El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	SOCI
Course Number:	109A
Descriptive Title:	Introduction to Statistics and Data Analysis for the Behavioral Sciences
Division:	Behavioral and Social Sciences
Department:	Sociology
Course Disciplines:	Psychology, Sociology
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: This course is the same as Psychology 109A.
Prerequisite:	Sociology 101 or Sociology 101H or Psychology 101 or Psychology 101H, proficient in intermediate algebra skills
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	3
Outside Study Hours:	6
Total Course Hours:	108
Course Units:	4
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to July 1992
Transfer UC:	Yes
Effective Date:	
General Education: ECC	Area 4B - Language and Rationality: Communication and Analytical Thinking 6 - Mathematics Competency
Term:	
Other:	

CSU GE:	Area B4 - Mathematics/Quantitative Reasoning
Term:	Fall 1988
Other:	
IGETC:	Area 2A - Mathematical Concepts and Quantitative Reasoning
Term:	Fall 2007
Other:	
Student Learning Outcomes:	**SLO #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. **SLO #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). **SLO #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).
Course Objectives:	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 measure of Central Tendency: Mode, Median, and Mean (including Zero Sum Principle). 6. Define, calculate, and compare these measures 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 and 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 ($r2$); 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 ($r2$), Confidence Interval.

Major Topics:	**I. Science and Statistical Analysis (6 hours, lecture)**
	
	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
	
	II. Numerical Description of Data (9 hours, lecture)
	
	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

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
       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

IV. Sampling Distributions and Interval Estimation (6 hours, lecture)

   A. Sampling Distribution of the Mean
   B. Calculating Confidence Intervals
       1.   Population Standard Deviation Known (Normal Distribution)
       2.   Population Standard Deviation Unknown (Student's t Distribution)
   C. Interpreting Confidence Intervals

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

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 1 and Type II Errors
   G. Statistical Significance and Power

VII. NHST for 2 and 3+ Groups (6 hours, lecture)

   A. t-Test and Confidence Intervals
   B. One-Way ANOVA
       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

VIII. Correlation and Regression (6 hours, lecture)

   A. Regression Line
       1.   Parameters: Slope and Intercept

2. Prediction
3. NHST of the Regression Slope
B. Pearson Product Moment Correlation Coefficient (r) and Coefficient of Determination (r2)
C. Assumptions and Limitations

IX. Non-Parametric NHSTs: Chi-Square Test for Disproportionality (3 hours, lecture)

X. Limitations of and Alternatives to NHST: Effect Size and Precision (3 hours, lecture)

A. Misinterpretations of p Values
B. Cohen's d, Coefficient of Determination (r2), Confidence Interval
C. Sample Size, Power, and Precision
D. Repeated Measure Designs

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

XII. Library Literature Searches (6 hours, lab)

A. Journals Versus Monographs
B. Refereed Versus Nonrefereed Journals
C. Searching Via the Internet

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
G. Tables and Figures

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
Primary Method of Evaluation:	1) Substantial writing assignments
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.
Critical Thinking Assignment 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.
Critical Thinking Assignment 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.
Other Evaluation Methods:	Homework Problems, Multiple Choice, Objective Exam, Reading Reports, Term or Other Papers, Written Homework. Other. Calculation and short answer items, lab assignments, research papers
Instructional Methods:	Demonstration, Lab, Lecture
If other:	Data collection, Computer data analysis
Work Outside of Class:	Problem solving activity, Required reading, Skill practice, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	
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.
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	

Requisite:	Prerequisite
Category:	sequential
Requisite course(s): List both prerequisites and corequisites in this box.	Sociology 101 or Sociology 101H or Psychology-101 or Psychology-101H
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**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 deviance and social control variables in social groups.** 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 methods and distinguish between qualitative and quantitative research methods. **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 or 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.
Requisite Skill:	Proficient in intermediate algebra skills
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	**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.** 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.** Recognize functional relationships in the form of graphs, data or symbolic equations.
Requisite course:	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Donald Fridley
Date:	03/01/1978
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Stacey Allen
Date:	02/23/2023
Last Board Approval Date:	07/17/2023