EMR 645 Elementary Statistics

Credit and Clock Hours
3 Semester hours
Tuesday 6:00 to 9:15 PM

Course Catalogue Description
EMR 6450 is a graduate level course covering principles of research design and data analysis in the social and behavioral sciences at both the conceptual and applied levels. Emphasis is placed on the development of conceptual skills of design analysis and interpretation. Techniques of statistical analysis include the use of computer programs for data analysis.

EMR 6450 will cover basic measurement and scaling considerations applicable in behavioral research, descriptive statistics (central tendency, variability, tables, and graphics), introduce hypothesis testing, estimation, confidence intervals, rates and proportions, chi-square, and bivariate correlation. An introduction to linear regression will also be presented. All topics will be taught from an applied perspective which will include statistical computing using SAS and/or SPSS with an emphasis on interpretation and write-up of statistical output.

Prerequisite
EMR 6400 Introduction to Evaluation, Measurement and Research

Instructor
Penelope Miller-Smith
Adjunct Faculty
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Course Website

Office Hours
By Appointment

Required Text

**Recommended Text**

**Instructional Objectives**
- Differentiate, utilize, and apply statistical description and inference to basic, applied, and clinical research in psychology, applied research in education, and the broader arena of the behavioral sciences
- Differentiate between statistical description and statistical inference in reference to the generalizability of statistical findings vis-a-vis research goals (summary, measurement and estimation, hypotheses testing, evaluation).
- Understand and be able to utilize various forms of charts and graphs useful for statistical description.
- Understand the concept and utility of statistical error and statistical sampling distributions.
- Create a data set suitable for data analysis by SAS and/or SPSS.
- Write, debug, and interpret SAS and/or SPSS programs and associated output.
- Use a statistical program for data analysis.
- Select statistical analyzes appropriate to the type of data being analyzed and the question being asked.
- Distinguish type I and type II errors in statistical hypothesis testing.
- Interpret the concepts of statistical power and the influence of sample size on statistical inference.
- Conduct a statistical power analysis.
- Correctly interpret statistical output so that it can be written-up (APA style) and understood by a non-statistician.

**Course Components and Methods of Evaluation**
In order to benefit most from your study of this course material, you are expected to: read the course text, related documents, and journal articles, complete assignments related to course topics, and document mastery of course content through a midterm and final exam.

**Need for Accommodations**
Any student with a documented disability (e.g., physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the professor and the appropriate Disability Services office at the beginning of the semester. The two disability service offices on campus are: Disabled Student
Resources and Services 269-387-2116 and the Office of Services for Students with Learning Disabilities 269-387-4411.

**Diversity Statement**
The Department of Educational Studies EMR program maintains a strong and sustained commitment to the diverse and unique nature of all learners and high expectations for each student.

**Professional Concerns**
You are responsible for making yourself aware of and understanding the policies and procedures in the Undergraduate (pp. 268-270) [Graduate (pp. 24-26)] Catalog that pertain to Academic Integrity. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity, and computer misuse. If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Judicial Affairs. You will be given the opportunity to review the charge(s). If you believe you are not responsible, you will have the opportunity for a hearing. You should consult with me if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

**Attend and Participate in Classes**
Be prepared to discuss problems and readings as a class or in cooperative groups. If you have questions, you may ask them in class, or via email, as it is your responsibility to gain clarification. We will do supplementary reading for this class. If you have to be absent, please make arrangements to get materials/notes from a classmate or instructor. Regardless of the reason, you can not receive credit for participation if you are not present to participate.

Regular and punctual class attendance is expected of all students. A student will be dropped from a course and assigned a failing grade for excessive absences. Excessive absences mean failure to attend 75% of scheduled class meetings. Two absences will be accepted without affecting your participation grade.

**Evaluation Policy**
Timely completion and the quality of your work will contribute to your overall course grade. In fairness to all, a penalty will be imposed for any work submitted late. Generally speaking the penalty will be equivalent to one letter grade or more. Extenuating circumstances will be considered with proper documentation.

