Unit 5: Descriptive Statistics

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Course(s): **Discrete Mathematics**
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

DISCRETE MATHEMATICS & STATISTICS, GRADES 11/12

DESCRIPTIVE STATISTICS

Belleville Board of Education

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Unit Overview

In this unit, students will learn mathematical applications related to the collection, organization and interpretation of statistical data.

These applications include:

- Demonstrating the purposes and strategies of data collection
- How data is organized, presented and summarized
- How mathematics are used to model, analyze and make predictions about bell-shaped data sets in real life

Enduring Understanding

IN THIS UNIT, STUDENTS WILL UNDERSTAND:

- The data collection process is important in analyzing a sample's ability to represent a population.
- Each method of data collection best applies to a specific situation.
- Minimizing error is critical to the data collection process.
- There is a need to be able to summarize and communicate statistical data.
- There are a wide variety of applications of descriptive statistics.
- Large sets of data can be made manageable and understandable by the proper use of descriptive statistics.
- Statistical data can be manipulated to present misleading conclusions.

- There is an ideal "normal" distribution of data that has a specific mathematical meaning.
- Distribution of data is more easily understood when compared to, but not exclusively fit within, a "normal" distribution.
- The distribution of data can be used for decision-making.

Essential Questions

IN THIS UNIT, WE WILL ASK:

- What are the methods by which we can insure a proper collection of data?
- Which data collection method is best suited to a specific situation?
- What measures can be taken to minimize error in data collection?
- What are effective and efficient ways to summarize data?
- How can descriptive statistics be used to assess situations and help make decisions?
- How can misuse of descriptive statistics be recognized and/or avoided?
- What is the connection between normal curves and real-world data?
- What is the relation between data distributions, statistical interference and decision-making?

Exit Skills

BY THE END OF THIS UNIT, THE STUDENT SHOULD BE ABLE TO:

- Identify the population to which data applies
- Understand and apply concepts of population, sampling, and sampling methods
- Understand and apply concepts of clinical studies to determine cause and effect
- Construct and interpret various graphical descriptions of data
- Understand how to properly represent data that is categorical, numerical, discrete or continuous
- Compute descriptive data values
- Compare data display distributions and descriptive data values to the normal distribution
- Standardize data using z-values
- Understand the 68-95-99.7 Rule for a normal curve distribution
- Understand and apply the "honest" and "dishonest" coin principles to statistical interference
- Determine standard error for a data distribution and express confidence intervals

New Jersey Student Learning Standards (NJSLS-S)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
MA.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.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.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).
MA.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.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.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.

Interdisciplinary Connections

LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
SOC.6.2.12.CS6	Contemporary Issues: Technological innovation, economic interdependence, changes in population growth, migratory patterns, and the development, distribution, and use of natural resources offer challenges and opportunities that transcend regional and national borders.
9-12.HS-LS2-5.4.1	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

