



Statistics CURRICULUM

Board Approved: 3/20/2025

Course Information

**High School
Semester course**

Course Description:

This semester-long course is an introduction to elementary statistics including a wide variety of applications. It is appropriate for many disciplines such as medicine, psychology, business, computer science, education, agriculture, and engineering. This class covers topics such as hypothesis testing, confidence intervals, and probability distributions.

Transfer Goals:

- **Statistical Reasoning:** Use appropriate data to support reasonable conclusions.
- **Critical Thinking:** Recognize when data or data collection is flawed and unreliable.

Curriculum Standards: [Missouri Core 42 - Statistical Reasoning](#)

Curriculum Resource(s): Elementary Statistics: Picturing the World, 8e, Pearson, 2023, 9780137493326

priority standards indicated in **bold*

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Unit 1: Data Exploration

Timeframe: 2 weeks

Unit Description: In this unit, students will learn to compare and interpret data using various graphical representations. They will focus on constructing and analyzing different types of graphs, such as bar graphs, histograms, box plots, and scatter plots. A key emphasis will be on understanding and interpreting critical features of data sets, including measures of center (mean, median, mode) and measures of spread (range, interquartile range, standard deviation).

Enduring Understandings:

- Appropriate measures of center depend on the shape of the data.
- Standardized values allow the comparison of data from different contexts.
- Outliers have notable effects on the spread and center of data.
- Correlation coefficient measures the strength of the connection between two variables.

Essential Questions:

- How does the shape of the data affect the measures of the center?
- When comparing standardized values, what about the data is being compared?
- How can you account for outliers when comparing and analyzing data?
- What is the difference between correlation and causation?
- What does a correlation coefficient of 1 or -1 tell you about the correlation of two variables?

Unit 1 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
MOTR Math 110 -I.A	<ul style="list-style-type: none"> ● I can create and interpret boxplots. ● I can create and interpret histograms. ● I can analyze key features of graphical displays, such as: <ul style="list-style-type: none"> ○ Center ○ Shape ○ Spread ○ Outliers ○ Gaps ○ Clusters
MOTR Math 110 -I.B	<ul style="list-style-type: none"> ● I can interpret measures of center, such as: <ul style="list-style-type: none"> ○ Mean ○ Median ○ Mode ● I can interpret measures of spread, such as: <ul style="list-style-type: none"> ○ Range ○ Interquartile Range ○ Standard Deviation ● I can interpret measures of position, such as: <ul style="list-style-type: none"> ○ Quartiles

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	<ul style="list-style-type: none"> ○ Percentiles ○ Standardized Values ● I can compare data using graphical displays, such as: <ul style="list-style-type: none"> ○ Box plots ○ Stem-and-Leaf plots ○ Histograms ○ Dot plots
MOTR Math 110 -I.C	<ul style="list-style-type: none"> ● I can analyze scatterplots for key features, such as: <ul style="list-style-type: none"> ○ Patterns ○ Linearity ○ Outliers ● I can calculate the correlation coefficient. ● I can interpret correlation coefficients.
MOTR Math 110 -I.D	<ul style="list-style-type: none"> ● I can create and interpret frequency tables. ● I can create and interpret bar charts. ● I can compare distributions of categorical data.

priority standards indicated in **bold*

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Unit 2: Statistical Design

Timeframe: 1-2 weeks

Unit Description: In this unit, students will learn effective methods for data collection, focusing on how to gather information accurately. They will explore the importance of randomness to achieve unbiased and representative results, identify potential sources of bias, and understand how bias can influence data interpretation. The unit will also cover various data collection methods, including surveys, experiments, observational studies, and simulations, along with their definitions and key features.

Enduring Understandings:

- Samples must be randomly selected for the best results.
- Bias in data collection can create misleading results.
- Control groups give a baseline against which results are compared.

Essential Questions:

- Why should data collection be random?
- What are some common sources of bias in data collection?
- What is the purpose of a control group in an experiment?
- Why do we use samples instead of whole populations?

Unit 2 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
MOTR Math 110 -II.A	<ul style="list-style-type: none"> • I can identify the population of interest. • I can determine whether an observational study or experiment is appropriate and feasible in a study design. • I can explain the importance of randomness in the design of a study or experiment.
MOTR Math 110 -II.B	<ul style="list-style-type: none"> • I can describe the elements of a sample survey. • I can determine when a census or survey is appropriate. • I can identify potential bias in sampling. • I can identify potential bias in surveys.
MOTR Math 110 -II.C	<ul style="list-style-type: none"> • I can describe the elements of experimental design. • I can explain the importance of a control group in an experiment. • I can explain the importance of blinding in an experiment. • I can identify potential sources of confounding in an experiment.

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Unit 3: Probability

Timeframe: 3-4 weeks

Unit Description: In this unit, students will learn effective data collection methods with a focus on gathering information accurately. They will examine the importance of randomness to ensure unbiased results, identify potential sources of bias, and understand how these biases can affect data interpretation. The unit will also introduce various data collection techniques, including surveys, experiments, observational studies, and simulations, highlighting their definitions and key features.