Course grades are based on total points from homework assignments and exams, including extra homework and exam credits, as described above. However, regardless of total points, no student who fails the final examination will receive an "A" grade in the course.

Professionalism in all course-related endeavors and active class participation is expected. All work will be evaluated based on accuracy, adherence to guidelines and
due dates, thoroughness, evidence of effort, evidence of professionalism, evidence of data integration, coherence, and appearance. Be sure to check, proof, and edit all work submitted.

**Homework Policy**
Homework will be accepted up to 1 class meeting past the due date and can only receive a maximum of 50% of the available points for that assignment unless prior arrangements are made with the instructor. All homework write-ups (when appropriate) are to be typed in APA style. SAS and/or SPSS programs, logs (SAS only), and listings are to be included if computer work is required by the assignment. Homework is due by email as a MS Word attachment prior to the next class following the assignment unless otherwise indicated by the instructor. Extra credit homework opportunities may be offered.
Homework Descriptions

All homework write-ups are to be typed in APA style. Programs and output must be attached. Email attachments must be readable in Word or as otherwise noted.

EMAIL (2 pts extra credit)
Assigned 8/30/05
Due by 5:00 pm 9/6/05
Email the instructor penelope.smith@comcast.net a hello note, tell me something about you and why you are taking this class.

Exercise #1 CODEBOOK (10 pts) SPSS
Assigned 8/30/05
Due by 5:00 pm 9/6/05
Part A: Use the questions developed in class and develop a code book. (10 pts)
Part B: Enter a minimum of 10 subject lines of data into a computer file according to the code book directions. (5 pts)
Email the code book and data file as attachments to the instructor. (This may be done in Excel, as a Word table, or in SPSS.)

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that explains how quantitative data were coded, or recoded, prior to statistical analyses. Turn-in a complete APA reference for the article along with a paragraph to a page summary of the research conforming to APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., how was their coding or recoding applied in the analysis), (c) does the analysis relate to the general problem the researchers are investigating (e.g., from your answers to part b), and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #2 DESCRIPTIVE ANALYSIS (10 pts) SAS
Assigned 9/6/05
Due by 5:00 pm 9/13/05
Use the HSB data set and complete a complete descriptive analysis of the variables RACE, SES, RDG & MATH. Turn-in a write-up conforming to the APA editorial style that includes a) a table of means and standard deviations for the continuous variables, a frequency table for the non-continuous variables and a graphic appropriate for the variable type.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents quantitative data descriptively in tabular form. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research
question/hypothesis are the researchers testing within the specified analysis (i.e., descriptive analysis), (c) does the analysis relate to the general problem the researchers are investigating (e.g., from your answers to parts a and b), and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #3 CHI-SQUARE (10 pts) SPSS
Assigned: 9/13/05
Due by 5:00 pm 9/27/05
Use the HSB data set to test the hypothesis that there is no relationship (independence) between a person’s race and their social economic status. Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study, a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings and include a two dimensional frequency table.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a Chi-square test of independence. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., chi-square analysis), (c) what are the variables under study, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answers to parts a and b), and (e) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #4 CONFIDENCE INTERVALS (10 pts) SAS
Assigned: 9/27/05
Due by 5:00 pm 10/4/05
Using the HSB data set place 90% and 95% confidence intervals around the means of RDG & MATH. Write up an interpretation of each confidence interval and discuss why they are different.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that illustrates the use of confidence intervals. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers investigating, (c) what are the variables under study, (d) does their use of confidence intervals support their investigation and analysis (e.g., from your answer to part b), and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.
Exercise #5 ONE SAMPLE T-TEST (10 pts) SPSS
Assigned: 10/4/05
Due by 5:00 pm 10/11/05
Use the HSB data set to test two hypotheses: are the mean WRTG and SCI T-scores different from 50. Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study (dependent and independent variables), a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings and include a summary table of descriptive statistics.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a one sample t-test. Turn in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., one-sample t-test), (c) what is the variable under study and what are they basing the population mean on, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answer to part (a and b), and (e) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #6 INDEPENDENT T-TEST (10 pts) SAS
Assigned: 10/11/05
Due by 5:00 pm 10/25/05
Use the HSB data set to test two hypotheses: that there is a difference in means between males and females MATH and WRTG T-scores. Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study (dependent and independent variables), a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings and include a summary table of descriptive statistics.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents an independent t-test. Turn in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., independent t-test), (c) what are the variables under study, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answer to part (a and b), and (e) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.
Exercise #7 DEPENDENT T-TEST (10 pts) SPSS
Assigned: 10/18/05
Due by 5:00 pm 10/25/05
Use the EXERCISE data and test if there is a change in mean pulse rate after exercising. Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study, a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings and include a summary table of descriptive statistics.
Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a dependent t-test. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., dependent t-test), (c) what is/are the variable(s) under study, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answers to parts a and b), and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #8 CORRELATION (10 pts) SAS
Assigned: 10/25/05
Due by 5:00 pm 11/1/05
Use the HSB data set to examine the bivariate relationships between RDG, WRTG, MATH, SCI, and CIV for each gender. Using a Fisher Z test, test if the correlation between RDG and WRTG is the same for males and females. Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study, a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings along with two figures of the RDG, WRTG bivariate relationship for each gender; be sure to include a table of descriptive statistics in your write-up.
Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a bivariate correlation analysis. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., correlation), (c) what are the variables under study, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answers to parts a and b), and (d) what
are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #9 1-VARIABLE REGRESSION (10 pts) SPSS
Assigned: 11/1/05
Due by 5:00 pm 11/8/05
Use the HSB data set to determine if LOCUS of control can predict a students reading T-score (RDG). Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study (predictor and criterion), a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings along with a figure relationship, be sure to include a table of descriptive statistics in your write-up.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a one variable linear regression analysis. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., one (predictor) variable regression), (c) what are the variables under study, (d) does the analysis relate to the general problem the researchers are investigating (e.g., from your answer to part (a)) and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

