REVISED AP Statistics Syllabus (Math Medic)

Course Overview

This course provides a comprehensive introduction to statistics, equivalent to a one-semester, introductory college statistics course that does not require calculus. Students will learn the complete statistical problem-solving process, from formulating questions and collecting data to analyzing and interpreting results. The curriculum is built upon four main pillars: exploring data, sampling and experimentation, probability and simulation, and statistical inference. To build a deep conceptual understanding, students will frequently use technology, engage in investigations, solve problems, and communicate their findings in writing.

This course will be taught using an Experience First, Formalize Later (EFFL) learning model, where students work collaboratively to think, to discuss, and to construct their own understanding of new content before the teacher helps students to arrive at formal definitions and formulas.

Course Expectations

Students are expected to fully participate in small groups when working through the activity for each new lesson. Each member of the group should contribute to the discussion in the group, as well as to listen to and critique ideas from others.

During the whole-class debrief of the collaborative activity, students will be asked to share ideas generated in their groups. The teacher will guide the discussion towards a more formal understanding of what was learned in the activity. Students will be expected to record any new learning that results from the class discussion.

At the end of each lesson, students work individually or in small groups to complete the Check Your Understanding questions. These formative assessments reinforce the key ideas of the activity and extend students' thinking to other contexts, representations, or applications.

Students are expected to complete all homework problems to the best of their ability. If they need additional support, they can refer to the additional resources listed below.

Additional Resources

The Math Medic Assessment Platform for AP Statistics provides pre-made homework, quizzes, and tests perfectly aligned to the Math Medic lessons, and covering every topic of the CED (Units 1-5). This resource also allows teachers to edit assessments and build their own assessments from a bank of high-quality questions.

The College Board also provides a plethora of resources to help students learn, practice, and review the content in AP Statistics.

- AP Daily videos are short 5 – 9-minute videos found in AP Classroom that cover all of the content in the AP Statistics course. Students can find fill-in-the-blank notes that go with the videos on blog.mathmedic.com.
- Students looking for more practice can request access to additional questions in AP Classroom.

At the end of the year, students will use the Math Medic AP Statistics Exam Review Course, which includes videos, practice problems, and AP Exam Tips.

Student Practice

The Math Medic Assessment Platform for AP Statistics provides high-quality homework assignments, quizzes, and tests that can be assigned to students digitally or in print. These questions are perfectly aligned to the Math Medic AP Statistics lessons and cover every topic in the CED (Units 1-5). The questions vary in difficulty, feature multiple representations, and give students ample opportunities to practice the Skill Categories outlined for AP Statistics.

Throughout each unit, Topic Questions from AP Classroom will also be provided to help students check their understanding. The Topic Questions are especially useful for confirming understanding of difficult or foundational topics before moving on to new content or skills that build upon prior topics. Topic Questions can be assigned before, during, or after a lesson, and as in-class work or homework. Students will get rationales for each Topic Question that will help them understand why an answer is correct or incorrect, and their results will reveal misunderstandings to help them target the content and skills needed for additional practice.

Personal Progress Checks will be provided in class or as homework assignments in AP Classroom at various points in the course. Students will get a personal report with feedback on every topic, skill, and question that they can use to chart their progress, and their results will come with rationales that explain every question's answer.

Textbook Requirement CR1

In lieu of a traditional textbook, we will be using the AP Statistics lessons at portal.mathmedic.com/lesson-plans/course/AP-Statistics, along with the homework, quizzes, and tests available through the Math Medic Assessment Platform for AP Statistics. The Math Medic lessons have been vetted by the College Board and meet the Course Audit curricular requirements.

Technology Requirement | Computer Output CR2

To satisfy Curricular Requirement 2, the Math Medic AP Statistics course provides opportunities for students to interpret standard computer output and use graphing calculators with statistical capabilities to describe data, determine probabilities, and perform tests. For example, in "Lesson 1.5 – Measuring Variability" students learn how to calculate standard deviation on their calculator. "Lesson 10.3 – Making Predictions," students use a graphing calculator to calculate a regression equation and look at computer output to determine how they can determine the equation of the least-squares regression equation. Additionally, in "Lesson 4.2 – Normal Distribution Calculations," students utilize technology to determine probabilities associated with normal distributions. Outside of the lessons, homework assignments also feature questions that require students to understand computer and technology output to answer questions.

Course Outline and Pacing CR3

- August/September – Math Medic Unit 1
- October – Math Medic Unit 2, Unit 3
- November – Math Medic Unit 4
- December – Math Medic Unit 5
- January – Math Medic Unit 6, Unit 7
- February – Math Medic Unit 8, Unit 9
- March – Math Medic Unit 10
- April/May – AP Exam Review

Course Outline and Description CR3

All lessons for each unit are from the AP Statistics curriculum on Math Medic.

