

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

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

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 |

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| | 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

Declarative Knowledge

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

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

Formative Assessments

Observations

Task completion

Student journals and notebooks

Cooperative team work

Summative Assessments

Project completion

Task completion on unit assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

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

Digital Launchpad book companion

INTERDISCIPLINARY CONNECTIONS

Educational tech applications

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.

