, understand the nature of the problem, and devise effective plans to solve the problem They will investigate the root cause of the problem and then carefully consider the options to solve the problem. Once a solution is agreed upon, they will follow through to ensure the problem is solved, whether through

their action or the action of others.

CRP.11 Use technology to enhance productivity.

Students will develop their statistical understanding by maximizing the productive value of existing and new technology, including graphing calculators, statistical software, and ChromeBooks. They will understand the risks, personal and organizational, of technology applications, and take actions to prevent or mitigate these risks.

| Learning Targets | |
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| **CPI #** | **Cumulative Progress Indicators (CPI) for Unit** |
| See all previous units. | |
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| **Unit Essential Questions:** | **Unit Enduring Understandings:** |
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| ● What are effective strategies to prepare for the AP Statistics Exam?<br>● Why is review important?<br>● How can I effectively communicate my ideas to maximize my score on the exam? | ● The AP Statistics Exam consists of forty multiple choice questions and six free response questions.<br>● The six free response questions require a clear explanation of the reasoning needed to reach an accurate and meaningful conclusion. |

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| **Unit Objectives:**<br>***Students will know….***<br>● See all unit objectives of previous units. | **Unit Objectives:**<br>***Students will be able to…...***<br>● Know when to guess on multiple choice questions.<br>● Know when to use the calculator and when not to use the calculator.<br>● Read all problems carefully and follow directions, e.g. when asked to "justify" or "explain" be sure to do so.<br>● Recognize extraneous information in a problems.<br>● Clearly identify variables when using a formula, writing it down, and then substituting.<br>● Communicate your thinking clearly.<br>● Organize your thoughts before you write.<br>● Write neatly and efficiently.<br>● Know how to score a free response answer using an official AP rubric. |

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**Lower Cape May Regional School District Statistics-Mathematics Curriculum**
**Evidence of Learning**

**Specific Formative Assessments Utilized in Daily Lessons:**

- Student observation in the classroom
- Homework practice
- Class participation
- Warm Up or Do Now
- Notebook
- Statistics Journal
- Quizzes
- Oral presentations
- Closure questions or Exit questions
- Investigative activities
- Sample AP exam questions
- Magazine or newspaper article statistical analysis
- Kahoot
- Quizlet

**Summative Assessment Utilized throughout Units:**

- Unit project
- Student presentations
- Unit Benchmark assessment
- AP Statistics Practice Test
- AP Final Test

**Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:**
Teacher tutoring
Peer tutoring
Cooperative Learning Groups
Modified Assignments
Differentiated Instruction
Response to Intervention (www.help4teachers.com)
Follow all IEP and 504 modifications
See High Prep and Low Prep Differentiation Strategies

**Teacher Notes:**

- As required by the NJ Department of Education, teachers in all content areas will integrate the 21st Century Life and Careers Standards. As the NJDOE indicates, "Providing New Jersey students with the life and career skills needed to function optimally within this dynamic context is a critical focus and organizing principle of K-12 public education. New Jersey has both an obligation to prepare its young people to thrive in this environment, and a vested economic interest in grooming an engaged citizenry made up of productive members of a global workforce that rewards innovation, creativity, and adaptation to change." The links below indicate the CPIs for grade ranges and need to be addressed throughout the units of study:

  Life and Career Standards

- As indicated in the NJSLS, standards and interdisciplinary connections will be integrated throughout content area curriculum. Links to relevant content standards can be found below:

  LINK APPROPRIATE INTERDISCIPLINARY CONNECTIONS & RELEVANT NJSLS HERE

**Project-based Learning Tasks:**

- Choose a quantitative peer-reviewed article from a scholarly journal. Write a statistical critique of the article.
- Research Project:Identify a Research Question

1. Collect Data- Observational Study or Experiment
2. Analyze Data - Graphically and Numerically
3. Perform Inference-Answer Research Question
4. Present Findings

- Simple Regression-Go to a local grocery store and collect these data for at least 75 breakfast cereals: cereal name; grams of sugar per serving; and the price per ounce (or gram). If the store you select does not have at least 75 breakfast cereals, then collect data from another store too. Use these data to estimate the simple regression model with price as the dependent variable and sugar as the explanatory variable
- ANOVA - estimate and compare the average words per sentence in *People*, *Time*, and *New Republic*.
- Comparing Two Samples: Compare the prices of men and women's t-shirts.

