Unit 3: Sampling and Inference

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Course(s): **Math 7 Pre-Algebra**
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Pre-Algebra, GRADE 7

Unit 3: Sampling and Inference

Belleville Board of Education

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Unit Overview

Students will analyze and use statistics to make interferences about a population. From this unit students will be able to use sampling to draw inferences about a population, investigate chance processes, and use and evaluate probability models. Students will be able to use graphs to interpret and investigate data. Students will be able to calculate and determine central tendency and range from both data and graphs. Students will use sampling to conduct a survey, use various methods to organize their data to make predictions for larger populations.

Enduring Understanding

By the end of the unit students will understand .....

measures of center and measures of variability

that statistics can be used to gain information about a population by examining a sample of the population

various sampling techniques and how they can predict the actions of a larger group

that the probability of an event is a number between 0 and 1 and expresses the likelihood of the event occurring.

the difference between experimental probability and theoretical probability.

that data, statistics, and probability are used to understand and interpret data to make informed decisions

students will determine how outliers affect data in a set.

how to use statistics to make estimates and inferences.

Essential Questions

How are statistics measures can be used to compare data sets?

How can selected data be used to draw inferences, make predictions, and compare populations?

How do you use a survey to make conclusions about the general population?

How can experimental and theoretical probabilities be used to make predictions or draw conclusions?

How do you find the probability of a compound event?

How are statistics and probability relatable to real world situations?

Exit Skills

Compute and use measures of central tendencies(mean, median and mode)

Choose an appropriate measure of central tendency..

Compute measures of variability.

Compute mean absolute deviation.

Compare populations using the measure of center and variability.

Identify sampling techniques.

Predict actions of a larger group using an appropriate sample.

Determine probability of an event.

Determine the probability of the complement of an event.

Discover and compare experimental and theoretical probabilities.

Determine the number of outcomes for an event.

Determine the probability of a compound event.

New Jersey Student Learning Standards (NJSLS)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.SP.A	Use random sampling to draw inferences about a population.
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. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.
MA.7.SP.B	Draw informal comparative inferences about two populations.
MA.7.SP.B.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.
MA.7.SP.B.4	Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.
MA.7.SP.C	Investigate chance processes and develop, use, and evaluate probability models.
MA.7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
MA.7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.
MA.7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
MA.7.SP.C.7a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.
MA.7.SP.C.7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?
MA.7.SP.C.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
MA.7.SP.C.8a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
MA.7.SP.C.8b	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling

	double sixes"), identify the outcomes in the sample space which compose the event.
MA.7.SP.C.8c	Design and use a simulation to generate frequencies for compound events. For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?

Interdisciplinary Connections

STEM/STEAM

Economics

Business

Statistics

Science.

LA.W.7.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
6-8.MS-ESS3-5.1.1	Ask questions to identify and clarify evidence of an argument.
6-8.MS-ESS1-1.2.1	Develop and use a model to describe phenomena.
6-8.MS-ESS1-4.3	Scale, Proportion, and Quantity
6-8.MS-ESS2-2.3	Scale Proportion and Quantity
6-8.MS-ESS1-2.4.1	Models can be used to represent systems and their interactions.
6-8.MS-ESS1-3.4.1	Analyze and interpret data to determine similarities and differences in findings.
VPA.1.3.8.D.2	Apply various art media, art mediums, technologies, and processes in the creation of allegorical, theme-based, two- and three-dimensional works of art, using tools and technologies that are appropriate to the theme and goals.
VPA.1.3.8.D.6	Synthesize the physical properties, processes, and techniques for visual communication in multiple art media (including digital media), and apply this knowledge to the creation of original artworks.
VPA.1.3.8.D.CS1	The creation of art is driven by the principles of balance, harmony, unity, emphasis, proportion, and rhythm/movement.

Learning Objectives

The student will be able to .....

Obtain the measures of center and variability of a data set and use them to interpret and analyze data.

Determine if a set of data contains an outlier.

Compute and compare the mean absolute deviation for two sets of data.

Create a dot plot for a set of data.

Display and analyze data in box-&-whisker plots and dot plots and use these to compare populations.

Identify , compare and analyze sampling methods.

Make a inference about a larger population based on a sample.

