

# 04 Data Collection

Content Area: **Math**  
Course(s):  
Time Period: **Full Year**  
Length: **Type Length of Unit**  
Status: **Published**

## **General Overview, Course Description or Course Philosophy**

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The goal of this course is to expose students to practical mathematics that they can expect to encounter in their world. Students who complete this course will be proficient in gathering, displaying, and interpreting statistics in context. In the later part of the course, students will be exposed to discrete mathematics topics that can be directly applied to a wide variety of fields, including computer science, business, manufacturing, life sciences, and mathematics.

## **OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS**

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In this unit, students will understand:

- Statistical data can be collected truly randomly or with bias; if data is collected with bias, the results of the statistical survey may not be valid.
- Simulations are conducted to model real-world occurrences in order for statisticians and researchers to gain insight and make determinations about correlation and causation.

## **CONTENT AREA STANDARDS**

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MA.9-12.II.A.1	Census
MA.9-12.II.A.2	Sample survey
MA.9-12.II.A.3	Experiment
MA.9-12.II.A.4	Observational study
MA.9-12.II.B.1	Characteristics of a well-designed and well-conducted survey
MA.9-12.II.B.2	Populations, samples and random selection
MA.9-12.II.B.3	Sources of bias in sampling and surveys
MA.9-12.II.B.4	Sampling methods, including simple random sampling, stratified random sampling and cluster sampling
MA.9-12.II.C.1	Characteristics of a well-designed and well-conducted experiment
MA.9-12.II.C.2	Treatments, control groups, experimental units, random assignments and replication
MA.9-12.II.C.3	Sources of bias and confounding, including placebo effect and blinding
MA.9-12.II.C.4	Completely randomized design
MA.9-12.II.C.5	Randomized block design, including matched pairs design
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.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.S-IC.B.6	Evaluate reports based on data.

## **RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)**

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LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.11-12.SL.11-12.2	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
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.CRP11	Use technology to enhance productivity.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
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.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

## **STUDENT LEARNING TARGETS**

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## **Declarative Knowledge**

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Students will understand that:

- A statistical question is one that can be answered by collecting data and where there will be variability in that data.
- Simulation is a way to model random events, such that simulated outcomes closely match real-world outcomes; by conducting and observing simulated outcomes, statisticians and researchers gain insight on the real world.
- Statistical bias is a feature of a statistical technique or of its results whereby the expected value of the results differs from the true underlying quantitative parameter being estimated.
- Authentic random sampling is a procedure for collecting samples which is unbiased.

## **Procedural Knowledge**

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Students will be able to:

- 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.
- Describe how convenience and voluntary response sampling can lead to bias.
- Describe how random sampling can help avoid bias.
- Describe how to obtain simple random samples by using slips of paper or technology.
- Explain the concept of random sampling and the effect of increasing sample size.
- Use simulation to test a claim about a population proportion.
- Use simulation to approximate the margin of error for a sample population and a sample mean and interpret the margin of error.
- Explain how under-coverage, non-response, blinding, and other aspects of a sample survey can lead to bias.
- Determine where confounding can occur in statistical studies.
- Describe how to engage in random assignment manually or with technology.
- Explain the purpose of random assignments in an experiment; identify other sources of variability in a experiment; explain the benefits of keeping these variables the same for all experimental units.
- 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 how the difference between two means or two proportions in an experiment is significant.
- 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.
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## **EVIDENCE OF LEARNING**

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## **Formative Assessments**

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Observations

Task completion

Student journals and notebooks

Cooperative team work

## **Summative Assessments**

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Project completion

Task completion on unit assessments

## **RESOURCES (Instructional, Supplemental, Intervention Materials)**

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Statistics and Probability with Applications (High School) Third Edition, Starnes & Tabor, 2016

Digital Launchpad book companion

## **INTERDISCIPLINARY CONNECTIONS**

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Educational tech applications

## **ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS**

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See link to Accommodations & Modifications document in course folder.