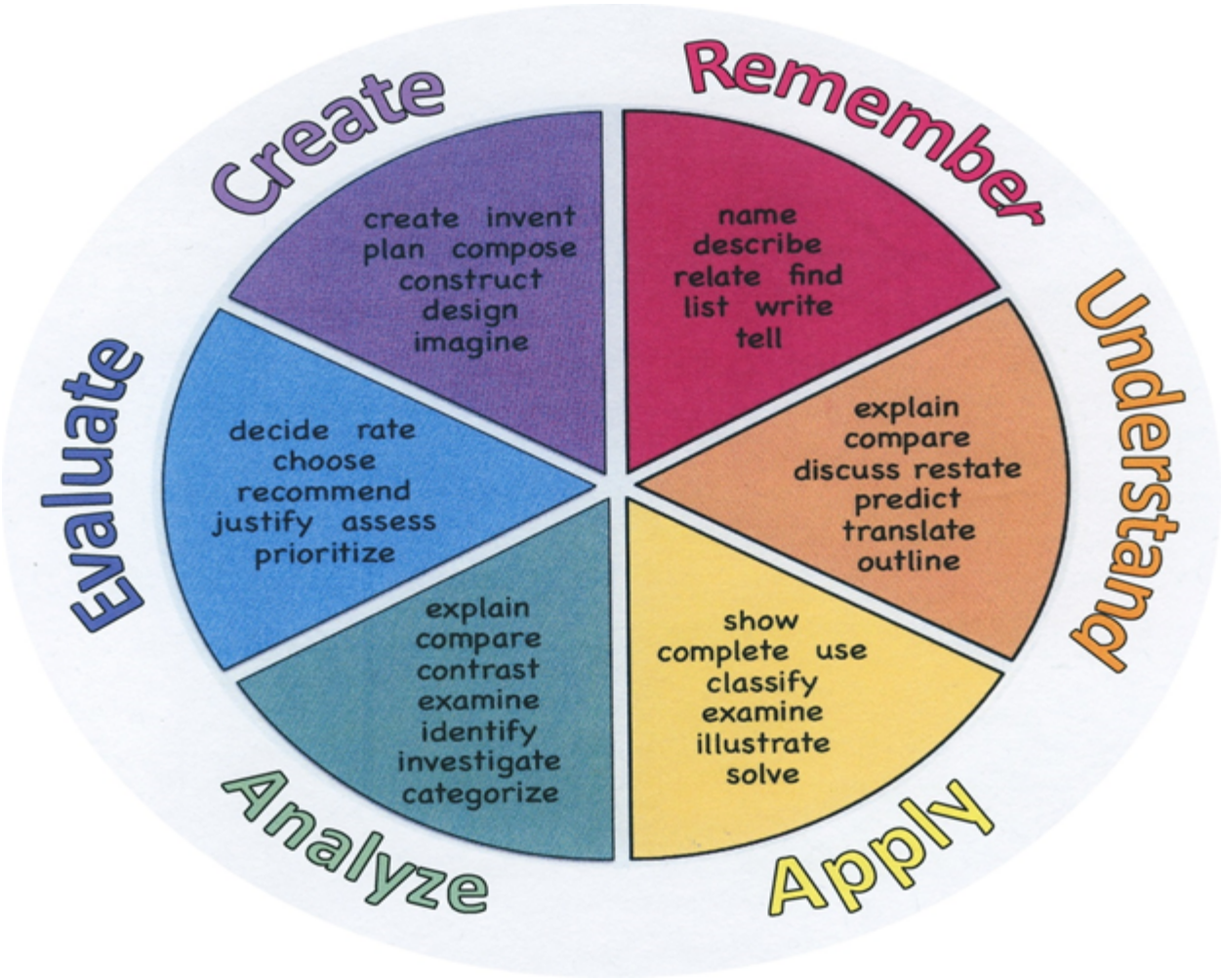
Learning Objectives

- Classify the population to which data applies
- Interpret key terms related to population (N-value, census) and sampling (sampling frame, bias, error, sampling variability)

- Distinguish between various sampling methods (quota, simple random, convenience, self-selection, stratified, systematic, catch-and-release)
- Apply a sampling method to measure population size
- Determine if bias exists within a sampling method
- Interpret key terms related to clinical studies (control group, treatment group, placebo effect)
- Identify the cause and effect of a clinical study, its type (controlled, randomized control, placebo, blind, double-blind)
- Determine if bias exists within a clinical study
- Determine the nature of data in a sample or survey (discrete, continuous, categorical, qualitative)
- Organize data into a frequency table, and translate it into a data display (bar graph, pictograph, histogram, pie chart, box-and-whisker)
- Compute descriptive data values (mean, median, mode, range, quartiles, percentiles, variance, standard deviation) from a set of quantitative data
- Illustrate normal data distributions
- Integrate common data distributions and their descriptive data values into normal distributions through z-value calculations
- Examine the 68-95-99.7 Rule of a normal distribution curve
- Calculate the means and standard deviations of "honest" and "dishonest" coins, and compare and contrast their distribution curves
- Determine standard error for a data distribution and express confidence intervals