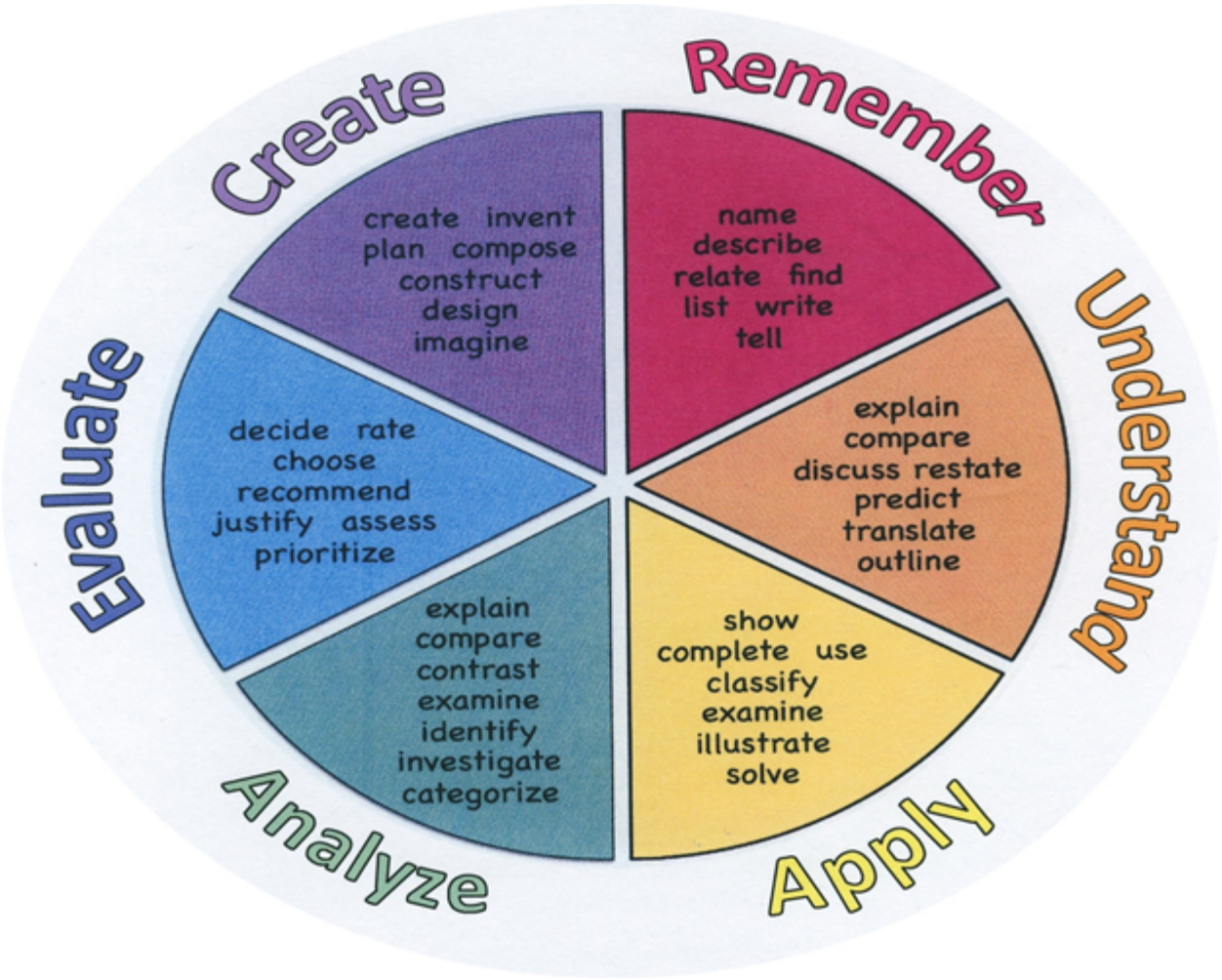
Determine the theoretical probability of a simple event and its complement.

Compare experimental and theoretical probability.

Use the Counting Principle to find the number of outcomes of an event.

Determine the probability of a compound event.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Activity #1: Student choose an existing game to analyze. Students determine and compare the theoretical to the experimental probability.

Activity #2: Students create an original game with a set of rules. Students determine, analyze and compare the theoretical to the experimental probability.

