Unit 04: Probability and Statistics

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **7 Weeks**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

MA.7.SP	Statistics and Probability
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.
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.
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.
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.
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.
MA.7.SP.C.7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
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.

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.8.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.8.D.1	Understand and model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics including appropriate use of social media.
TECH.8.1.8.D.5	Understand appropriate uses for social media and the negative consequences of misuse.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

Capacities of the Literate Individual
Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.
They come to understand other perspectives and cultures.

LA.K-12.NJSLSA.R	Reading
MATH.K-12.1	Make sense of problems and persevere in solving them
	Key Ideas and Details
LA.RL.7.1	Cite several pieces of textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferences drawn from the text.
MATH.K-12.2	Reason abstractly and quantitatively
LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning
LA.K-12.NJSLSA.W	Writing
	Text Types and Purposes
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.W.7.1	Write arguments to support claims with clear reasons and relevant evidence.
LA.W.7.1.A	Introduce claim(s), acknowledge alternate or opposing claims, and organize the reasons and evidence logically.
LA.W.7.1.B	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.
LA.K-12.NJSLSA.SL	Speaking and Listening
LA.W.7.1.C	Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), reasons, and evidence.
LA.W.7.1.D	Establish and maintain a formal style/academic style, approach, and form.
	Comprehension and Collaboration

LA.W.7.1.E	Provide a concluding statement or section that follows from and supports the argument presented.
LA.K-12.NJSLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.SL.7.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others' ideas and expressing their own clearly.
LA.SL.7.1.A	Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
LA.SL.7.1.B	Follow rules for collegial discussions, track progress toward specific goals and deadlines, and define individual roles as needed.
LA.SL.7.1.C	Pose questions that elicit elaboration and respond to others' questions and comments with relevant observations and ideas that bring the discussion back on topic as needed.
LA.SL.7.1.D	Acknowledge new information expressed by others and, when warranted, modify their own views.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale
Unit Rationale The purpose of this unit… The purpose of this unit is to expand on previous knowledge of simple probability to experimental probability, compound events, and comparing different populations. With a greater understanding of probability students will be able to better evaluate statistical data in the real-world.

Meaning

Essential Questions

Essential Questions

- How can we use the total number of outcomes and the amount of favorable outcomes to calculate the probability or likelihood of the event occurring?

- How can we calculate and use relative frequencies and experimental probability to make predictions of events?

- What methods can use to find the total number of outcomes of compound events?

- What strategies can we use to determine whether sample data is a true and unbiased representation of a population?

- How can we use box-and-whisker plots, dot diagrams, stem and leaf plots, and other measures of central tendency to compare multiple populations?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- Determining the number of outcomes of events can help us make decisions based on the probability or likelihood of a favorable event occurring.

- Experimental probability can be used to make predictions and be compared to theoretical probabilities

- Strategies such as tree diagrams, tables, or formulas can assist in finding the number of outcomes and probability of compound events.

- Population samples can be biased or unbiased depending on how closely they represent the majority of the population.

- Measures of central tendency and random sampling can be used to compare populations.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge
Students will know…

- Number of outcomes of a simple, compound, or experimental event

- Conversion among fractions, decimals, and percents

- Probability of an event describes and measures the likelihood of an event and is measured between 0 and 1

- Probability is the ratio between the number of favorable outcomes and total possible outcomes

- If a game is fair based on probability of events

- Experimental probability/relative frequency of events

- The difference between experimental probability and theoretical probability

- The variety of methods to determine the sample space or number of outcomes of compound events

- Multiple events can be either independent or dependent upon one another

- How to multiply fractions

- The difference between a sample and a population

- Whether a sample is a good representation of a population

- How to create box-and-whisker plots, dot plots, and tables in order to compare populations using central tendency

- How to apply the GIWAR method or other problem solving strategies to investigate real-world problems

