



# El Camino College

## COURSE OUTLINE OF RECORD - Official

### I. GENERAL COURSE INFORMATION

**Subject and Number:** Psychology 9A  
**Descriptive Title:** Introduction to Statistics and Data Analysis for the Behavioral Sciences

**Course Disciplines:** Psychology  
 or Sociology

**Division:** Behavioral and Social Sciences

**Catalog Description:** Students are taught standard descriptive and inferential statistics for summarizing sample data and estimating population parameters. All aspects of significance testing are emphasized: hypotheses, models, calculations, interpretations, and criticisms. Students are also taught to review scientific articles critically and to write APA-style manuscripts.

*Note: Psychology 9A is the same course as Sociology 109A.*

**Conditions of Enrollment:**

**Prerequisite**

Psychology 5 or

Psychology 5H or

Sociology 101

AND

Mathematics 73 or

Mathematics 80

with a minimum grade of C in prerequisite

**Course Length:**  Full Term  Other (Specify number of weeks):  
**Hours Lecture:** 3.00 hours per week  TBA  
**Hours Laboratory:** 3.00 hours per week  TBA  
**Course Units:** 4.00

**Grading Method:** Letter  
**Credit Status** Associate Degree Credit

**Transfer CSU:**  Effective Date: Prior to July 1992

**Transfer UC:**  Effective Date: Prior to July 1992

**General Education:**  
 El Camino College: 4B – Language and Rationality – Communication and Analytical

**Thinking**

Term:

Other:

**6 – Mathematics Competency**

Term:

Other:

**CSU GE:****B4 - Mathematics/Quantitative Thinking**

Term: Fall 1988

Other:

**IGETC:****2A - Mathematical Concepts and Quantitative Reasoning**

Term: Fall 2007

Other:

**II. OUTCOMES AND OBJECTIVES****A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)**

1. Logic of the Scientific Method: Students will be able to identify and differentiate research methodology versus statistics/data analysis.  
Fundamental Principles: Students will be able to calculate and interpret basic statistics, both descriptive (e.g., mean, Sum of Squares, variance, standard deviation) and inferential (e.g., coefficient of determination, Cohen's d, t-test, ANOVA, Pearson r).
2. Everyday Application: Students will be able to evaluate the strengths and limitations research data in their efforts to understand everyday life experiences (e.g., deciding whether to decline a childhood vaccination or to modify lifestyle in view of risk factors).

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at <http://www.elcamino.edu/academics/slo/>.

**B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)**

1. Define and differentiate the following basic research concepts: population and sample, parameter and statistic; predictor (independent) variable and response (dependent) variable; extraneous variable and confounding variable; manipulated and natural (subject) variable; operational definition; correlation and causation.  
Other (specify)  
Short Essay Exam Item, Homework problem, Lab Assignment, Quiz
2. Explain the goals of statistical data analysis by explaining how hypotheses are associated with models and so can be compared by how well each model fits ("accounts for" or "explains") the data.  
Other (specify)  
Short Essay Exam Item, Quiz
3. Apply American Psychological Association (APA) Publication Style by writing manuscripts suitable for journal submission, including Abstract, Introduction (literature review), Method, Results, Discussion, References, Tables, and Figures.  
Other (specify)