Exercise #10 Multiple Regression (10 pts) SAS
Assigned: 11/15/05
Due by 5:00 pm 11/29/05
Use the HSB data set to determine if locus of control (LOCUS), their motivation level (MOT) and their self concept (CONCPT) can predict a students reading Tscore (RDG). Write up your interpretation of the findings in APA format. Include in your write-up, a statement your research question/hypothesis which identifies the variables under study (predictor and criterion), a short description of the sample, a summarization of the test statistic findings and your conclusion regarding your research question/hypothesis. Support your conclusion with a tentative interpretation of the findings; be sure to include a table of descriptive statistics in your write-up.

Extra Credit is available for this assignment (2 pts). Select and read a primary source in a research area of your interest that presents a multiple linear regression analysis. Turn-in a complete APA reference for the article along with a paragraph to a page summary conforming to the APA style which includes answers the following questions: (a) What is the general problem under study, (b) specifically what research question/hypothesis are the researchers testing within the specified analysis (i.e., regression), (c) what are the variables under study, (d) does the analysis relate to the
general problem the researchers are investigating (e.g., from your answer to part (a)) and (d) what are the general conclusions of the study and are they justified based on the overall design and analysis of the study.

**Instructor’s Comment about the 10 Homework Assignments**
Although each assignment has the same point value this does not necessarily translate into equal difficulty among the 10 assignments. Some of the assignments will be more difficult for some students while others will be more difficult for other students. Moreover, some of the assignments will present greater difficulty in the writing phase while others will be more difficult in the analytical phase. Thus I have chosen to weight each assignment by the average and not try to guess which particular assignment will be easier or harder by topic or by student.

**Computer Application EXTRA CREDIT**
As noted above each assignment is associated with a particular computer application, i.e., SAS or SPSS. You may earn 2 additional points of EC by completing the computing portion of the assignment in the non-associated application and turning in the program file and output. For example, assignment #2 is slaved to SAS, you may each 2 pts EC by completing the assignment in SPSS and turning in the program file and output as attachments when you turn in your assignment.
Homework Scoring Guide

All work must be in APA format, including all tables and figures. Failure to comply will result in an automatic deduction of 20%.

