



Statistical Reasoning UNIT PLANNER



Unit title	Unit 3 Collecting Data	Unit duration	12 Days
Essential Questions (OR GUIDING QUESTIONS?)			
<ul style="list-style-type: none">• How is research data collected?• What characteristics define good and bad sampling?• When are simple random samples used in studies?• How do you estimate margin of error?• How is bias identified in samples and surveys?• What is the placebo effect and how is it related to observational studies?• How are treatments assigned in experiments?• When is an experimental result statistically significant?• What are factors that determine how to use a study?• What are the parameters that define ethical research?			
Assessments			
Common Formative Assessment – Checkpoint Quiz 1 topic 3.1-3.4 Checkpoint Quiz 2 topic 3.5-3.8 Common Summative Assessment - Unit 3 Test			
Content Standards			
<p><u>Students will formulate questions to clarify the problem at hand and formulate one (or more) questions that can be answered with data.</u></p> <p>MSR.FQ.1 Students will apply the statistical method to real-world situations.</p> <ul style="list-style-type: none">i. Formulate questions to clarify the problem at hand and formulate one (or more) questions that can be answered with data.ii. Collect data by designing a plan to collect appropriate data and employ the plan to collect the data.iii. Analyze data by selecting appropriate graphical and numerical methods and using these methods to analyze the data.iv. Interpret results by interpreting the analysis and relating the interpretation to the original question <p><u>Students will design and implement a plan to collect the appropriate data to answer the statistical question.</u></p> <p>MSR.CD.2 Students will understand that randomness should be incorporated into a sampling or experimental procedure.</p> <ul style="list-style-type: none">a. Students will be able to implement a reasonable random method for selecting a sample or for assigning treatments in an experiment.<ul style="list-style-type: none">i. Implement a simple random sample.			

ii. Randomly assign treatments to experimental subjects or objects.

MSR.CD.3 Students will distinguish between the three types of study designs for collecting data (sample survey, experiment, and observational study) and will know the scope of the interpretation for each design type.

i. Determine the type of study design appropriate for answering a statistical question.

ii. Determine the appropriate scope of inference for the study design used.

MSR.CD.4 Students will distinguish between the role of randomness and the role of sample size with respect to using a statistic from a sample to estimate a population parameter.

a. Students will be able to distinguish the roles of randomization and sample size with designing studies.

i. Recognize that randomization reduces bias where bias occurs when certain outcomes are systematically more likely to appear.

ii. Recognize that random selection from a population plays a different role than random assignment in an experiment.

iii. Recognize that sample size impacts the precision with which estimates of the population parameters can be made (larger the sample size the more precision).

Learning Activities and Experiences

Topic	Resource	Content Addressed	Standards Addressed
Data Collection	3.1 Introduction to Data Collection Statistics and Probability with Applications 3rd Edition pg. 182 – 187	<ul style="list-style-type: none"> Distinguish statistical questions from other types of questions. Identify the population and sample in a statistical study. Distinguish between an observational study and an experiment. 	MSR.FQ.1
Sampling Ideas	3.2 Sampling: Good and Bad Statistics and Probability with Applications 3rd Edition pg. 187 – 193	<ul style="list-style-type: none"> Describe how convenience sampling can lead to bias. Describe how voluntary response sampling can lead to bias. Explain how random sampling can help to avoid bias. 	MSR.CD.2
	3.3 Simple Random Samples Statistics and Probability with Applications 3rd Edition pg. 193 – 203	<ul style="list-style-type: none"> Describe how to obtain a simple random sample using slips of paper or technology. Explain the concept of sampling variability and the effect of increasing sample size. Use simulation to test a claim about a population proportion. 	MSR.CD.2 MSR.CD.4
	3.4 Estimating a Margin of Error Statistics and Probability with Applications 3rd Edition pg. 204 – 213	<ul style="list-style-type: none"> Use simulation to approximate the margin of error for a sample proportion and interpret the margin of error. Use simulation to approximate the margin of error for a sample mean and interpret the margin of error. 	MSR.CD.4
Bias and Variability	3.5 Sampling and Surveys Statistics and Probability with Applications 3rd Edition pg. 214 – 220	<ul style="list-style-type: none"> Explain how under coverage can lead to bias. Explain how nonresponse can lead to bias. Explain how other aspects of a sample survey can lead to bias. 	MSR.CD.2 MSR.CD.4

	3.6 Observational Studies and Experiments Statistics and Probability with Applications 3rd Edition pg. 220 – 228	<ul style="list-style-type: none"> ● Explain the concept of confounding and how it limits the ability to make cause-and-effect conclusions. ● Explain the purpose of comparison in an experiment. ● Describe the placebo effect and the purpose of blinding in an experiment. 	MSR.CD.2 MSR.CD.3 MSR.CD.4
	3.7 How to Experiment Well Statistics and Probability with Applications 3rd Edition pg. 228 – 235	<ul style="list-style-type: none"> ● Describe how to randomly assign treatments using slips of paper or technology. ● Explain the purpose of random assignment in an experiment. ● Identify other sources of variability in an experiment and explain the benefits of keeping these variables the same for all experimental units. 	MSR.CD.2 MSR.CD.3 MSR.CD.4
Inference for Experiments	3.8 Inference for Experiments Statistics and Probability with Applications 3rd Edition pg. 235 – 244	<ul style="list-style-type: none"> ● Outline an experiment that uses a completely randomized design. ● Explain the concept of statistical significance in the context of an experiment. ● Use simulation to determine if the difference between two means or two proportions in an experiment is significant. 	MSR.CD.3
Research Ethics	3.9 Using Studies Wisely Statistics and Probability with Applications 3rd Edition pg. 245 – 251	<ul style="list-style-type: none"> ● Identify when it is appropriate to use information from a sample to make an inference about a population and when it is appropriate to make an inference about cause and effect. ● Evaluate if a statistical study has been carried out in an ethical manner. 	MSR.CD.3
	Additional Resources: <ul style="list-style-type: none"> ● Online research ethics certification: https://ori.hhs.gov/education/products/montana_round1/research_ethics.html ● Textbook Resources 		
Personalized Learning and Differentiation			
<p>Teachers differentiate by providing examples (work samples or task-specific clarifications of assessment criteria); structuring support (advance organizers, flexible grouping, peer relationships); establishing flexible deadlines, and adjusting the pace.</p> <ul style="list-style-type: none"> -SWD/504- Accommodations provided -ELL- Five Principle ELL Curriculum Framework and Vocabulary Supports -Intervention Support- Re-teaching Activities in Small Groups with Progress Monitoring -Extensions- Enrichment Tasks and Projects 			
Resources			
Statistics and Probability with Applications (High School) 3rd Ed. Daren S. Starnes; Josh Tabor			