APA-style research paper, Lab Assignment, Presentation

4. Construct and/or interpret the following numerical descriptions of data: grouped and ungrouped frequency distributions, stemplots, boxplots, bar graphs, histograms, and polygons.
  - Other (specify)
  - Calculatin/Short Essay Exam Item, Homework problem
5. Define, calculate, and compare these measures of Central Tendency: Mode, Median, and Mean (including Zero Sum Principle).
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem
6. Define, calculate and compare these measure of Variation: Range, Interquartile Range, Sum of Squares, Variance, and Standard Deviation (including Least Squares Law).
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem
7. Evaluate the "health" of distributions by calculating and interpreting statistics that define shape, skew, and outliers.
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem
8. Apply Probability Theory by (a) defining and differentiating relevant concepts such as randomness, sample space, event, outcome, mutually exclusive, exhaustive, and independence; (b) applying the Addition and Multiplication Rules to calculate probabilities; and (c) applying Bayes' Theorem to calculate conditional probabilities (including the "Monty Hall Problem" and results of diagnostic tests).
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem, Quiz
9. Define z-scores and calculate probabilities for ranges of scores in a Normal Distribution.
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem, Quiz
10. Define and differentiate Population, Sample, Sampling Distributions; apply the Central Limit Theorem and Law of Large Numbers to show how these distributions are linked and so allow for statistical inference.
  - Other (specify)
  - Calculation/Short Essay Exam Item
11. Explain the mainstream procedure for evaluating research results, i.e., Null Hypothesis Statistical Testing (NHST), by defining and differentiating: Null and Alternate Hypotheses, Null and Full Linear Models, residuals, directional and nondirectional tests, alpha levels,  $p$ -values, Type I and Type II Errors, statistical significance, and statistical power.
  - Other (specify)
  - Short Essay Exam Item, Quiz
12. Apply the NHST procedure to 2 and 3+ groups by calculating and interpreting  $t$ -test, one-way ANOVA (and related post hoc tests such as Tukey's HSD, Fisher's LSD, and Simultaneous Confidence Intervals).
  - Other (specify)
  - Calculation/Short Essay Exam Item, Homework problem, Quiz

13. Analyze and explain the advantages of multigroup and factorial research designs in comparison to single factor two-group designs.

Other (specify)

Short Essay Exam Item, Quiz

14. Define and differentiate Correlation and Regression by (a) estimating the Regression Line parameters; (b) applying the Regression Line by calculating and interpreting predicted scores; (c) conducting and interpreting an NHST of the Regression slope; calculating and interpreting the Pearson Product Moment Correlation Coefficient ( $r$ ) and Coefficient of Determination ( $r^2$ ); and (d) identifying and explaining the assumptions and limitations of these statistics.

Other (specify)

Calculation/Short Essay Examination Item, Homework problem, Quiz

15. Explain non-parametric NHSTs by calculating and interpreting the Chi-Square test for disproportionality.

Other (specify)

Calculation/Short Essay Exam Item, Homework problem, Quiz

16. Explain limitations of and alternatives to NHST by calculating and interpreting (or reinterpreting) estimates of Effect Size and Precision, e.g., Cohen's  $d$ , Coefficient of Determination ( $r^2$ ), Confidence Interval.

Other (specify)

Calculation/Short Essay Exam Item, Homework problem, Quiz

**III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)**

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	6	I	Science and Statistical Analysis A. Goals 1. Hypotheses and Their Models 2. Accounting for Data: Prediction and Explanation, 3. Comparing Models: Fit and Parsimony B. Variables 1. Quantitative and Categorical 2. Predictor and Response 3. Manipulated and Natural 4. Extraneous and Confounding 5. Operational Definitions
Lecture	9	II	Numerical Description of Data A. Central Tendency 1. Mean 2. Median 3. Mode 4. Zero Sum Principle B. Measures of Dispersion 1. Range and Interquartile Range (IQR) 2. Sum of Squares 3. Variance 4. Standard Deviation 5. Least Squares Law C. "Health" of a Distribution: Shape, Skew, and Outliers