- Math Medic Unit 1: Exploring One-Variable Data (CED Unit 1 & 2)
- Math Medic Unit 2: Collecting Data (CED Unit 1)
- Math Medic Unit 3: Probability (CED Unit 2)
- Math Medic Unit 4: Random Variables (CED Unit 2)
- Math Medic Unit 5: Sampling Distributions (CED Unit 2, 3, & 4)
- Math Medic Unit 6: Confidence Intervals for Proportions (CED Unit 3)
- Math Medic Unit 7: Significance Tests for Proportions (CED Unit 3)
- Math Medic Unit 8: Confidence Intervals for Means (CED Unit 4)
- Math Medic Unit 9: Significance Tests for Means (CED Unit 4)
- Math Medic Unit 10: Two-Variable Data (CED Unit 5)

Statistical Practice 1: Formulate Questions CR4

Skill 1.A: Determine a valid investigative question that requires a statistical investigation

In "Lesson 7.1 - Introduction to Significance Tests," students are implicitly working on this skill when determining how to set up a test for a population proportion. The lesson involves a scenario where there is a claim about the true proportion of free throws that someone can make. Students must determine what type of question they can ask about the free throw percentage to carry out a statistical investigation.

Statistical Practice 2: Collect Data CR5

Skill 2.A: Identify information to answer a question or solve a problem.

In "Lesson 1.4 - Describing Quantitative Data," students analyze a dotplot of University of Michigan football scores. To answer questions about the distribution, students must identify key information like the shape, outliers, center, and variability.

In "Lesson 2.2 – Stratified Random Samples," students are presented with a scenario where the problem to be solved is determining the best method to estimate fan enjoyment at a Taylor Swift concert. Students are then asked questions that require them to identify the question to be answered, such as, "Which method will produce the best estimate for the true population average enjoyment? In order to do this, they must first figure out what data they will need as well as what some information about the situation that may influence people's perspectives when answering the question.

In "Lesson 2.3 - Cluster and Systematic Samples," students are given a scenario about a hotel manager wanting to survey guests to determine their satisfaction with the view from their rooms. To answer the questions, students must identify key and relevant information such as the number of floors, the number of rooms per floor, and the different views from the rooms.

Skill 2.B: Justify an appropriate method for ethically gathering and representing data.

In "Lesson 1.2 - Analyzing Categorical Data," students learn how to represent categorical data related to student's favorite core class and favorite elective class using bar graphs, segmented bar graphs, and pie charts. Students are asked to describe how these representations are constructed and what type of data is appropriate for each.

In "Lesson 2.2 – Stratified Random Samples," students explain the steps involved in taking a simple random sample, a stratified random sample, and a systematic random sample in the context of surveying Taylor Swift fans and which one is most appropriate for the situation.

In "Lesson 2.4 - Potential Problems with Sampling," students are asked to identify what is wrong with different survey methods. For example, in one case fireman is surveying if people support budget cuts to the fire department while walking door to door in his uniform. Students must identify the problem with a survey and then explain the bias, leading to conversations regarding how to ethically gather data.

Skill 2.C: Identify appropriate statistical inference methods.

In "Lesson 6.1 - Interpreting a Confidence Interval," students identify the appropriate inference method by analyzing scenarios involving estimating a population parameter, such as the proportion of adults who pay for unused subscriptions and discussing what the interval means. This helps students build an understanding of the importance of identifying critical aspects about a problem (such as proportion vs. mean).

In "Lesson 7.1 - Introduction to Significance Tests," students are implicitly working on this skill when determining how to set up a test for a population proportion. The lesson involves a scenario where there is a claim about the true proportion of free throws that someone can make. Like confidence intervals, this lesson stresses to students the importance of thinking about the data being analyzed to choose the correct procedure.

In "Lesson 8.1 - Constructing a Confidence Interval for a Mean," students are asked to "Choose the inference procedure and set it up" in the context of estimating average screen time for AP Statistics students. Students in all confidence interval problems are specifically taught to identify the procedure by name, such as "one-sample t-interval for μ" as the appropriate procedure. This activity directly addresses the skill of identifying an appropriate inference method for confidence intervals.

In "Lesson 9.1 - Introduction to Significance Tests for a Mean," students are implicitly working on this skill when determining how to set up a test for a population mean. The lesson includes scenarios where students must choose the correct test, such as a test to determine if sample data provides convincing evidence that the average AP exam score for East Kentwood is greater than 3.11. Similar to Lesson 7.1, this beginning of unit lesson helps the student understanding the different type of procedure being selected.

Skill 2.D: Identify types of errors and relationships among components in statistical inference methods.