**Vocabulary:**

In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.

**Unit 1**

1.5 *x* IQR Rule for Outliers
68-95-99.7 Rule
Association
Categorical Variable
Coefficient of Determination
Conditional Distribution
Correlation
Density Curve
Distribution
Explanatory Variable
Extrapolation
Five-number Summary
Individuals
Influential
Least-squares Regression Line

Marginal Distribution
Mean
Median
Negative Association
Normal Curve
Normal Distribution
Outlier
Percentile
Positive Association
Predicted Value
Quantitative Variable
Regression Line
Residual
Residual Plot
Response Variable
Scatterplot
Skewed Distributions
Slope
Standard Deviation
Standard Deviation of the Residuals
Standard Normal Distribution
Standard Normal Table
Standardized Score (z-score)
Symmetric
Variables
Variance
*y* intercept

**Unit 2**
Bias
Census
Clusters
Cluster Sample
Completely Randomized Sample
Confounding
Convenience Sample
Double-blind
Experiment
Experimental Units
Nonresponse

Observational Study
Population
Random Assignment
Random Sampling
Sample
Simple Random Sample (SRS)
Statistically Significant
Strata
Stratified Random Sample
Subjects
Treatment
Undercoverage
Voluntary Response Sample

**Unit 3**

Binomial coefficient
Binomial distribution
Binomial random variable
Binomial setting
Central limit theorem
Conditional probability
Continuous random variable
Event
Geometric distribution
Geometric random variable
Geometric setting
Independent events
Independent random variables
Mean (expected value) of a discrete random variable
Mean (expected value) of a geometric random variable
Mean of a binomial random variable
Mean of the sampling distribution
Multiplication rule for independent events
Mutually exclusive (disjoint)
Parameter
Probability distribution
Probability model
Random variable
Sample space
Sampling distribution

Standard deviation of a binomial variable
Standard deviation of a discrete random variable
Standard deviation of the sampling distribution
Statistic
Unbiased estimator
Variability of a statistic
Variance of a discrete random variable

**Unit 4**

Alternative hypothesis Ha
Chi-square statistic
Confidence interval
Confidence level
Degrees of freedom
Expected count
Margin of error
Null hypothesis H0
One-sided alternative hypothesis
One-tailed
Point estimate
Point estimator
Population Proportion
Power of a test
P-value
Standard error
Standard error of the sample mean
Statistically significant at level
Test statistic
Two-sided alternative hypothesis
Two-tailed
Type I error
Type II error

**The Research Process:**

The research process must be integrated within each course curriculum. Student will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.

- EBSCOhost
- https://ow
- l.english.purdue.edu/owl/
- https://www.causeweb.org/cause/

**Technology:**

Students must engage in technology applications integrated throughout the curriculum. Applicable technology utilized in this curricula are included below:

- Graphing Calculator
- Microsoft EXCEL
- StatDisk - http://www.statdisk.org/manual/
- Chromebook
- Kahoot
- Quizlet
- Geogebra

**Resources:**

Ancillary resources and materials used to deliver instruction are included below:

- http://www.seeingstatistics.com/
- https://blog.kissmetrics.com/guide-to-facebook-insights/
- https://blog.bufferapp.com/facebook-insights
- http://onlinestatbook.com/rvls.html
- https://www.statcrunch.com/
- http://www.learner.org/resources/series65.html (Against All Odds)
- https://www.causeweb.org/wiki/chance/index.php/Main_Page
- http://www.macmillanlearning.com/Catalog/studentresources/tps5e
- http://www.robertniles.com/data/

**Differentiation Strategies**

Differentiation strategies can require varied amounts of preparation time. High-prep strategies often require a teacher to both create multiple pathways to process information/demonstrate learning and to assign students to those pathways. Hence, more ongoing monitoring and assessment is often required. In contrast, low-prep strategies might require a teacher to strategically create process and product choices for students, but students are allowed to choose which option to pursue given their learning profile or readiness level. Also, a low-prep strategy might be focused on a discrete skill (such as vocabulary words), so there are fewer details to consider. Most teachers find that integration of one to two new low-prep strategies and one high-prep strategy each quarter is a reasonable goal.

| **Low Prep Strategies (add to list as needed)** | |
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| **Varied journal prompts, spelling or vocabulary lists** | Students are given a choice of different journal prompts, spelling lists or vocabulary lists depending on level of proficiency/assessment results. |

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| **Anchor activities** | Anchor activities provide meaningful options for students when they are not actively engaged in classroom activities (e.g., when they finish early, are waiting for further directions, are stumped, first enter class, or when the teacher is working with other students). Anchors should be directly related to the current learning goals. |
| **Choices of books** | Different textbooks or novels (often at different levels) that students are allowed to choose from for content study or for literature circles. |
| **Choices of review activities** | Different review or extension activities are made available to students during a specific section of the class (such as at the beginning or end of the period). |
| **Homework options** | Students are provided with choices about the assignments they complete as homework. Or, students are directed to specific homework based on student needs. |
| **Student-teacher goal setting** | The teacher and student work together to develop individual learning goals for the student. |
| **Flexible grouping** | Students might be instructed as a whole group, in small groups of various permutations (homogeneous or heterogeneous by skill or interest), in pairs or individual. Any small groups or pairs change over time based on assessment data. |
| **Varied computer programs** | The computer is used as an additional center in the classroom, and students are directed to specific websites or software that allows them to work on skills at their level. |
| **Multiple Intelligence or Learning Style options** | Students select activities or are assigned an activity that is designed for learning a specific area of content through their strong intelligence (verbal-linguistic, interpersonal, musical, etc.) |

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| **Varying scaffolding of same organizer** | Provide graphic organizers that require students to complete various amounts of information. Some will be more filled out (by the teacher) than others. |
| **Think-Pair-Share by readiness, interest, and/or learning profile** | Students are placed in predetermined pairs, asked to think about a question for a specific amount of time, then are asked to share their answers first with their partner and then with the whole group. |
| **Mini workshops to re-teach or extend skills** | A short, specific lesson with a student or group of students that focuses on one area of interest or reinforcement of a specific skill. |
| **Orbitals** | Students conduct independent investigations generally lasting 3-6 weeks. The investigations "orbit" or revolve around some facet of the curriculum. |
| **Games to practice mastery of information and skill** | Use games as a way to review and reinforce concepts. Include questions and tasks that are on a variety of cognitive levels. |
| **Multiple levels of questions** | Teachers vary the sorts of questions posed to different students based on their ability to handle them. Varying questions is an excellent way to build the confidence (and motivation) of students who are reluctant to contribute to class discourse. Note: Most teachers would probably admit that without even thinking about it they tend to address particular types of questions to particular students. In some cases, such tendencies may need to be corrected. (For example, a teacher may be unknowingly addressing all of the more challenging questions to one student, thereby inhibiting other students' learning and fostering class resentment of that student.) |
| **High Prep Strategies (add to list as needed)** | |