Lecture	6	III	<p>Probability</p> <p>A. Definition</p> <p>B. Randomness and Order</p> <p>C. Event, Outcome, Mutually Exclusive, Exhaustive, Independence, Sample Space</p> <p>D. Addition and Multiplication Rules, Conditional Probabilities and Bayes' Theorem</p> <p>E. Probability Distributions</p> <ol style="list-style-type: none"> <li>1. Law of Large Numbers, Central Limit Theorem, and the Normal Distribution</li> <li>2. The Binomial Distribution</li> <li>3. Calculating Probabilities for Normally Distributed Variables: Z-Scores</li> </ol>
Lecture	6	IV	<p>Sampling Distributions and Interval Estimation</p> <p>A. Sampling Distribution of the Mean</p> <p>B. Calculating Confidence Intervals</p> <ol style="list-style-type: none"> <li>1. Population Standard Deviation Known (Normal Distribution)</li> <li>2. Population Standard Deviation Unknown (Student's <math>t</math> Distribution)</li> </ol> <p>C. Interpreting Confidence Intervals</p>
Lecture	3	V	<p>Modeling Data and Estimating Parameters</p> <p>A. Four Steps of Fitting Models to Data</p> <p>B. Point Estimation: Parameters and Samples</p> <p>C. Categorical and Quantitative Predictor Variables</p>
Lecture	6	VI	<p>Mainstream Procedure for Evaluating Research Results (Null Hypothesis Statistical Testing -- NHST)</p> <p>A. Null and Alternate Hypotheses</p> <p>B. Null and Full Linear Models</p> <p>C. Residuals</p> <p>D. Directional and Nondirectional Tests</p> <p>E. Alpha Levels and P-Values</p> <p>F. Type I and Type II Errors</p> <p>G. Statistical Significance and Power</p>
Lecture	6	VII	<p>NHST for 2 and 3+ Groups</p> <p>A. t-Test and Confidence Intervals</p> <p>B. One-Way ANOVA</p> <ol style="list-style-type: none"> <li>1. A Priori and Post Hoc Tests (e.g., Tukey's HSD, Fisher's LSD)</li> <li>2. Simultaneous Confidence Intervals</li> </ol> <p>C. Advantages of Multi-Group and Factorial Designs</p>
Lecture	6	VIII	<p>Correlation and Regression</p> <p>A. Regression Line</p> <ol style="list-style-type: none"> <li>1. Parameters: Slope and Intercept</li> <li>2. Prediction</li> <li>3. NHST of the Regression Slope</li> </ol> <p>B. Pearson Product Moment Correlation Coefficient (<math>r</math>) and Coefficient of Determination (<math>r^2</math>)</p> <p>C. Assumptions and Limitations</p>
Lecture	3	IX	<p>Non-Parametric NHSTs: Chi-Square Test for Disproportionality.</p>
Lecture	3	X	<p>Limitations and Alternatives to NHST: Effect Size and Precision</p> <p>A. Misinterpretations of <math>p</math> Values</p> <p>B. Cohen's <math>d</math>, Coefficient of Determination (<math>r^2</math>), Confidence Interval</p>

			C. Sample Size, Power, and Precision D. Repeated Measures Designs
Lab	6	XI	Graphical Descriptions of Data A. Grouped/Ungrouped Frequency Distributions of Qualitative/Quantitative Data B. Bar Graphs, Histograms, and Polygons C. Stemplots and Boxplots D. Computer Graphing
Lab	6	XII	Library Literature Searches A. Journals Versus Monographs B. Refereed Versus Nonrefereed Journals C. Searching Via the Internet
Lab	6	XIII	The APA Publication Style: Manuscript Preparation A. Abstract B. Introduction (Literature Review) C. Method 1. Participants 2. Materials 3. Procedure D. Results E. Discussion F. References H. Tables and Figures
Lab	36	XIV	Conducting Research A. Choosing and Developing a Topic B. Proposing a Study C. Conducting a Study D. Analyzing the Data E. Preparing the Manuscript
<b>Total Lecture Hours</b>		54	
<b>Total Laboratory Hours</b>		54	
<b>Total Hours</b>		108	

#### IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

##### A. PRIMARY METHOD OF EVALUATION:

Substantial writing assignments

##### B. TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:

Read and analyze data from the study entitled, *Researching the Relationship Between Quality of Parental Relationships and Educational Goals in College Students*. Perform the appropriate statistical analysis on the data and state your conclusion. Write a research report in APA format that includes all the relevant elements: a review of scientific literature, description of method, report of results (including figures and tables), and discussion.

##### C. COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:

1. Consider the following results and conclusion of a survey:

*The degree to which young girls participate in sports is positively correlated to a number of desirable variables (e.g., academic achievement, staying in school, avoiding drug and alcohol use) and is negatively correlated with a number of undesirable variables (e.g., breast cancer, eating disorder, unwed motherhood). These data show that parents and teachers should encourage young girls to become more active in sports.*

In a two-page paper, analyze the research design of this study and determine whether its conclusions are justified, focusing especially on causal inference.

2. After reading the research article distributed in class, consider the following survey results showing that decreasing health (as measured by the number of doctor appointments and hospitalizations) is associated with lower life satisfaction (as measured by the Life Satisfaction Inventory) and higher marital discord (as measured by divorce rate). In a two-page paper, identify the hypothetical variables and analyze these variables in terms of their operational definitions.

#### **D. OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Objective Exams

Reading reports

Written homework

Homework Problems

Term or other papers

Multiple Choice

Other (specify):

Calculation and short answer items, lab assignments, research papers

#### **V. INSTRUCTIONAL METHODS**

Demonstration

Laboratory

Lecture

Other (please specify)

data collection, computer data analysis

**Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.**

## VI. WORK OUTSIDE OF CLASS

Study

Skill practice

Required reading

Problem solving activities

Written work

**Estimated Independent Study Hours per Week: 8**

## VII. TEXTS AND MATERIALS

### A. UP-TO-DATE REPRESENTATIVE TEXTBOOKS

Robert S. Lockhart. Introduction to Statistics and Data Analysis for Behavioral Science. VHPS, 2007.

Howard T. Tokunaga. Fundamental Statistics for the Social and Behavioral Sciences. 1 ed. Sage, 2016.

American Psychological Association. Publication Manual of the APA. 6 ed. APA, 2009.

### B. ALTERNATIVE TEXTBOOKS

### C. REQUIRED SUPPLEMENTARY READINGS

### D. OTHER REQUIRED MATERIALS

## VIII. CONDITIONS OF ENROLLMENT

### A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Psychology-5 or	Sequential
Course Prerequisite Psychology-5H or	Sequential
Course Prerequisite Sociology-101 AND	Sequential
Course Prerequisite Mathematics-73 or	Computational/Communication Skills
Course Prerequisite Mathematics-80	Computational/Communication Skills

### B. Requisite Skills

Requisite Skills
Students will learn statistical methods involved in the scientific method; they will more likely succeed if they are already familiar with this method as well as specific research topics used in Psychology 5, such as cognition, emotion, and personality variables in individuals. PSYC 5 - Outline the steps of the scientific method, identify common research methods, and discuss ethical considerations of psychological research.
Students will learn statistical methods involved in the scientific method; they will more likely succeed if they are already familiar with this method as well as specific research topics used in Sociology 101, such as cognition, emotion, and personality variables in individuals. SOCI 101 - Identify the six steps in the scientific method and distinguish between qualitative and quantitative research methods.



SOCI 101 -  
Evaluate the advantages and disadvantages of research methodologies sociologists use to gather and analyze data.

Students will learn statistical methods including: a) creating and interpreting graphs of functional relationships between predictor and response variables and b) solving linear regression equations; they will more likely succeed if they are already familiar with these concepts. MATH 73 -  
Recognize functional relationships in the form of graphs, data or symbolic equations.

Students will learn statistical methods including: a) creating and interpreting graphs of functional relationships between predictor and response variables and b) solving linear regression equations; they will more likely succeed if they are already familiar with these concepts. MATH 80 -  
Recognize functional relationships in the form of graphs, data or symbolic equations.

### C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification
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### D. Recommended Skills

Recommended Skills
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### E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact
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Course created by Donald Fridley on 03/01/1978.

**BOARD APPROVAL DATE:**

**LAST BOARD APPROVAL DATE:**

**Last Reviewed and/or Revised by Richard Mascolo on 03/15/2016**

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