Inquiry Labs - Textbook pages 452,475,487

Textbook, eAssessment, supplemental materials:

https://my.mheducation.com/login

AI Assessment and Learning System:

https://www.aleks.com/

Probabilty Video:

https://www.youtube.com/watch?v=tyAwxrUadtw

Videos on mathematical concepts (grade 6 - alg 2)

https://www.virtualnerd.com/

Lessonplans and instructional resources:

https://betterlesson.com/home?from=bl_landing_plans_cta

Mindset:

https://www.youtube.com/watch?v=3icoSeGqQtY

http://www.youcubed.org/wp-content/uploads/Positive-Classroom-Norms2.pdf

Math Discourse:

https://mrorr-isageek.com/start-a-math-fight/

Teaching Strategies for Improving Algebra Knowledge in Middle and High School Students:

https://ies.ed.gov/ncee/wwc/PracticeGuide/20

Coaching Corner:

https://sites.google.com/belleville.k12.nj.us/thecoachingcorner/home

Algebra Tools - Functions:(Refer to problems included in the pre-requisite skills in this document)

https://www.state.nj.us/education/aps/cccs/math/NJISTFunctions.pdf

Algebra Tools - Algebra:(Refer to problems included in the pre-requisite skills in this document)

https://www.state.nj.us/education/aps/cccs/math/NJISTAlgebra.pdf

Quia (Quintessential Instructional Archive)- use to create or use already created online activities:

https://www.quia.com/web

Misc Mathematics materials:

http://www.mathnstuff.com/

Kahoot:

https://create.kahoot.it/

Assessment Evidence - Checking for Understanding (CFU)

Activity #1: Entrance Ticket/Giant Marble Jar - as student enter the room they pull a colored marble from a jar. The experimental and theoretical probability is determined.-formative assessment

Activity #2: Experiment - student groups are given a number of items (marbles, letter tiles etc), number cubes, spinners etc and asked to formulate an experiment, list the experimental and theoretical probability of their simulation.-formative assessment

Unit tests-summative assessment

Web-based assessment-alternate assessment

Inquiry Labs - Textbook pages 452,475,487/Textbook, eAssessment, supplemental materials-benchmark assessement

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer

- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Study Guide
- Surveys
- Teacher Observation Checklist
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Math Accelerated-A Pre-Algebra Program 2017 - McGraw-Hill

