



I. GENERAL COURSE INFORMATION

Subject and Number: Psychology 109A
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 109A is the same course as Sociology 109A.

Conditions of Enrollment:

Prerequisite: Psychology 101 or Psychology 101H or Sociology 101 or Sociology 101H AND Mathematics 73 or Mathematics 80 with a minimum grade of C in prerequisite

Course Length:	X 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: X Effective Date: Prior to July 1992
Transfer UC: X 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:** On examination (e.g., m/c, T/F, fill-in, matching, essay), written essay, research paper, and or oral presentation, students will be able to identify and differentiate research methodology versus statistics/data analysis.
2. **Fundamental Principles:** On examination (e.g., m/c, T/F, fill-in, matching, essay), written essay, research paper, and or oral presentation, 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).
3. **Everyday Application:** On examination (e.g., m/c, T/F, fill-in, matching, essay), written essay, research paper, and or oral presentation, 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).

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.
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.
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.
4. Construct and/or interpret the following numerical descriptions of data: grouped and ungrouped frequency distributions, stemplots, boxplots, bar graphs, histograms, and polygons.
5. Define, calculate, and compare these measures of Central Tendency: Mode, Median, and Mean (including Zero Sum Principle).
6. Define, calculate and compare these measure of Variation: Range, Interquartile Range, Sum of Squares, Variance, and Standard Deviation (including Least Squares Law).
7. Evaluate the "health" of distributions by calculating and interpreting statistics that define shape, skew, and outliers.
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).
9. Define z-scores and calculate probabilities for ranges of scores in a Normal Distribution.
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.
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.
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).
 13. Analyze and explain the advantages of multigroup and factorial research designs in comparison to single factor two-group designs.
 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.
 15. Explain non-parametric NHSTs by calculating and interpreting the Chi-Square test for disproportionality.
 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.

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	I. Science and Statistical Analysis (6 hours, lecture) A. Goals <ol style="list-style-type: none"> 1. Hypotheses and Their Models 2. Accounting for Data: Prediction and Explanation, 3. Comparing Models: Fit and Parsimony B. Variables <ol style="list-style-type: none"> 1. Quantitative and Categorical 2. Predictor and Response 3. Manipulated and Natural 4. Extraneous and Confounding 5. Operational Definitions
Lecture	9	II	II. Numerical Description of Data (9 hours, lecture) A. Central Tendency <ol style="list-style-type: none"> 1. Mean 2. Median 3. Mode 4. Zero Sum Principle B. Measures of Dispersion <ol style="list-style-type: none"> 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	III. Probability (6 hours, lecture) A. Definition B. Randomness and Order C. Event, Outcome, Mutually Exclusive, Exhaustive, Independence, Sample Space D. Addition and Multiplication Rules, Conditional Probabilities and Bayes' Theorem E. Probability Distributions <ol style="list-style-type: none"> 1. Law of Large Numbers, Central Limit Theorem, and the Normal Distribution 2. The Binomial Distribution 3. Calculating Probabilities for Normally Distributed Variables: Z-Scores
Lecture	6	IV	IV. Sampling Distributions and Interval Estimation (6 hours, lecture) A. Sampling Distribution of the Mean B. Calculating Confidence Intervals <ol style="list-style-type: none"> 1. Population Standard Deviation Known (Normal Distribution) 2. Population Standard Deviation Unknown (Student's <i>t</i> Distribution) C. Interpreting Confidence Intervals
Lecture	3	V	V. Modeling Data and Estimating Parameters (3 hours, lecture) A. Four Steps of Fitting Models to Data B. Point Estimation: Parameters and Samples C. Categorical and Quantitative Predictor Variables
Lecture	6	VI	VI. Mainstream Procedure for Evaluating Research Results (Null Hypothesis Statistical Testing -- NHST) (6 hours, lecture) A. Null and Alternate Hypotheses B. Null and Full Linear Models C. Residuals D. Directional and Nondirectional Tests E. Alpha Levels and P-Values F. Type I and Type II Errors G. Statistical Significance and Power
Lecture	6	VII	VII. NHST for 2 and 3+ Groups (6 hours, lecture) A. t-Test and Confidence Intervals B. One-Way ANOVA <ol style="list-style-type: none"> 1. A Priori and Post Hoc Tests (e.g., Tukey's HSD, Fisher's LSD) 2. Simultaneous Confidence Intervals C. Advantages of Multi-Group and Factorial Designs
Lecture	6	VIII	VIII. Correlation and Regression (6 hours, lecture) A. Regression Line <ol style="list-style-type: none"> 1. Parameters: Slope and Intercept 2. Prediction 3. NHST of the Regression Slope B. Pearson Product Moment Correlation Coefficient (<i>r</i>) and

			Coefficient of Determination (r^2) C. Assumptions and Limitations
Lecture	3	IX	IX. Non-Parametric NHSTs: Chi-Square Test for Disproportionality. (3 hours, lecture)
Lecture	3	X	X. Limitations and Alternatives to NHST: Effect Size and Precision (3 hours, lecture) A. Misinterpretations of p Values B. Cohen's d , Coefficient of Determination (r^2), Confidence Interval C. Sample Size, Power, and Precision D. Repeated Measures Designs
Lab	6	XI	XI. Graphical Descriptions of Data (6 hours, lab) 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	XII. Library Literature Searches (6 hours, lab) A. Journals Versus Monographs B. Refereed Versus Nonrefereed Journals C. Searching Via the Internet
Lab	6	XIII	XIII. The APA Publication Style: Manuscript Preparation (6 hours lab) 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	XIV. Conducting Research (36 hours, lab) A. Choosing and Developing a Topic B. Proposing a Study C. Conducting a Study D. Analyzing the Data E. Preparing the Manuscript
Total Lecture Hours		54	
Total Laboratory Hours		54	
Total Hours		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

Howard T. Tokunaga. Fundamental Statistics for the Social and Behavioral Sciences. 2nd ed. Sage, 2018.
American Psychological Association. Publication Manual of the APA. 7th ed. APA, 2019.

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-101 or	Sequential
Course Prerequisite Psychology-101H or	Sequential
Course Prerequisite Sociology-101 or	Sequential
Course Prerequisite Sociology-101H 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 101 and Psychology 101H, such as cognition, emotion, and personality variables in individuals.

PSYC 101 - Outline the steps of the scientific method, identify common research methods, and discuss ethical considerations of psychological research.

PSYC 101H - 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 and Sociology 101H, 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 101H - 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.

SOCI 101H - 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

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: 03/23/2020

Last Reviewed and/or Revised by Richard Mascolo on 01/29/2020

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