Advanced Placement
Statistics
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Course Overview:

I cover all of the topics in the AP Statistics topic outline as they appear in the AP Statistics Course Description. In addition, I always go beyond the AP curriculum and cover additional topics in probability, graphical displays using technology, and calculator capabilities. We explore and learn the many topics of statistics in a way that allows each of my students the opportunity to work with all types of data and concepts in the following ways: graphically, numerically, analytically and verbally.

On a regular basis, I require my students to explain to the class their solutions, their methods of solving a problem, and the process involved in finding these solutions. We also discuss, on a regular basis, other options to the explanations presented in class. Also, at other times in class, students will work in groups of three or four, selected by either me or them, and work as a team in solving problems. Students are expected to do daily written assignments on each of the units in the curriculum. By the end of the school year, each student can use their graphing calculator for its intended purposes on the AP exam. 1) finding a regression equation, 2) sketching a graph of a distribution function, 3) graphing data in different forms, 4) finding confidence intervals, 5) calculating one variable and two-variable statistics, 6) testing claims, and 7) performing a simulation of probability distribution.

Each of my students has a graphing calculator, while some have a Texas Instrument TI-83 Plus or TI-84 graphing calculator, others have a TI-89 Graphing calculator. Students have previously learned how to use the basic functions of these calculators prior to studying statistics. However, they have not learned the capabilities for solving statistical problems. Part of my teaching involves how to use the calculator as a mathematical tool. However, the primary source for teaching statistics is the text book. Each student has year-round possession of a college-level text book, which has been recommended for the AP level.

The AP Statistics course is an option for all students who feel they are mathematically qualified, as we have no entrance requirements, but rather recommendations. The majority of our AP Statistics students have come through our school system's accelerated mathematics program, which begins in grade 7 with an accelerated pre-algebra class. All of my AP students are strongly encouraged to take the AP Statistics Exam, but our school's policy does not require that students actually take the AP Exam. On average over the last few years one in three of my students in statistics take the exam.

Teaching Strategy:

I encourage students to become more independent learners, like at the collegiate level. This requires a student to read the textbook carefully and note the important points in their notebook. My students are expected to come to class prepared with their assignments complete and questions on the material. Students are given a syllabus at the beginning of each chapter, showing the written assignments and reading. In class, students will frequently be asked to work in groups of three or four on a set of problems. Collectively, each group will solve their problems and present them to the class. During this process I provide direction and support. The interaction among the classmates enhances the learning process dramatically.

Assessment:

A student's overall grade is determined by their performance on written assignments, quizzes, and tests. Although a major project is expected following the AP Exam, the largest factor of their grade is from tests' scores. These tests are not multiple-choice nor are they True-False type problems. Most responses require work to be shown, as well as an explanation of their solution.

<u>Some Examples of Student Activities</u>:

    A. My students perform the typical Statistics graphing calculator experiments.

        1) We find the different regression equations from a set of data.

        2) We graph data using the calculator's graph and table menus

        3) We analyze data using the statistics option of the calculator.

        4) We tests claims using the calculator's program for testing data.

        5) We find confidence intervals for population parameters.

        6) We find the probability of an event occurring.

    B. My students go to the chalkboard or overhead and explain their solution to a problem.

    C. A student will explain an alternative method to finding a solution.

    D. Students will be challenged to derive equations to solving a problem.

    E. Students will compete against each other in solving proplems.

<u>Post AP Exam</u>

    A. Major Project involving collecting data, analyzing data, and making inferences from the analysis.

    B. Experiments involving the analysis of data.

    C. Experiments involving the Goodness-of-Fit Test.

    D. Experiments involving Testing Claims of Products.

    E. Experiments involving Confidence Intervals.

Course Planner

Unit 1: Data Analysis Process and Collecting Data Sensibly: (2 weeks)

    A. The Role of Statistics
        a. Reasons to study statistics
        b. The nature and role of variability
        c. Methods for collecting data
            1. Convenience
            2. Random
            3. Systematic
            4. Observational
            5. Stratified
            6. Cluster

        d. Types of Data

                1. Numerical
                2. Categorical
                3. Quantitative
                4. Qualitative

B. Data Analysis
    a. Planning a study
    b. Sampling
        1. Survey
        2. Bias
        3. Selection Bias
        4. Response Bias
    c. Experiments
        1. Treatments
        2. Confounding factors
        3. Extraneous factor
        4. Blocking
        5. Randomization
        6. Placebo
        7. Single-Blind
        8. Double-Blind

Unit 2: Graphical Methods for Describing Data (3 weeks)

A. Graphical Displays of Data
    a. Dotplot
    b. Pie Chart
    c. Frequency Table
    d. Relative Frequency Table
    e. Bar Chart
    f. Stem-and-Leaf
    g. Histogram
B. Comparitive graphical displays of data
    a. Bar Chart
    b. Pie Chart
    c. Stem-and-Leaf
C. Types of Distributions
    a. Symmetric
    b. Normal
    c. Uniform
    d. Skewed

D. Displays of Bivariate Data
    a. Scatter Plot
    b. Line Graph

Unit 3: Numerical Methods for Describing Data (3 weeks)