Math Accelerated-A Pre-Algebra Program 2017 - Digital Resources - McGraw-Hill

Ancillary Resources

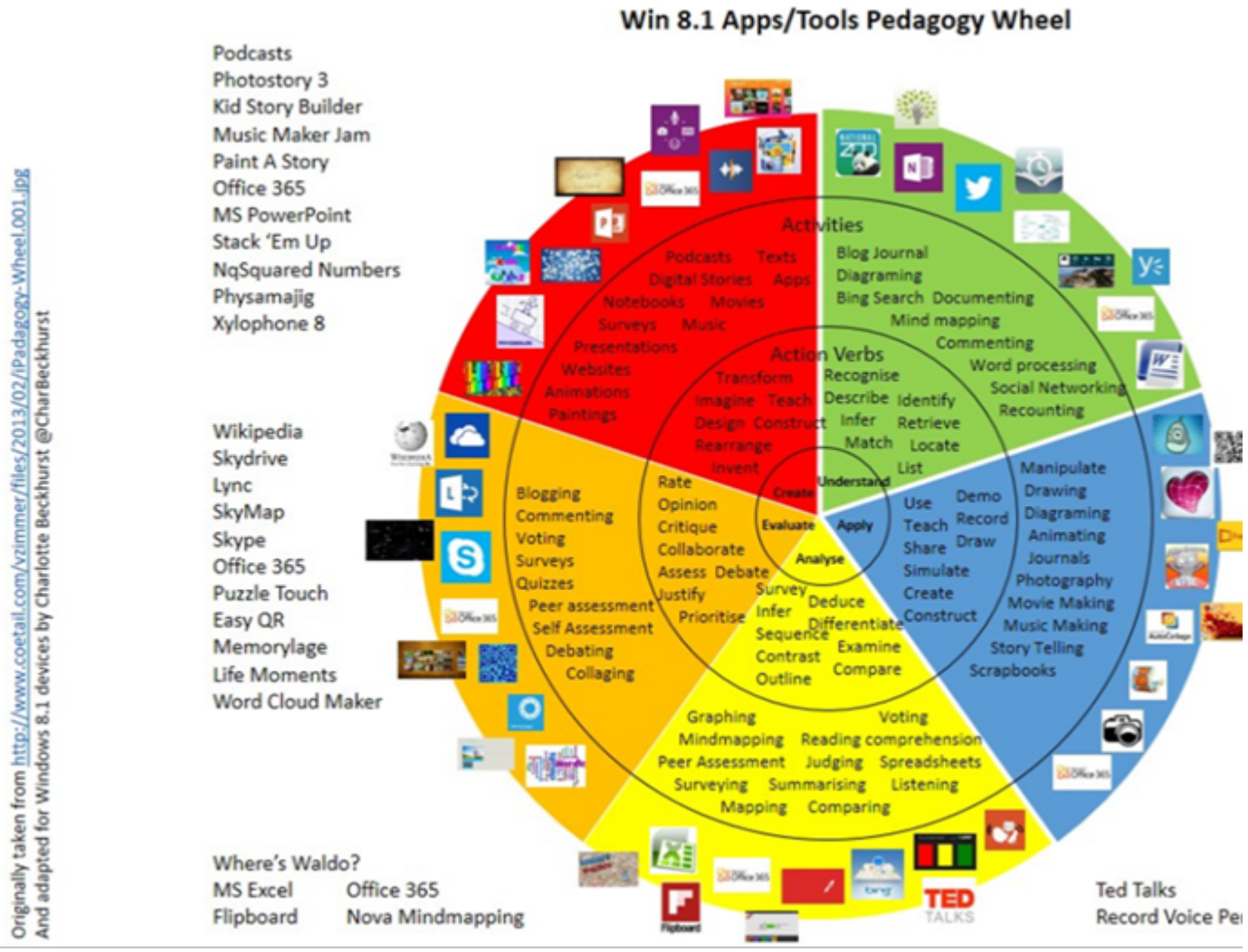
Glencoe McGraw-Hill Algebra 1 2014

Technology Infusion

Activity: Students use online random number generators, coin flips etc to explore experimental vs theortical probability.

- ALEKS

- Calculator/Graphing calculator
- Google Classroom
- McGraw-Hill Education
- Desmos.com
- geogebra.org
- Youtube
- Khan academy
- MS Excel
- Office 365
- MS Word
- PodCasts
- MS Powerpoint
- Wikipedia
- Skype
- Twitter
- Ted Talks
- Flipgrid



Alignment to 21st Century Skills & Technology

Mastery of key subjects and 21st century themes is essential for all students in the 21stcentury.

Key subjects include:

- English, Language Arts
- World languages
- Arts
- Statistics
- Economics
- Science
- Geography
- Social Studies
- Computer Science

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different

	ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
CAEP.9.2.8.B.1	Research careers within the 16 Career Clusters ® and determine attributes of career success.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
CAEP.9.2.8.B.6	Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.
TECH.8.1.8.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.

21st Century Skills/Interdisciplinary Themes

- English, Language Arts
- World languages
- Arts
- Statistics
- Economics
- Science
- Geography
- Social Studies
- Computer Science

21st Century Skills

STEM/STEAM

Global and Environmental Awareness

Problem Solving Skills

Personal Literacy

Business

Differentiation

Activity: Small Group Instruction - student choice of one or more of the activities already listed in others areas and modeled using a variety of manipulatives.

Differentiations available as per the particular needs of individual students as per teacher assessment:

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions

- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw

- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Use of Manipulative: Students write each of the letters of their name on a separate card and place them in a bag. Students determine the theoretical probability for each letter then conduct and experimental withdrawing and replacing letters a set number of times to determine experimental probability.

Possible options available as per the particular needs of individual students as per teacher assessment:

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments

- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Activity: Exploring combination - Create a real world situation to model using index cards to list the individual options such as ordering a pizza with toppings or an ice cream sundae, to determine the possible combinations they could order.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Activity: Students explore population sampling- students determine a survey question to ask a given population. Students must determine their sample population record the data and come to a conclusion how their results reflect the whole population.

Possible options available as per the particular needs of individual students as per teacher assessment:

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Activity: Students research and create an original carnival game. Students explore chance and probability of their game and create a working model of their game which can be played in class to demonstrate.

Possible options available as per the particular needs of individual students as per teacher assessment:

- Above grade level placement option for qualified students
- Advanced problem-solving

- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: