



SCHOOL DISTRICT OF MONROE

Preparing for the Future, One Child at a Time

Statistics (Non AP) Curriculum

Course Description:

Students encounter variability in their lives, their science and social studies coursework, the news media, and social media. Study of the topics in statistics and probability gives students the capability to interpret statistical information and make informed decisions. The concepts and techniques of statistics and probability will be introduced and used in context using real world data and situations. The study of topics will give students methods for summarizing data, introduce the students to mathematical models for random phenomena, and provide tools for decision making under uncertainty. Whenever possible, technology (calculators and statistical software) will be used for computations and graphing.

The curriculum for this elective course Statistics course is developed from the Common Core Standards for Statistics and Probability, Common Core Standards for Writing, and the use of technology in the modern-day math classroom. This course in statistics and probability is built around four main ideas:

Interpreting Categorical and Quantitative Data

Data exploration and study design: Students explore and compare univariate and bivariate data sets using both graphical and numerical summary measures and learn principles of data collection and study design that aim to minimize bias and variability of resulting data.

Conditional Probability and the rules of probability

Probability models and their application. Students use discrete probability distributions as models for random systems and use conditional probability to solve applied problems. The normal distribution is studied and sampling distributions for means and proportions are developed based on the normal distribution.

Using Probability to make Decisions

Model assessment. Students will calculate expected values and them and probability to solve problems. Students learn to assess the validity of assumptions of statistical and probabilistic models and to assess the effect of departures from model assumptions.

Making Inferences and Justifying Conclusions

Statistical inference: Students will understand and evaluate random processes underlying statistical experiments. Students will learn the logic and terminology of confidence interval estimations and significant testing. They will make inferences and justify conclusions from sample surveys, experiments and observational studies. They will apply these techniques to questions involving means and proportions in one and two sample settings, to categorical data, and to the simple linear regression model.

Mastery Standards

- Represent data with plots on the real number line (dot plots, histograms, and box plots). (CCSS.Math.Content.HSS.ID.A.1)
- Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (CCSS.Math.Content.HSS.ID.A.2)
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (CCSS.Math.Content.HSS.ID.A.3)
- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. (CCSS.Math.Content.HSS.ID.B.6)
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (CCSS.Math.Content.HSS.ID.C.7)
- Compute (using technology) and interpret the correlation coefficient of a linear fit. (CCSS.Math.Content.HSS.ID.C.8)
- Distinguish between correlation and causation. (CCSS.Math.Content.HSS.ID.C.9)
- Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. (CCSS.Math.Content.HSS.IC.B.3)
- 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. (CCSS.Math.Content.HSS.IC.B.4)

- Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). (CCSS.Math.Content.HSS.CP.A.1)
- Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. (CCSS.Math.Content.HSS.CP.A.2)
- Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B . (CCSS.Math.Content.HSS.CP.A.3)
- Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. (CCSS.Math.Content.HSS.CP.A.4)
- Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. (CCSS.Math.Content.HSS.CP.A.5)
- Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. (CCSS.Math.Content.HSS.CP.B.7)
- Use permutations and combinations to compute probabilities of compound events and solve problems. (CCSS.Math.Content.HSS.CP.B.9)
- Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (CCSS.Math.Content.HSS.IC.A.1)
- Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. (CCSS.Math.Content.HSS.IC.A.2)
- Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. (CCSS.Math.Content.HSS.IC.B.5)
- Evaluate reports based on data. (CCSS.Math.Content.HSS.IC.B.6)
- Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. (CCSS.Math.Content.HSS.ID.A.4)
- Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. (CCSS.Math.Content.HSS.ID.B.5)

Common Core ELA – Literacy: Writing Standards

- Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. (CCSS.ELA-Literacy.W.9-10.1.d)
- Use precise language and domain-specific vocabulary to manage the complexity of the topic. (CCSS.ELA-Literacy.W.9-10.2.d)

Unit	Description of Unit and Learning Targets
<p>Unit 1: Analyzing one-variable data</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> How can you tell a story from the set of one-variable data using tables, graphs, and values? 	<p>Students will.....</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> be able to display categorical and quantitative data appropriately. be able to describe the data and the location in a distribution.
<p>Unit 2: Analyzing two-variable data</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> How can you tell a story from the set of two-variable data using tables, graphs, and values? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> be able to distinguish the relationship between two categorical or two quantitative variables. be able to create and interpret a regression analysis.

<p>Unit 3: Collecting Data</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How does one tell if a survey is valid or from biased collection? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to conduct a proper sample and estimate the margin of error for said sample. • be understanding the different methods of data collection and what a biased sample is.
<p>Unit 4: Probability</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How can I use probabilities to make an informed decision in my everyday life? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to model and calculate various models of probability. • Be able to apply probabilities and determine the impact as they relate to real life situations.
<p>Unit 5: Random Variables</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • What is a discrete probability distribution and how does this influence my everyday living? • Where have I encountered the normal distribution in my educational life and why do I care? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to determine whether a random variable is discrete, continuous, or binomial. • be able analyze discrete random variables.
<p>Unit 6: Sampling Distributions</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • Why is a sample enough to inform us about a population? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • understand how sampling distributions center and variability are influenced by sample size. • be able to explain the Central Limit Theorem (CLT) and how CLT helps answer the essential question.
<p>Unit 7: Estimating a Parameter</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How do the pollsters determine the margin of error for our elections? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to explain the effects of the margin of error and how it relates to our political polls. • be able to create confidence intervals for a proportion and a mean.

<p>Unit 8: Testing a Claim</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • Just because something is different does that mean there is a real change? • Why do scientists disagree with statisticians on whether or not a significant change has occurred? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to test claims made by companies about proportions and means of products. • be able to explain what the amount of change there is and if it is significant and relevant to the consumer.
<p>Unit 9: Comparing Two Populations or Treatments</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • How claims made in advertisements affect our lives and are they truthful? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • Be able to construct a two sample confidence interval. • be able to conduct a two sample statistical analysis between two proportions or two means. • be able to interpret the results and determine where in their lives this is important to know.
<p>Unit 10: Inference for Distributions and Relationships</p> <p><u>Essential Questions:</u></p> <ul style="list-style-type: none"> • What is the difference between categorical and quantitative analysis? • Where are the claims in business and science that compare categorical data? 	<p>Students will...</p> <p><u>Learning Targets:</u></p> <ul style="list-style-type: none"> • be able to analyze categorical data with Chi-square tests. • Interpret results of categorical analysis with real world data.