Assignment 1 (This assignment is not subject to the APA format rule. You may construct a table within WORD or use a program such as EXCEL)

Your code book should contain the following information:
- variable name
- variable label
- columns
- coding (e.g., gender 1=male, 2=female)
- level of measurement (e.g., gender is nominal)

Your data table must correspond to your code book

To receive full credit I must be able to READ your data according to your codebook without error.

Assignment 2
- Introduction of variables under study and the sample from which they originate (2 pts).
- Your description of the four variables under study should include both sentence (3 pts) and tabular descriptions appropriate for that variable (3 pts).
- Include in your write up graphical presentations of each variable appropriate for the variable type (2 pts).

Assignments 3, 5 - 10
- Statement of the scientific hypothesis with identification of the variables under study (2 pts)
- Statement of the statistical design and sample descriptor (2 pts)
- Statement of the statistical test(s) (1 pt)
- Statement of the results of the statistical test with reference to a table or a chart of summary statistics validity of the statistical assumptions and any associated tests (4 pts)
- Include a conclusion statement that summarizes the findings of the full analysis. (1 pt)

Assignment 4
This assignment is a bit different. You are to write essentially 4 sentences that present a statement of the CI for each variable. These sentences will be worth 5 points. Then, to earn the remaining 5 points, you will need to write a couple of more sentences that discuss why the 90% and 95% CI differ.
### Grading Scale

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<th>Percentage</th>
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<tr>
<td>100-95%</td>
<td>A</td>
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<td>94-90%</td>
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<td>Below 75 %</td>
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### Evaluation Points

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<tr>
<th>Assignment</th>
<th>Weighting</th>
<th>Points</th>
<th>EC: Abstract</th>
<th>EC: Statistical Application in other program SAS or SPSS</th>
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<td>Attendance/Participation</td>
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<td>Homework</td>
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<td>Homework 1 Code Book (SPSS)</td>
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<td>Homework 2 Descriptive Statistics (SAS)</td>
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<td>Homework 3 Chi Square (SPSS)</td>
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<td>Homework 5 1 Sample T-test in (SPSS)</td>
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<td>Homework 6 2 Sample T-test (SAS)</td>
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## Course Schedule

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<thead>
<tr>
<th>Week/Date</th>
<th>Topic</th>
<th>Text</th>
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<tbody>
<tr>
<td>1</td>
<td>Aug 30</td>
<td>Overview, research questions, variables, measurement, and 2 activities in SAS and SPSS</td>
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<tr>
<td>2</td>
<td>Sept 6</td>
<td>Codebook, data entry, descriptive statistics, exploratory data analysis-univariate</td>
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<td>3</td>
<td>Sept 13</td>
<td>Descriptive statistics, exploratory data analysis, 2-way frequency tables (contingency tables)</td>
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<td>4</td>
<td>Sept 20</td>
<td>N-way frequency analysis, graphs and catch-up</td>
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<tr>
<td>5</td>
<td>Sept 27</td>
<td>Sampling, sampling distributions, Confidence Intervals, introduction to power, Z distributions (z scores)</td>
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<tr>
<td>6</td>
<td>Oct 4</td>
<td>One-sample Z and T-tests</td>
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<td>7</td>
<td>Oct 11</td>
<td>Two-sample t-test (power) assumptions, alternatives, non-parametric MID-TERM handed out</td>
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<td>8</td>
<td>Oct 18</td>
<td>Dependent t-test MID-TERM DUE</td>
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<td>9</td>
<td>Oct 25</td>
<td>Correlation analysis</td>
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<td>10</td>
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<td>Fisher Z test, bivariate description</td>
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<td>11</td>
<td>Nov 8</td>
<td>One-variable regression</td>
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<td>12</td>
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<td>Part and partial correlations</td>
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<td>13</td>
<td>Nov 22</td>
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<td>14</td>
<td>Nov 29</td>
<td>Multiple regression and review FINAL EXAM handed out</td>
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| 15       | Dec 6   | FINAL EXAM due to GR regional center by 5:00 PM | }