Skills

Skills

Student will be skilled at …

- Determine the number of outcomes of a simple, compound, or experimental event

- Calculate the probability of simple, compound, or experimental events

- Compare probability of a variety of events

- Determine which outcomes are more likely than others

- Explain whether a game is fair based on the probability of particular events

- Generate tables, tree diagrams, or use formulas to determine likelihood of compound events

- Determine whether multiple events are independent or dependent

- Establish whether a sample is a biased or unbiased representation of a population

- Create box-and-whisker plots, dot plots, and tables in order to compare populations

- Interpret the question and solution of a real-world problem by applying strategies such as GIWAR or other problem solving methods.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Unit 4 activities.docx
Unit 4-PARCC.docx
Aromatic Adventures Project Overview.doc
Aromatic Adventure Scenario.doc
Lesson 1 Let It Grow.doc
Lesson 2 Herb Gardens-What do you know.doc
Lesson 3 Ready Set Grow.doc
Lesson 4 Mean, Median, Mode, Range.doc
Lesson 5 Excellent Math.doc
Lesson 6 Herb Uses.doc
Aromatic Adventures Test Blueprint.doc
Aromatic Adventures Test.doc
Materials Needed for Aromatic Adventures Project.doc
STEM Careers.doc
Organics Lesson 1 Introduction.doc
Organics Lesson 2 Soils.docx
Organics Lesson 3 & 4 Plant Growth.docx
Organics Lesson 5 Organic Chronicles.doc
Organics Lesson 6 Taste Testing.docx
Organics Lesson 7 Graphing Simulation GIZMO.docx
Organics Lesson 7 Graphing Simulation GIZMO.docx
Organics Lesson 8 Graphing Data with Excel.docx
What's the Dirt on Organics Project Overview.docx
What's the Dirt on Organics Scenario.doc
Organics Equipment and Materials.docx
Organics Extension Options.docx
Organics Faculty Resources.docx
Organics Methods and Teaching Strategies.docx
Organics Stem Careers.docx

Formative Assessment Strategies

Formative Assessment Strategies

- ixl.com scores
- tenmarks.com scores
- teacher center observation
- STEM projects

Learning Activities/Unit of Study

Learning Activities/Unit of Study

Probability and Statistics: Approximately 5 Cycles

Cycle 1: Topics Covered

- Outcomes of simple events
- Theoretical probability of simple events

- Activities/Centers
    - IXL.com centers
        - CC.1 Probability of simple events
        - CC.4 Make predictions
        - CC.2 Probability of opposite, mutually exclusive, and overlapping events
    - Tenmarks centers
        - 7.SP.5 Understanding the Probability of an Event
        - 7.SP.6 Approximating the Probability of an Event
        - 7.SP.7 Using Uniform Models to Calculate Probability
    - Hands-On/Creative Centers
        - This site has multiple center ideas for games to determine fairness
          http://www.actuarialfoundation.org/pdf/Math-Academy-Are-You-Game.pdf
    - Online games
        - Simple probability game http://www.math-play.com/Probability-Game.html
    - Xtramath: review flashcards
    - Teacher Directed Stations
        - Bellringers: Week 26—page 207-208
        - Bellringers: Week 26—page 205-206
- STEM activity: What's the Dirt on Organics? (Grades 6-8)

In this project, students will participate in inquiry-based activities to compare and contrast conventional and organic farming in the areas of soil, plant growth, and food product choices available to them as consumers. Students will participate in taste testing to analyze the difference between conventional and organic foods. Students will also analyze soil content and learn what a seed needs to grow. As students collect and analyze data, they will learn about fractions, decimals, percents, statistics, and graphs.*

Cycle 2: Topics Covered

- Relative frequency
- Experimental probability

- Activities/Centers
    - IXL.com centers

- CC.3 Experimental probability
    - Tenmarks centers
        - 7.SP.7b Identifying a Probability Model
    - Hands-On/Creative Centers
        - Rock-Paper-Scissors activity http://www.education.com/download/worksheet/102986/rock-paper-scissors-probability.pdf
        - Many activities with all resources regarding theoretical and experimental probability centers https://www.stem.org.uk/system/files/elibrary-resources/legacy_files_migrated/24771-Probability%20pack%201.pdf
    - Online games
        - Probability challenge http://www.scholastic.com/probabilitychallenge/
    - Xtramath: review flashcards
    - Teacher Directed Stations
        - Bellringers: Week 26—page 203-204
        - Bellringers: Week 26—page 201-202
- STEM activity: Aromatic Adventures (Grades 6-8)

In this project, students will study the benefits of producing and processing an indoor herb garden. The project includes options for students to design an indoor herb garden, research the benefits of different herbs, raise three common types of herbs, and complete production calculations to derive data that relates to plant growth and physiology. Students will use Excel to conduct a statistical analysis and create graphs to represent the data*

Cycle 3: Topics Covered

- Outcomes of compound events
- Fundamental Counting Principles

- Activities/Centers
    - IXL.com centers
        - CC.5 Compound events: find the number of outcomes
        - CC.9 Permutations
        - CC.10 Counting principle
    - Tenmarks centers
        - 7.SP.8a Understanding Compound Events
        - 7.SP.8b Identifying the Probability of Compound Events
    - Hands-On/Creative Centers
        - A variety of centers for groups to work together to use tree diagrams and fundamental counting principle http://jwilson.coe.uga.edu/EMAT6680Su10/Wall/EMAT%206690/Wall/Probability%20Instructional%20Unit/Supplement%20Folder/Day%201/MM1D1a%20Practice.pdf
    - Xtramath: review flashcards
    - Teacher Directed Stations
        - Bellringers: Week 25—page 199-200
        - Bellringers: Week 25—page 197-198
        - Teacher created problems: out many outcomes? on white boards

Cycle 4: Topics Covered

- Probability of compound events

- Independent vs. dependent events

- <u>Activities/Centers</u>
  - IXL.com centers
    - CC.6 Identify independent and dependent events
    - CC.7 Probability of independent and dependent events
  - Tenmarks centers
    - 7.SP.8a Understanding Compound Events
    - 7.SP.8b Identifying the Probability of Compound Events
  - Hands-On/Creative Centers
    - http://www.cpalms.org/Public/PreviewResourceLesson/Preview/71747
  - Online games
    - Drawing marbles from a bag http://www.free-training-tutorial.com/math-games/probability-objects-from-bag.html?1&
  - Xtramath: review flashcards
  - Teacher Directed Stations
    - Bellringers: Week 25—page 195-196
    - Bellringers: Week 25—page 193-194

<u>Cycle 5: Topics Covered</u>

- Population and samples—biased vs. unbiased
- Box-and-whisker plots

- <u>Activities/Centers</u>
  - IXL.com centers
    - BB.5 Identify representative, random, and biased samples
    - AA.15 Interpret box-and-whisker plots
  - Tenmarks centers
    - 7.SP.1 Understanding and Inferring Sample Data
    - 7.SP.2 Inferring Variation in Data Samples
    - 7.SP.3 Understanding Overlap of Data Distributions
    - 7.SP.4 Using Measures of Center to Draw Inferences
  - Hands-On/Creative Centers
    - Box and whisker activity for NBA statistics (can change to any team!) http://illuminations.nctm.org/uploadedFiles/Content/Lessons/Resources/6-8/NBAStats-AS-SportsPlot.pdf (statistics that can be used) http://illuminations.nctm.org/uploadedFiles/Content/Lessons/Resources/6-8/NBAStats-AS-Players.pdf
  - Online games
    - Construct box-and-whisker plots https://campus.mangahigh.com/en-us/px/554/0/0
  - Xtramath: review flashcards
  - PARCC practice*
  - Teacher Directed Stations
    - Bellringers: Week 24—page 191-192
    - Bellringers: Week 24—page 189-190
- STEM activity: Human box-and-whisker plot http://www.learnnc.org/lp/pages/3767?ref=search

Modifications and/or Accommodations
Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of

using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.