A. Measures of Central Tendency
    a. Mean
    b. Mode
    c. Median
    d. Midrange

    B.   Measures of Variability
- a. Standard Deviation
- b. Variance
- c. Outliers
- d. Range

    C.   Five-Number Summary
- a. Minimum
- b. Maximum
- c. Three Quartiles

    D.   Boxplots
- a. Modified
- b. Skeletal

    E.   Rules for Distribution of Data
- a. Empirical Rule
- b. Chebyshev's Rule

Unit 4: Bivariate Data and Regression Equations: (3 weeks)

    A.   Bivariate Data
- a. Scatter Plot
- b. Linear Regression Equation
- c. Correlation Coefficient
- d. Residuals
- e. Residual Plot
- f. Predicted Values
- g. Coefficient of Determination
- h. Standard Error

    B.   Nonlinear Relationships
- a. Polynomial Regression
- b. Exponential Regression
- c. Logarithmic Regression
- d. Transformations of Data

Unit 5: Probability (4 weeks)

    A.   Sample Space
- a. Venn Diagram
  - i. Union of Events
  - ii. Intersection of Events
- b. Tree Diagram
- c. Complement of an Event

    B.   Counting Outcomes
- a. Permutations
- b. Combinations

    C.   Probability
- a. Classical Probability
- b. Relative Frequency Probability
- c. Conditional Probability

    D.   Laws of Probability
- a. Basic Laws
- b. Law of Large Numbers
- c. General Multiplication Rule for Two Events
- d. General Addition Rule for Two Events

    e. Law of Total Probability
    f. Bayes' Rule

  E. Simulation
    a. Using a graphing calculator
    b. Without using a graphing calculator

Unit 6: Sampling Variability and Sampling Distributions (3 weeks)

  A. Random Variables
    a. Discrete
    b. Continuous

  B. Probability Distributions
    a. Discrete
    b. Continuous

  C. Measures of a Random Variable
    a. Mean
    b. Standard Deviation

  D. Discrete Distributions
    a. Binomial Distribution
    b. Geometric Distribution
  E. Continuous Distribution
    a. Normal
    b. Standard Normal
    c. Checking for Normality
    d. Approximating a Discrete Distribution

Unit 7: Sampling Variability and Sampling Distributions (3 weeks)

  A. Sampling Variability
  B. Central Limit Theorem
  C. Sampling Distribution
    a. Of a Sample Mean
    b. Of a Sample Proportion

Unit 8: Estimating Using a Single Sample (2 weeks)

  A. Point Estimation
  B. The Meaning of a Confidence Interval
  C. Confidence Interval for a Population Proportion
  D. Confidence Interval for a Population Mean
  E. Interpreting the Results of Statistical Analyses

Unit 9: Hypotheses Testing Using a Single Sample (4 weeks)

  A. Hypotheses Procedures
  B. Null and Alternative Hypotheses
  C. P-Value

     D. Type I and Type II Errors
     E. Test Procedures
     F. Errors in Hypothesis Testing
     G. Tests for a Population Proportion for a Large-Sample
     H. Tests for a Population Mean
     I. T-distribution
     J. Single sample t-test procedures
     K. Two Sample t-procedures
     L. Probability of Type II Error
     M. Interpreting the Results of Statistical Analyses

Unit 10: Comparing Two Populations or Treatments (2 weeks)

     A. Inferences Concerning the Difference Between Two Population or Treatment Means Using Independent Samples
     B. Inferences Concerning the Difference Between Two Population or Treatment Means Using Paired Samples
     C. Inferences Concerning the Difference Between Two Population or Treatment Proportions Using Large Samples
     D. Interpreting the Results of Statistical Analyses

Unit 11: The Analysis of Categorical Data (2 weeks)

     A. Chi-Square Distribution
     B. Chi-Square Tests for Univariate Categorical Data
     C. Goodness-of-Fit Test
     D. Tests for Homogeneity and Independence in a Two-Way Table
     E. Interpreting the Results of Statistical Analyses

       The above course planner allows for nearly 2 weeks, in late April and early May, to review the major concepts of statistics. We use previously-released AP type problems and problems from various AP Prep books (see below). I also allow students to see me before school or after school for extra practice sessions.   During these two weeks we also discuss multiple-choice strategies and review sample questions from previous exams. Furthermore, throughout the school year, the students and I go through the multitude of AP "style" problems that are included in the supplemental text (see below). These in-text problems include the typical free-response and multiple choice type questions, as well as many True-False problems. Students learn how to write a concise justification for their claim using Statistics vocabulary and reasoning. Another point of emphasis is the assessment part of the exam. How are responses scored and overall how many points are necessary for a score of a 5 on the exam compared to a 4, 3, or 2.

Major Text:

Peck, Roxy; Olsen, Chris; Devore, Jay, *Statistics and Data AnalysisGraphical,* Second Edition, Thomson Brooks/Cole, 2005

Other resources:

Kelly, Brendan; *Statistics with the TI-83 Plus & TI-83 Plus SE*, Brendan Kelly Publishing Inc.,2002

(AP Examination Preparation books and Exams from The College Board)

Released Exam, AP Statistics, The College Board, 1997

Released Exam, AP Statistics, The College Board, 1999, 2005, 2006, 2007

Technology:

Computer: Window XP Excel

Graphing calculators: TI-83, TI-84 or TI-89

Graphing calculator: Teacher uses the overhead version of the TI-83, TI-84, and TI-89.