Enduring Understandings:

- Sampling distributions must have a large enough sample size in order to be reliable.
- Probability of each event must be between 0 and 1.
- Probability of all events must sum to be 1.
- The probability of one event may change given that another event has occurred.
- Normal distributions are appropriate when the variable is continuous and the sample size is adequately large.

Essential Questions:

- If an event has a probability of 0, what does that mean?
- Why is it not possible to have a probability over 1?
- What criteria must be met in order to be able to use a normal distribution?
- How can the occurrence of one event change the probability of another?

Unit 3 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
MOTR Math 110 -III.A	<ul style="list-style-type: none"> • I can calculate the probability of a single event. • I can calculate the probability of multiple events using: <ul style="list-style-type: none"> ○ The addition rule (or) ○ The multiplication rule (and) • I can interpret probability as the likelihood of something happening after a high amount of repeated times (Law of Large Numbers). • I can explain the difference between dependent and independent events. • I can determine whether or not two events are mutually exclusive.
MOTR Math 110 -III.B	<ul style="list-style-type: none"> • I can explain the difference between discrete and continuous variables. • I can identify a variable as discrete or continuous. • I can estimate the mean of a probability distribution in the following shapes: <ul style="list-style-type: none"> ○ Normal ○ Skewed ○ Uniform • I can identify the standard deviation of a probability distribution in the following shapes: <ul style="list-style-type: none"> ○ Normal ○ Skewed ○ Uniform • I can describe when a probability distribution is either:

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	<ul style="list-style-type: none"> ○ Normal ○ Skewed ○ Uniform
<p>MOTR Math 110 -III.C</p>	<ul style="list-style-type: none"> ● I can distinguish between the distribution of a sample and a sampling distribution. ● I can describe the sampling distribution of a sample mean using: <ul style="list-style-type: none"> ○ Center ○ Shape ○ Spread ● I can describe the sampling distribution of a sample proportion using: <ul style="list-style-type: none"> ○ Center ○ Shape ○ Spread ● I can explain how center, shape, and spread relate to sample size. ● I can identify when the use of normal distributions is appropriate.

priority standards indicated in **bold*

Unit 4: Statistical Inference

Timeframe: 4-5 weeks

Unit Description: In this unit, students will explore statistical inference by learning how to construct and interpret confidence intervals and perform hypothesis tests. They will use these tools to analyze data, evaluate claims, and make informed decisions. Key skills include determining when to use different types of tests and drawing meaningful conclusions from the results. By the end of the unit, students will be able to apply these methods to assess real-world data.

Enduring Understandings:

- Sample size must be adequately large in order to perform certain tests or create certain models.
- Data must be randomly collected or selected to perform certain tests or create certain models.
- Hypothesis tests and confidence intervals are predictions and estimates based on data, not evident truths.

Essential Questions:

- Why is it important that data is randomly collected or selected?
- What are some factors that could change the results of a confidence interval or hypothesis test?
- What effect could having too small of a sample size have on the results of a confidence interval or hypothesis test?

Unit 4 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
MOTR Math 110 -IV.A	<ul style="list-style-type: none"> • I can determine when a confidence interval is appropriate based on sample size and shape. • I can construct and interpret one-sample confidence intervals for: <ul style="list-style-type: none"> ○ Sample means ○ Population proportions • I can construct and interpret two-sample confidence intervals for: <ul style="list-style-type: none"> ○ Sample means ○ Population proportions • I can explain the meaning of a confidence level associated with a confidence interval in context.
MOTR Math 110 -IV.B	<ul style="list-style-type: none"> • I can determine when a hypothesis test is appropriate based on sample size and randomness of sample. • I can construct and interpret a one-sample hypothesis test for: <ul style="list-style-type: none"> ○ Sample means ○ Population proportions • I can construct and interpret a two-sample hypothesis test for: <ul style="list-style-type: none"> ○ Sample means ○ Population proportions

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Unit 5: Regression Modeling

Timeframe: 1-2 weeks

Unit Description: In this unit, students will expand their understanding of linear regression by learning to create accurate regression equations, predict outcomes, and analyze trends. They will interpret key features like slope and y-intercept to understand relationships between variables. By the end, students will confidently apply linear regression to model real-world situations and make predictions.

Enduring Understandings:

- Regression lines are tools to predict data.
- Correlation coefficient is a measure of the likely accuracy of a regression line.

Essential Questions:

- What are the properties of a regression line with strong correlation?
- What are some applications of regression lines in the real world?

Unit 5 Standards

STANDARD CODE	STUDENTS WILL KNOW, BE ABLE TO, AND UNDERSTAND:
MOTR Math 110 -V.A	<ul style="list-style-type: none"> • I can determine the equation of the regression line. • I can interpret the slope of the regression line in context to a situation. • I can interpret the y-intercept of the regression line in context to a situation.

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