Unit 03: Normal Distribution (8 weeks)

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

Standards Alignment

New Jersey Student Learning Standards

MA.S-CP	Conditional Probability and the Rules of Probability
MA.S-CP.A	Understand independence and conditional probability and use them to interpret data
MA.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.
MA.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
MA.S-CP.B	Use the rules of probability to compute probabilities of compound events in a uniform probability model
MA.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B \mid A)] = [P(B)] \times [P(A \mid B)]$, and interpret the answer in terms of the model.
MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
MA.S-MD	Using Probability to Make Decisions
MA.S-MD.A	Calculate expected values and use them to solve problems
MA.S-MD.A.1	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
MA.S-MD.A.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
MA.S-MD.A.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.
MA.S-MD.A.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.
MA.S-MD.B	Use probability to evaluate outcomes of decisions
MA.S-MD.B.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
MA.S-MD.B.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

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.8.1.12	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.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

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 build strong content knowledge.

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.4	Model with mathematics
MATH.K-12.7	Look for and make use of structure
LA.K-12.NJSLSA.W	Writing
LA.K-12.NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
	Research to Build and Present Knowledge

LA.K-12.NJSLSA.W7	Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
	Comprehension and Collaboration
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.W.11-12.6	Use technology, including the Internet, to produce, share, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
LA.W.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.SL.11-12.1.D	Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.

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

see Crosswalks

21st Century Life and Careers

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

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

The purpose of this unit is to learn to use mean and standard deviations for normal distributions in real world settings to estimate probabilities. Most processes in real life (especially ones related to biology in any way) follow a normal distribution. This includes how our heights our spread out, life expectancy, or even IQ. We can

use this organization to calculate useful probabilities.

Meaning

Essential Questions

Essential Questions

- **What is a bell curve and how does it relate to probability**
- **What happens when we are looking at groups of things rather than just individuals?**
- **Where do random variables and probability distributions manifest themselves in everyday life?**

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- **Most data values fall near the mean in a set because there is the most area under that part of the curve.**
- **Outliers occur according to the shape of a bell curve. The curve is shorter at the ends meaning there are less outliers in that region.**
- **The likelihood of coming across outstanding data values changes if you are looking for them in groups instead of individually.**
- **Milestone z-scores and the areas under the bell curve that they correspond to allow us to determine usual values when creating interval estimates.**

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- **areas percents and probabilities on a bell curve**
- **z values from percents**
- **z-chart versus using a calculator**
- **visual representations of the central limit theorem**
- **practical representations of the central limit theorem**
- **t-score or chi-square charts versus the normal z-table**
- **empirical rule shortcuts**

Skills

Skills

Student will be skilled at …

- **Use calculator to find normal distribution areas**
- **navigate a z-table and utilize symmetry of a bell-curve to quickly calculate probabilities**
- **apply the central limit theorem for samples from given distributions**
- **explain how the central limit theorem works using small samples.**
- **Use z-table in both directions**
- **Use t-table to find specific multipliers for creating confidence intervals**
- **Determine if values are too unusual based on an interval.**
- **Students will be able calculate sample size necessary to arrive at an appropriate given margin of error.**

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- **Elementary Statistics Textbook 11th Edition**
- **TI-83 Calculator**
- **Online Statistical Calculators (http://www.stattrek.com)**
- **Z-table**
- **T-table**
- **Online Central Limit Theorem Applet**

Formative Assessment Strategies

Formative Assessment Strategies

- **Do-Now activities**
- **Exit tickets**
- **Oral questioning from instructor**
- **Order of Operations Check-up**
- **Do Now--problem of the day related to previous learned skills or bellringers problems**
- **Review/Check Homework - (group check, partner check, whiteboard check)- Lecture**
- **Board/White Board Work - (solve problems/practice skills at board, or at seat with individual white boards)**
- **Kahoot to reinforce skills**
- **Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding**
- **Jeopardy style review games**
- **Relay races--each student does one part of a problem, hands it to the next student to check then completes the next part, etc.**
- **Scavenger hunts--self-checking, out of seats activity**

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- **Powerpoint Lectures**

- **students design inform studies to be used for lecture examples**
- **word problem breakdown (pulling out variables and values)**
- **Students will explore the central limit theorem with computer applets in the media center**
- **Confidence interval study project**
- **Watch Prudential “Stickers” commercial**
- **scavenger hunts**
- **Work together to understand and practice the skill - partner work/larger group work to read lesson, and practice skills through “On Your Own” problems incorporated throughout each lesson**
- **Stations - (Small group instruction, skills practice - scavenger hunts, online games, board work)**
- **Review and practice skills using a variety of materials - (text, workbook, chromebook, games, activities, discussion)**
- **GIWAR - graphic organizer for analyzing/interpreting/organizing word problems**

Student led instruction

- **Foldables--creates an organized study guide per chapter**

- **Socrative--non-multiple choice technology option where students can either “race” or work at the teacher-pace**

- **Story time--a power point run story where the students are characters and must use a mathematical skill to solve a problem**

- **Partner/Group investigation where students must create a formula, method, or strategy to solve a problem.**

- **Students “as teachers” where they present a method or formula they discovered through investigation**

- **Pear Deck--an interactive online powerpoint where students enter answers, watch videos, and record notes from the information shown on their own device as well as projected.**

- **Videos by Shmoop to introduce or reinforce concepts in an engaging and comical way**

- **Math created songs to help reinforce concepts**

- **Online games on chromebooks (see resources)**

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.