In "Lesson7.6 – Type I and Type II Errors," students must consider a situation where water is potentially not safe to drink. The students are provided different p-values to determine whether why would reject or fail to reject the null hypothesis. Afterwards, they are asked to consider what consequences each result would have if it was incorrect, which error is the most extreme, and how we can minimize each type of error.

In "Lesson 7.7 – Power of a Test," students will investigate the concept of the power of a significance test, which measures the probability of correctly rejecting a false null hypothesis. Using an interactive applet, students will visualize and explore the relationship between power, the probability of a Type II error, and the significance level. The activity guides students to discover how practical factors—such as sample size and the true value of the parameter—affect a test's power. By the end of the lesson, students will be able to interpret the power of a test in context and explain how to increase a test's ability to detect a true effect.

Skill 2.E: Identify the null and alternative hypothesis.

"Lesson 7.1 - Introduction to Significance Tests" requires students to "State appropriate hypotheses for performing a significance test" in the context of a claim about a true proportion of free throws. The teacher establishes the idea of the null and alternative hypotheses (e.g., Ho: p=0.84, Ha: p>0.84) related to claims about population proportions.

"Lesson 8.4 – Confidence Intervals for a Mean Difference" also involves stating the null and alternative hypotheses in the context of comparing peak temperatures to determine if climate change is occurring.

Statistical Practice 3: Analyze Data

CR6

Skill 3.A: Construct tabular and graphical representations of data and distributions

In "Lesson 1.4 - Describing Quantitative Data," students collect data on how many pairs of shoes they own. This data is input into an applet to visualize its transformation into various plots such as dotplots, stem-and-leaf plots, and histograms with the help of technology. Students are then asked to describe the data using the plots, focusing on shape, outliers, center, and spread.

In "Lesson 1.3 - Representing Categorical Data," students are given the percentage of teachers and students who prefer each mascot. They use these percentages to complete segmented bar graphs, observing potential relationships in mascot support. The lesson also addresses the importance of sample size versus percentages that can cause graphical representations to be misleading.

In "Lesson 10.1 - Scatterplots," students collect data by recording the number of rubber bands attached to a Barbie doll and the resulting bungee jump distance. After creating the scatterplot, they describe the relationship. The class responses are used to formalize the characteristics of the relationship, including direction, form, unusual features, and strength.

Skill 3.B: Calculate summary statistics, relative positions of points within a distribution, and predicts responses.

In "Lesson 1.5 - Measuring Variability," students analyze weather data for Denver. They complete a table to guide them through calculating standard deviation. The table includes steps such as finding the mean, subtracting the mean from each value, squaring the differences, summing the squares, dividing by the total number, and taking the square root. This process helps students understand standard deviation as the average distance from the mean. The students are then shown how to find all summary statistics on a calculator.

In "Lesson 10.2 - Correlation," students are introduced to the concept of correlation through various scatterplot examples. The teacher then instructs students on how to use a calculator to determine the correlation coefficient.

Skill 3.C: Calculate and estimate expected counts, percentages, probabilities, and intervals.

In "Lesson 3.2 - Simulation," students use simulations to estimate probabilities of events. For example, students use simulations to estimate probabilities of events like determining the likelihood of getting a certain number of "Bankrupt" spins on a Wheel of Fortune. They additionally need to calculate the expected number of times we would expect the results to occur so we can consider if our results are statistically significant.

In "Lesson 3.3 - Introduction to Probability," students determine relative frequencies, proportions, or probabilities using calculations. For instance, they calculate probabilities for events and their complements, such as calculating the probability of selecting a particular color of Starburst candy.

In "Lesson 8.1 - Constructing a Confidence Interval for a Mean," students are asked to choose, check, calculate, and conclude all relevant information to develop an interval regarding situations such as estimating the average daily phone screen time for AP Statistics students.

In "Lesson 8.4 - Confidence Intervals for a Mean Difference," students construct confidence intervals for the difference of means in scenarios like comparing actual time spent on the internet vs. parent's perception after checking the appropriate conditions.

Skill 3.D: Calculate means, standard deviations, and parameters for probability distributions.

In "Lesson 4.4 - Discrete Random Variables," students determine parameters, specifically the mean and standard deviation, for discrete random variables. The lesson uses data collected by the class, like the number of children in a student's family, to illustrate how to calculate these parameters.

In "Lesson 4.7 - Parameters for Binomial Distributions," students calculate and interpret the mean and standard deviation for a binomial distribution. The lesson uses examples such as calculating these parameters (mean and standard deviation) in the context of a student guessing on a multiple-choice quiz.

Skill 3.E: Calculate appropriate statistical inference method results.

In "Lesson 7.2 - Conditions and p-value," students calculate a test statistic and find a p-value in the context of hypothesis testing to appropriately interpret the results of their inference method. An example includes testing a claim about the proportion of teenagers who can taste a soapy flavor in cilantro.