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| **Cubing** | Designed to help students think about a topic or idea from many different angles or perspectives. The tasks are placed on the six sides of a cube and use commands that help support thinking (justify, describe, evaluate, connect, etc.). The students complete the task on the side that ends face up, either independently or in homogenous groups. |
| **Tiered assignment/ product** | The content and objective are the same, but the process and/or the products that students must create to demonstrate mastery are varied according to the students' readiness level. |
| **Independent studies** | Students choose a topic of interest that they are curious about and wants to discover new information on. Research is done from questions developed by the student and/or teacher. The researcher produces a product to share learning with classmates. |
| **4MAT** | Teachers plan instruction for each of four learning preferences over the course of several days on a given topic. Some lessons focus on mastery, some on understanding, some on personal involvement, and some on synthesis. Each learner has a chance to approach the topic through preferred modes and to strengthen weaker areas |
| **Jigsaw** | Students are grouped based on their reading proficiency and each group is given an appropriate text on a specific aspect of a topic (the economic, political and social impact of the Civil War, for example). Students later get into heterogeneous groups to share their findings with their peers, who have read about different areas of study from source texts on their own reading levels. The jigsaw technique allows you to tackle the same subject with all of your students while discreetly providing them the different tools they need to get there. |
| **Multiple texts** | The teacher obtains or creates a variety of texts at different reading levels to assign strategically to students. |

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| **Alternative assessments** | After completing a learning experience via the same content or process, the student may have a choice of products to show what has been learned. This differentiation creates possibilities for students who excel in different modalities over others (verbal versus visual). |
| **Modified Assessments** | Assessments can be modified in a variety of ways – for example by formatting the document differently (e.g. more space between questions) or by using different types of questions (matching vs. open ended) or by asking only the truly essential questions. |
| **Learning contracts or Personal Agendas** | A contract is a negotiated agreement between teacher and student that may have a mix of requirements and choice based on skills and understandings considered important by the teacher. A personal agenda could be quite similar, as it would list the tasks the teacher wants each student to accomplish in a given day/lesson/unit. Both Learning contracts and personal agendas will likely vary between students within a classroom. |
| **Compacting** | This strategy begins with a student assessment to determine level of knowledge or skill already attained (i.e. pretest). Students who demonstrate proficiency before the unit even begins are given the opportunity to work at a higher level (either independently or in a group). |
| **Literature circles** | Flexible grouping of students who engage in different studies of a piece of literature. Groups can be heterogeneous and homogeneous. |
| **Learning Centers** | A station (or simply a collection of materials) that students might use independently to explore topics or practice skills. Centers allow individual or groups of students to work at their own pace. Students are constantly reassessed to determine which centers are appropriate for students at a particular time, and to plan activities at those centers to build the most pressing skills. |

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| **Tic-Tac-Toe Choice Board (sometimes called "Think-Tac-Toe"** | The tic-tac-toe choice board is a strategy that enables students to choose multiple tasks to practice a skill, or demonstrate and extend understanding of a process or concept. From the board, students choose (or teacher assigns) three adjacent or diagonal. To design a tic-tac-toe board: - Identify the outcomes and instructional focus - Design 9 different tasks - Use assessment data to determine student levels - Arrange the tasks on a tic-tac-toe board either randomly, in rows according to level of difficulty, or you may want to select one critical task to place in the center of the board for all students to complete. |

**Curriculum development Resources/Instructional Materials:**

List or Link Ancillary Resources and Curriculum Materials Here:

- http://www.seeingstatistics.com/
- https://blog.kissmetrics.com/guide-to-facebook-insights/
- https://blog.bufferapp.com/facebook-insights
- http://onlinestatbook.com/rvls.html
- https://www.statcrunch.com/
- http://www.learner.org/resources/series65.html (Against All Odds)
- https://www.causeweb.org/wiki/chance/index.php/Main_Page
- http://www.macmillanlearning.com/Catalog/studentresources/tps5e

**Board of Education Approved Text(s)**

Starnes, D. S., Tabor, J., Yates, D. S., & Moore, D. S. (2015). *The practice of statistics*. New York: W.H. Freeman and Company/BFW.