Probability and Statistics - Unit 1 Data and Design of Experiments	20 – 25 Days Established 14-15 Revised 20-21 Revised Nov 2021

Standard – NJSLS: S.IC
Data and Design of Experiments

Strand
S-IC: Making Inferences and Justifying Conclusions

Understand and evaluate random processes underlying statistical experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

3. Recognize the purposes and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
6. Evaluate reports based on data

Curriculum aligned with: 2009 New Jersey Core Curriculum Content Standards for 21st Century Skills (9.1 A-F)

21st Century Theme: *Global Awareness ☐, Financial, economic, business and entrepreneurial literacy ☐, , Civic literacy ☐, Health literacy Environmental Literacy ☐,*

21st Century Skills: *Critical Thinking & Problem Solving , Creativity and Innovation ☐, Collaboration, Teamwork and Leadership ☐, Cross-Cultural Understanding and Interpersonal Communications ☐, Communication and Media Fluency ☐, Accountability, Productivity and Ethics ☐*

Interdisciplinary Connection: Math=MA, English=ELA, Science=SCI, Social Studies=SS, Physical Education=PE, Art=ART, Music=MU, Technology=TECH, World Language=WL, Business = BU

Essential Questions	Enduring Understandings	Activities, Investigation, and Student Experiences
1. What are real life applications involving experiments and observations?	*Students will Understand….* ● Statistics is a way to interpret	***Task 1:*** ● Why is it important to be able to differentiate between the different levels of measurement? Identify examples of the various levels of measurement. ***Answer:***

2. How do we understand and communicate data? 3. How can statistics be misleading and to what extent? 4. What is the importance of random selection? How is it used in society today?	information from data. ● Population is a complete collection of all elements and a sample is a sub collection of members selected from the population. ● Sample data must be collected through a process of random selection or else the data cannot be used. ● Small samples, a voluntary response sample, and missing data involve samples that cannot be used to make inferences about populations. ● A parameter is a measurement	● It is important to distinguish between the different levels of measurement so that you can determine whether parametric or nonparametric statistics need to be used. The four levels of measurement are: nominal, ordinal, interval and ratio. The nominal level of measurement consists of categorical or qualitative data. An example of such data is the favorite colors of BHS students. The ordinal level of measurement can be arranged in some order such as ranks but different between data values cannot be determined. Such data would be grades of A, B, C, D, or F. The interval level of measurement does not have a natural zero starting point and temperature is an example. Zero degrees Fahrenheit does not mean no temperature exists and therefore is not a natural starting point. Ratio level of measurement consists of continuous data where zero indicates that none of that quantity is present. An example would be quantities such as height and weight. ***Task 2:*** ● A teacher at a school obtains a sample of students by selecting a random sample of 20 students from each grade. What kind of sampling is being used here? Will the resulting sample be a simple random sample of the population of students at the school? Explain your thinking. ***Answer:*** ● Stratified sampling is being used because the population of BHS students is being broken into different subgroups and a sample from each subgroup is being selected. It would be a random sample as long as the subjects are selected in a way that every possible of the *same size* has the same chance of being chosen. ***Task 3:*** **Interdisciplinary PE** ● Read the brief report of statistical research and identify: a) Whether it was an observational study or an experiment

	describing a characteristic of a population. ● A statistic is a measurement describing a characteristic of a sample. ● Discrete data is either a finite number or countable number. ● Continuous data are measurements that exist on a scale that covers a range of values. ● The nominal level of measurement is used for categorical or qualitative data. ● The ordinal level of measurement involves data that can be ranked but the gaps between the data values are	*If it was an observational study, identify (if possible)* b) Whether it was retrospective or prospective. c) The subjects studied and how they were selected. d) The parameter of interest. e) The nature and scope of the conclusion the study can reach. *If it was an experiment, identify (if possible)* b) The subjects studied. c) The factor(s) in the experiment and the number of levels for each. d) The number of treatments. e) The response variable measured. f) The design (completely randomized, blocked or matched). g) Whether it was blind. h) The nature and scope of the conclusion the experiment can reach. *Report: Athletes who had suffered hamstring injuries were randomly assigned to one of two exercise programs. Those who engaged in static stretching returned to sports activity in a mean of 15.2 days faster than those assigned to a program of agility and trunk stabilization exercises.* ***Answer:*** a. Experiment. b. Athletes with hamstring injuries. c. 1 factor; type of exercise program. d. 2 treatments e. Time to return to sports. f. Completely randomized g. Blinding did not occur.

	meaningless or undeterminable. ● The interval level of measurement includes data that does not have a natural zero starting point such as temperature. ● The ratio level of measurement is data that has a natural zero starting point such as height. ● Observational studies observe specific characteristics but the subjects being studied aren't modified as in an experiment. ● In an experiment, randomized design must be used so that confounding does not occur – that is, the	h. Can determine which of the 2 exercise programs is more effective. **Problems taken from Pearson textbook.* **Modifications and/or Accommodations:** ● **Special Education:** Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks. ● **English Language Learners:** Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of online bilingual dictionary, and modified assessment and/or rubric. ● **Students at Risk of School Failure:** Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic, provide individual instruction as needed, modify assessments and/or rubrics, repeat instructions as needed. ● **Gifted Students:** Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect student to related talent development opportunities. **Teacher Resources** online achievethecore resource online learnzillion resource online khanacademy resource

	inability to distinguish between the effects of different factors in the experiments. ● A simple random sample involves selection so that every sample of the same size *n* has the same chance of being selected.	online desmos resource online ixl resource
Content Statements	**Cumulative Progress Indicators**	
Students will know… ● How to distinguish between a population and a sample ● How to determine whether data is discrete or continuous and qualitative or quantitative ● How to determine what level of measurement data exists at	● Tests ● Quizzes ● Practice problems for homework ● Workbook pages ● Worksheets	

- How to sample data from a population using various methods
- How to use random selection
- How to determine if a sample is a simple random sample

Desired Results

- **Differentiate between populations and samples**
- **Discrete or continuous**
- **Qualitative or quantitative**
- **Sample data from a populations**
- **Random selection**

Standards for Mathematical Practices

1. **Make sense of problems and persevere in solving them.**
2. **Reason abstractly and quantitatively.**
3. **Construct viable arguments and critique the reasoning of others**
4. **Model with mathematics**
5. **Use appropriate tools strategically.**
6. **Attend to precision.**
7. **Look for and make use of structure.**
8. **Look for and express regularity in repeated reasoning.**

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LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*

- Alan Turning: English mathematician, computer scientist, logician, cryptanalyst, philosopher, and theoretical biologist. Turning was highly influential in the development of theoretical computer science.

The mission is to ensure that every student is able to see themselves in our rich and diverse history.

Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***
Self-Awareness Social Awareness Self-Management Relationship Skills Responsible Decision-Making	• Recognizing the importance of self-confidence in handling daily tasks and challenges. • Demonstrate an awareness of the expectations for social interactions in a variety of ways. • Demonstrate an understanding of the need for mutual respect when viewpoints differ. • Recognize the skills needed to establish and achieve personal and educational goals. • Utilize positive communication and social skills to interact effectively with others. • Develop, implement, and model effective problem solving and critical thinking skills.