In "Lesson 7.8 – Chi-Square Test for Homogeneity," students analyze categorical data, such as the acceptance data into colleges, and calculate the chi-square test statistic and determine the p-value to assess if there is a difference in the acceptance distributions between two colleges.

Statistical Practice 4: Interpret Results CR7

Skill 4.A: Describe and compare tabular and graphical representations of data.

In "Lesson 1.4 - Describing Quantitative Data," students collect data on how many pairs of shoes they own. This data is input into an applet to visualize its transformation into various plots such as dotplots, stem-and-leaf plots, and histograms with the help of technology. Students are then asked to describe the data using the plots, focusing on shape, outliers, center, and spread.

In "Lesson 1.6 - Comparing Quantitative Data," students are presented with parallel boxplots showing points scored by the 1997 University of Michigan and Michigan State University football teams. They are required to write a comparison of the distributions, addressing shape, outliers, centers, and spreads.

In "Lesson 4.4 – Discrete Random Variables," students describe probability distributions by addressing their shape, outliers, centers, and variability in the context of number of children in a family and the number of Home Alone movies someone has seen.

Skill 4.B: Justify a claim based on statistical calculations and results

In "Lesson 7.1 - Introduction to Significance Tests," students are asked to "Interpret a p-value and make a conclusion for a significance test for p." This involves scenarios where students must make conclusion about a claim about a population proportion based on the results of a simulated significance test. For example, students determine if there is convincing evidence a free thrower shooter is not as good as they claim.

In "Lesson 8.4 - Confidence Intervals for a Difference in Proportions," students justify a claim about the difference the difference of two proportions based on a confidence interval. This requires students to analyze a confidence interval and make a claim about whether there is a statistically significant difference between the proportion of juniors and seniors planning on attending the prom.

Skill 4.C: Describe distributions and compare relative positions of points within a distribution.

In "Lesson 1.6 - Comparing Quantitative Data," students are presented with parallel boxplots showing points scored by the 1997 University of Michigan and Michigan State University football teams. They are required to write a comparison of the distributions, addressing shape, outliers, centers, and spreads.

In "Lesson 1.7 - Location in a Distribution," students learn about z-scores using a test scores example. The lesson concludes with a problem where students create a scenario where Lorraine's biology test score is higher than her psychology test score, even though her biology test z-score was lower.

Skill 4.D: Interpret statistical calculations and results to assess meaning or a claim.

In "Lesson 2.2 - Simulation," students are asked to perform a simulation to see if Pepsi's 1 in 6 contest is actually fair after the class finds a lower amount of winners than expected. This involves setting up a simulation to be able to calculate the likelihood of various amounts of winners happening to assess if the game is fair or now.

In "Lesson 9.2 – Significance Tests for a Mean," students investigate a claim as to whether the normal body temperature is 98.6 degrees Fahrenheit. This likely involves tasks where students analyze the results of a hypothesis test and then also reference a confidence interval to make a claim about a population mean.

Skill 4.E: Justify the use of a chosen statistical inference method by verifying conditions.

In "Lesson 7.3 – Significance Tests for a Proportion," students verify that inference procedures apply as they up a hypothesis test to determine if you can "Taste the Rainbow". This includes checking conditions like randomness, independence, and sample size requirements to ensure the validity of using a z-test for a proportion.

In "Lesson 8.2 - Constructing Intervals for a Mean," students verify the conditions for calculating confidence intervals for a population mean to determine how much screen time students typically send on their phone. This involves confirming that conditions such as randomness, normality, and independence are met before constructing a t-interval for a mean.

Skill 4.F: Interpret results of statistical inference methods.

In "Lesson 7.3 – Significance Tests for a Proportion," students complete a statistical inference method to discover if people can really "Taste the Rainbow". By the end of the activity the students must uncover their test statistic and p-value interpret their result in the context of the problem.

In "Lesson 8.2 - Constructing Intervals for a Mean," students complete a statistical inference method to determine how much screen time students typically send on their phone. By the end of the activity the students must use their interval to interpret what the confidence interval is telling them about the amount of screen time students typically have.

Skill 4.G: Justify a claim based on statistical inference method results.

In "Lesson 6.5 - Confidence Intervals for a Difference of Proportions," students justify a claim based on a confidence interval for a difference of population proportions. Students are asked to make a claim about the difference in proportion of students planning to attend prom.

In "Lesson 8.1 – Constructing a Confidence Interval for a Mean," students justify a claim that the average weight of an Oreo is 11.33 grams. Students construct a confidence interval to capture the true average weight of an Oreo.

In "Lesson 8.4 - Confidence Intervals for a Difference in Proportions," students justify a claim about the difference the difference of two proportions based on a confidence interval. This requires students to analyze a confidence interval and make a claim about whether there is a statistically significant difference between the proportion of juniors and seniors planning on attending the prom.