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

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

STUDENTS WILL REACH OBJECTIVES AND ACQUIRE SKILLS & UNDERSTANDING THROUGH:

- Examination and performance on problems selected from the texts
- Student groups with assigned specific roles that can assist each other in overall understanding
- Exit tickets to offer additional summary of key concepts, level of understanding and additional questions
- Project-based learning for students to conduct sampling and data display experiments

Assessment Evidence - Checking for Understanding (CFU)

SPECIFIC SAMPLES INCLUDE:

- Exit tickets at the close of each lesson will address definitions, concepts and formulas (EX: what classifies different types of

clinical studies) (Formative)
- Share and combine results of individual numerical experiments to prove how normal distribution curves form with larger amounts of data (Formative)
- Chapter Test/Quiz (Summative)
- Common Quarterly/Benchmark Exams - Quarter 3 Exam for this unit (Benchmark)
- Web-Based Assessments (using Google Forms, ALEKS, Edulastic, Khan Academy, etc.) (Formative/Summative)

- Admit Tickets
- Common Benchmarks
- Compare & Contrast
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Illustration
- Journals
- Quickwrite
- Quizzes
- Self- assessments
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests
- Web-Based Assessments

Primary Resources & Materials

- Excursions in Modern Mathematics 9th edition textbook (Frank Tannenbaum)
- Excursions in Modern Mathematics 6th edition textbook (Frank Tannenbaum)

Ancillary Resources

Sample web pages based on material are included here. This list will be edited as more reference material is found.

- https://www.shsu.edu/~jga001/Math%201332%20chapter%2014%20slides.pdf

Technology Infusion

CHROMEBOOK: Students will use the following functions within their Chromebooks for the tasks described:

- Google Forms: Creation of survey questions for fellow students to answer for convenience and quota sampling scenarios
- Google Sheets: Construction of formulas and tables (measures of data, calculation of sizes of pie chart wedges), sorting of data (percentiles, medians, quartiles and normal distributions) and creation of data displays based on data sets

SMART TV: Real-time updates of data displays as data is added to demonstrate Google Sheet functions and long-term forming of normal distribution data



Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- Technology

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
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.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.12.F.CS4	Use multiple processes and diverse perspectives to explore alternative solutions.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

SPECIFIC EXAMPLES INCLUDE:

- Small task-oriented groups where each member is responsible for sorting, finding key values, displaying, etc. of data for different presentations

- Study guides provided prior to quizzes and tests

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Study guides
- Rephrase written directions
- Additional time
- Preview vocabulary
- Preview content & concepts
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Games and tournaments
- Group investigations
- Independent research and projects
- Interest groups
- Project-based learning
- Problem-based learning
- Tiered activities/assignments
- Varying organizers for instructions

Lo-Prep Differentiations:

- Exploration by interest
- Flexible grouping
- Goal setting with students
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Varied supplemental materials

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

SPECIFIC EXAMPLES INCLUDE:

- Note cards for assembling Google Sheet formulas (data measures, standardized value, honest-coin, etc.)

- One-on-one oral questioning during testing to elicit responses

- 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)

SPECIFIC EXAMPLES INCLUDE:

- Translated material
- Peer partners for assignments and tests with students that can translate material and meanings of concepts verbally

- 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

SPECIFIC EXAMPLES INCLUDE:

- Printed or video copy of material missed during excessive absences
- Corrections of incorrect work from tests
- Rewriting of test questions to include options for formulas (data measures, standardized value, honest-coin) for student to execute within the work on free-response test questions

- 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)

SPECIFIC EXAMPLES INCLUDE:

- Complete "Running"-level problems in textbook containing higher-level thinking
- Student can construct original examples that can demonstrate full mastery of specific concepts and objectives
- Provide students with resources to allow them to move forward at a faster pace when they display faster mastery of learning objectives

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Complete activities aligned with above grade level text using Benchmark results
- Create a plan to solve an issue presented in the class or in a text
- 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: