GENERAL EDUCATION ASSESSMENT AND REVIEW FORM – SYMBOLIC SYSTEMS  
(GROUP III EXEMPTION) 5/15

Please attach/submit additional documents as needed to fully complete each section of the form.

I. COURSE INFORMATION

Department: Educational Leadership
Course Title: Statistical Procedures in Education
Course Number: EDLD 486

Type of Request: New One-time Only Renew * Change Remove

Rationale: Consideration as a symbolic system

*If course has not changed since the last review and is taught by the same tenure-track faculty member, you may skip sections III-V.

JUSTIFICATION FOR COURSE LEVEL

Normally, general education courses will not carry pre-requisites, will carry at least 3 credits, and will be numbered at the 100-200 level. If the course has more than one pre-requisite, carries fewer than three credits, or is upper division (numbered at the 300 level or above), provide rationale for exception(s).

II. ENDORSEMENT / APPROVALS

* Instructor: Daniel Lee

Date 10/2/15 Phone / Email: 243.5204 dan.lee@umontana.edu

Program Chair: JohnMatt

Date 10/2/15

Dean: Roberta Evans
Date 10/2/15

Signature

*Form must be completed by the instructor who will be teaching the course. If the instructor of the course changes before the next review, the new instructor must be provided with a copy of the form prior to teaching the course.

III. DESCRIPTION AND PURPOSE

General Education courses must be introductory and foundational within the offering department or within the General Education Group. They must emphasize breadth, context, and connectedness; and relate course content to students' future lives: See Preamble
IV. CRITERIA

BRIEFLY EXPLAIN HOW THIS COURSE MEETS THE CRITERIA FOR THE GROUP.

1. Course rigorously presents a mapping between a real-world system and a human abstraction of the system.

   The language of statistics transforms quantifiable information into a symbolic system that is used to communicate between people and cultures.

2. Course applies analysis, reasoning and creative thinking in the understanding and manipulation of symbolic codes.

   What does a statistic mean? Real world phenomena are described and, therefore understood, through statistical formulas and outcomes.

3. Course utilizes alternative methods of communication, perception, and expression in order to encourage rigorous thinking.

   At the heart of statistical communication is the formula which requires critical analysis to decode the meaning behind the number.

V. STUDENT LEARNING GOALS

BRIEFLY EXPLAIN HOW THIS COURSE WILL MEET THE APPLICABLE LEARNING GOALS.

Upon completion of this group, students will be able to:

1. demonstrate an understanding of the symbols and the transformations of the system.

   Students must understand the numeric and alphanumeric symbols related to statistics.

2. relay and interpret information in terms of the given symbolic system.

   Students must understand and communicate the outcomes of statistical tests.
3. apply creative thinking using the symbolic system in order to solve problems and communicate ideas.

Students must understand the philosophical underpinning of the language of statistics and probabilistically communicate hypothesis testing.

VI. ASSESSMENT

A. HOW ARE THE LEARNING GOALS ABOVE MEASURED? Describe the measurement(s) used, such as a rubric or specific test questions that directly measure the General Education learning goals. Please attach or provide a web link to the rubric, test questions, or other measurements used.

1. Why might the study of statistics be important? What use will it have for you in your fields of study?
2. How do professionals use statistics to make sense of data?
3. Why do we need statistics to analyze data? Can't we simply see patterns in data tables?
4. What is the difference between descriptive and inferential statistics?
5. Are statistics only useful in the natural sciences?
6. What are some things you can do as students to ensure your success in this course?
7. What do you think is the best way to describe a set of scores in a distribution?
8. There are several different ways of computing the “average” for a set of scores. These are often defined as measures of central tendency. What are the three types of averages that can be used to describe a set of scores?
9. What is the formula for computing the mean?
10. What is the difference between the mean and the median?
11. When would median be a better measure of central tendency?
12. How do you calculate the median? Can there be two medians? What if two medians are noted and they are the same number?
13. How do you calculate the mode of a distribution? What if there happens to be two modes?
14. When might someone prefer mode over mean or median to describe a data set’s central tendency?
15. We know that an average is one way of describing scores in a distribution . . . but it is only half of the story. What else might be important to know in addition to the measure of central tendency?
16. There are several different types of variability discussed in the chapter. What are the three types of variability that can be used to describe spread or dispersion?
17. How might you go about computing the range? What is the difference between an exclusive range and an inclusive range?
18. How would you compute the standard deviation for a given set of scores? Why is the standard deviation considered to be an unbiased estimate?
19. How do you calculate the variance of a set of scores? What do you notice about the formulas for variance and standard deviation?
20. How are the variance and the standard deviation similar to each other? How are they different?
21. Why do you think researchers use charts and figures to illustrate data?
22. What types of charts have you seen presented? What type of data are displayed in these different charts? For example, why might some want to use a bar chart? What about a line chart? How about a pie chart? When do you think these different ways to display data would be used?
23. What does the shape of a distribution (e.g., curve) tell us about the data? What is meant by skewness? What is kurtosis? Can you draw an example of each?
24. What’s the difference between positive and negative skew? Which has a mean greater than its median?
25. How would you explain platykurtic and leptokurtic distributions to a friend not taking this class?
26. If a researcher wants to go beyond the descriptive statistics such as measures of central tendency and variability, he or she might be interested in a more precise measure of the relationship between variables. What type of numerical index might be used?
27. What is a correlation coefficient? Is there just one? What is the range of a correlation coefficient? What does rxy = −.81 mean? Is this a positive or negative relationship?
28. What’s the difference between the coefficient of determination and the coefficient of alienation? If the correlation between two variables is .65, calculate each.
29. How might squaring a correlation coefficient be useful to understanding the relationship between two variables?
30. What is meant by the term continuous variable? What type of correlation coefficient would you calculate if you wanted to examine the relationship between two continuous variables?
31. How would you visually represent a correlation coefficient? How do you interpret the arrangement of the data points?
32. Why is it important to remember “association, not causation” when discussing correlations?
33. What is the purpose of a correlation matrix and why are the diagonal pairs all equal to 1.0?
34. Are there other types of correlation coefficients? What are some examples provided in the text?
35. Why are the measurement concepts of reliability and validity important to the research process? What dangers might there be if researchers did not establish reliability and validity when testing hypotheses?
36. What are the different types of reliability? How are these established? Can reliability be increased? If so, how?
37. How might a researcher establish validity? What are the different types of validity evidence that can be collected? Explain each.
38. What is the relationship between reliability and validity? How can a test be reliable and not valid? What do you think this means?
39. How would a researcher go about ensuring reliability and validity?
40. What is a hypothesis? Why do you think hypotheses are important?
41. What is the difference between a sample and a population? What is sampling error? Do you think there are ways to decrease sampling error?
42. What is the difference between the null and the research hypothesis? What is the importance of assuming the null hypothesis is true?
43. What are the two types of research hypotheses? How are they different? How would you determine which type you are testing?
44. What is meant by “one-tailed” and “two-tailed” tests? Give an example of a research question for each.
45. What are the criteria used to judge the quality of a hypothesis?
46. Practice writing out the null and research hypotheses for a potential research question. What do the symbols used to write the hypotheses represent?
47. How does understanding probability help us understand statistics?
48. What is a normal curve? What are the characteristics associated with a normal curve?
49. The normal curve is divided into sections. What do these sections represent?
50. What percent fall between the mean and one standard deviation above the mean?
51. What percent fall between the mean and –1 to +1 standard deviations from the mean?
52. What percent of scores (if they are normally distributed) will fall between –3 and +3 standard deviations under the normal curve?
53. What is a z score? Why are standard scores important? What do they allow researchers/educators to do?
54. How might you go about computing z scores for a set of raw scores? When might calculating a z score be necessary?
55. What does a z score represent?
56. What is meant by the term significance? How is significance level related to what you learned in previous chapters about probability?
57. If you fail to reject the null hypothesis when it is, in fact, false, what type of error is this called?
58. If you retain the null hypothesis when it is, in fact, true, have you made an error? If so, which one?
59. If you reject the null hypothesis when it is, in fact, true, what type of error have you committed?
60. What are the conventional levels of significance set by most researchers? What do these values mean (i.e., p values of .05 and .01)?
61. What are the steps associated with testing the null hypothesis when using a statistical procedure?
62. What is the critical value in relation to the normal curve? What portion of the normal curve does this include?
63. What is the main use of a one sample Z-Test?
64. Why would a researcher want to compare the mean of a sample to that of the population?
65. What is the purpose of calculating the Standard Error of the Mean?
66. The formula for the Z-test includes X-bar and $. What is the difference between the two?
67. What would a null hypothesis involving X-bar and $ look like? What does it mean?
68. If the result of Z-test reveals that the sample and population are different, what does this tell us about the null hypothesis? What does this suggest about the sample?
69. When would it be appropriate to use a t test for independent samples? What is the key piece of information you must know in order to decide?
70. What is the test statistic associated with a t test?
71. What does homogeneity of variance mean? How can it affect your results?
72. What are degrees of freedom? How are they calculated?
73. If the direction of the difference between two groups is not specified, will you want to use a one-tailed or a two-tailed test?
74. How do you interpret a t value?
75. What are the steps for using the Excel TTEST? Does it provide you with a t value? If not, what information does it provide?
76. What is an effect size estimate? Who is considered the “grand pooh-bah” of effect size estimates?
77. How is the “simplest” of effect size estimates (Cohen’s d) calculated?
77. When would it be appropriate to use a t test of dependent samples? How is this test different from the t test discussed in Chapter 11?
78. What do you notice about the formulas for these two different t tests?
79. What "path" should you follow to know that the t test for dependent samples is the correct test statistic (see Figure 12.1)?
80. What are you testing with a t test for dependent samples?
81. What information do the Excel functions TTEST and TDIST provide you?
82. What if you have more than two groups and you want to see if differences exist among the means of those groups? What is the appropriate statistical analysis?
83. According to Figure 13.1, what are the decision points that tell you ANOVA is the right procedure to use?
84. What is the test statistic associated with ANOVA? How is this test statistic similar to the t value discussed in previous chapters?
85. Can ANOVA be used with related groups or unrelated groups? ANOVAs used with related groups are also known as what?
86. What is meant by single-factor or one-way ANOVA? Can you give an example?
87. What are factorial design ANOVAs? Can you give an example of a 2 x 2 design? What about a 3 x 2 design?
88. What are the FTTEST and FDIST functions used to compute?
89. What type of ANOVA is required when there is more than one independent variable or factor to be examined?
90. What is the difference between a repeated-measures factorial ANOVA and a between-groups factorial ANOVA? When might you use each?
91. What is a main effect? Where are main effects found within the source table? How are they interpreted? Can main effects be plotted? If so, how?
92. What is an interaction effect? Where would interaction effects be found within the source table? How should they be interpreted? Can interaction effects be plotted? If so, how?
93. What are the steps in determining if factorial ANOVA is the appropriate statistical procedure?
94. What are the steps for computing the F statistic for a factorial ANOVA using the Data Analysis Toolpak in Excel?
95. If a researcher wants to examine the relationship among variables and not the difference, what test statistics should he or she use?
96. What do you already know about a correlation coefficient? What does a correlation represent? What is the range for a correlation coefficient (i.e., -1.0 or 1.0)?
97. What is the formula for computing the Pearson product-moment correlation coefficient? (see Formula 5.1 in Chapter 5).
98. What does the PEARSON Excel function calculate? What does a Pearson correlation assume?
99. What are the steps in the computation of a t test to test the significance of a correlation coefficient? What is the null hypothesis? What is the research hypothesis?
100. How do you interpret a p value associated with a correlation coefficient?
101. What is the difference between causation and association? What is a correlation coefficient really proposing?
102. What about significance versus meaningfulness? What should you keep in mind?
103. If a researcher wanted to predict how well a student might do in college, what do you think he or she might examine?
104. How does prediction work in the social and behavioral sciences? What can it be used to examine? What research questions might be addressed using prediction?
105. What statistical method is used for predicting one variable from another? Can you give an example of possible predictor and criterion variables in a study?
106. How does understanding the correlation between variables help us understand regression?
107. Explain the regression formula. What do the symbols within the formula represent? What are the slope and the intercept? What information do they provide?
108. What does the "line of best fit" illustrate? How precise is the regression line? How can we examine the error associated with the regression line? What is this error called?
109. Can more than one predictor variable be used to explain an outcome? What is this called? What are the "big rules" to consider when using more than one predictor?
110. What is the difference between parametric and nonparametric procedures? When might you use a nonparametric test instead of a parametric test?
111. What nonparametric procedure would you use to determine if the number of occurrences across categories is random?
112. What is the difference between the one-sample and the two-sample chi-square?
113. What is the formula for calculating a one-sample chi-square?
114. What nonparametric procedure would you use to compare two independent samples when you have violated the assumptions associated with a t test?
115. If you wanted to examine the correlation between rank in high school and rank in college, which procedure would you use?
116. What is multivariate analysis of variance? How is it different from analysis of variance?
117. What is repeated measures analysis of variance? When might it be used?
118. What is ANCOVA? When might you want to use this procedure? What does it help a researcher to do?
119. What is the difference between multiple regression and simple linear regression?
120. What is factor analysis? What does it allow a researcher to do?
121. How is factor analysis similar to structural equation modeling? How are they different (i.e., exploratory analysis vs. confirmatory analysis)?
122. What is path analysis? Do you think this procedure might be similar to regression? If so, in what ways?

A General Education Assessment Report will be due on a four-year rotating cycle. You will be notified in advance of the due date. This will serve to fulfill the University’s accreditation requirements to assess general education and will provide an opportunity to connect with your colleagues across campus and share teaching strategies. Items VI.B- D will be helpful in compiling the report.

B. ACHIEVEMENT TARGETS
[This section is optional. Achievement targets can be reported if they have been established.]
Describe the desirable level of performance for your students, and the percentage of students you expected to achieve this:

C. ASSESSMENT FINDINGS
[This section is optional. Assessment findings can be reported if they are available.]
What were the results/findings, and what is your interpretation/analysis of the data? (Please be detailed, using specific numbers/percentages when possible. Qualitative discussion of themes provided in student feedback can also be reported. Do NOT use course grades or overall scores on a test/essay. The most useful data indicates where students’ performance was stronger and where it was weaker. Feel free to attach charts/tables if desired.)
D. ASSESSMENT FEEDBACK

[This section is optional. Assessment feedback can be reported if it is available.]

Given your students' performance the last time the course was offered, how will you modify the course to enhance learning? You can also address how the course could be improved, and what changes in the course content or pedagogy you plan to make, based upon on the findings. Please include a timeframe for the changes.
Please submit syllabus in a separate file with the completed and signed form to the Faculty Senate Office, UH 221. The learning goals for the Symbolic Systems Group must be included on the syllabus. An electronic copy of the original signed form is acceptable.
The University of Montana
Phyllis J. Washington College of Education and Human Sciences
Department of Educational Leadership

EDLD 486 & EDU 421
Statistical Procedures in Education
Autumn 2015

Professor Information:

Professor: Daniel Lee, Ed.D.
Telephone: (406) 243.5204
Email: dan.lee@umontana.edu
Rm. 208 PJWCEHS
Office hours by appointment

Class Meets:

Thursdays in Rm 112 of the Phyllis J. Washington College of Education and Human Sciences Building.

- EDLD 486-01B and EDU 421-01A meets from 2:10 to 4:30 PM
- EDLD 486-02B and EDU 421-02A meets from 4:40 to 7:00 PM

Textbooks:


Purpose of the Course:

This course is designed for both undergraduate and graduate students seeking an introduction to statistical concepts and basic data analysis procedures. The text for this class provides students with real-life scenarios using Excel as the basic data analysis tool for furthering students’ understanding of the concepts presented. In addition, special emphasis will be given to the development of analytical thinking that is crucial enabling students to better comprehend the research literature they will encounter in their fields of study.

Course Objectives:

Students will demonstrate understanding of...

- Basic concepts associated with descriptive statistics
- Hypothesis testing and the relationship to the normal curve
- Measurement concepts and how they apply to statistics
- Importance and use of inferential statistical procedures
- Effective/application of statistical software package
- Nonparametric procedures
- Guidelines for data collection
Expectations:

In order to gain maximum benefits from this course students should:

1) Participate fully in class by...
   - reading assigned material prior to class sessions
   - attending class regularly
   - contributing meaningfully to class discussions

2) Take responsibility for your own learning by...
   - relating course content and projects to your own professional interests
   - monitoring your own understanding
   - seeking clarification and assistance when necessary

3) Demonstrate respect and consideration for others by...
   - listening when others are speaking
   - being present for the entire class period

Attendance:

Attendance is important for success and will be taken at the beginning of each class. Students who are on time and in attendance for the entire class, will be awarded one point that will be treated as extra credit on the final exam. So, for example, a student attending all classes with a final examination grade of 75% would receive a recorded score of 88%. (Students with an excused absence, arriving late or leaving early will not receive this credit.)

Course Requirements:

- **In-Class Exercises:** Most of these exercises will be completed in small groups, with every member of the group contributing. Often, these will be graded, not on the "correctness" of the answer, but on how the group demonstrates the analytical thinking and problem-solving skills required of a competent researcher. These in-class activities may involve the use of a computer lab. There will be approximately ten of these in-class exercises counting for approximately 10% of the final grade.

- **Research Article Analysis:** Students will analyze a research article of their choice that is related to their particular discipline or research interests. Students will complete a written evaluation report using APA format and a set of guidelines to be distributed later in the semester by the professor. The analysis will be worth 100 points, accounting for 20% of the final grade.

- **Homework:** There will be approximately four homework assignments during the course of the semester. These assignments will require students to apply their understanding of the concepts presented in class. Each homework assignment will be worth 25. The homework will count for approximately 20% of the final grade.
- **Online Quizzes:** There will be ten quizzes due weekly throughout the course consisting of multiple choice, matching, short answer, and/or essay type questions that will require students to apply the knowledge they’ve learned through their involvement in the course. Each quiz will be worth 25 points. Quizzes will be found on the course’s Moodle shell. Students will have two attempts and only the highest grade will be recorded. Quizzes will count for approximately 30% of the final grade.

- **Examinations:** There will be two preliminary exams (100 points each) and a final exam (100 points) worth 300 points to count for approximately 20% of the final grade. Many questions on these exams will be drawn from items found in the online quizzes.

**Grades:**

Grades will be determined by adding up the total points earned and dividing by the total points possible in the course. Please refer to the following:

In-Class Exercises: 10 exercises X five points each = 50 points (10%)
Research Article Analysis: 100 points (20%)
Homework: four homework assignments X 25 points = 100 points (20%)
Quizzes: 10 quizzes X 25 points = 250 points (30%)
Examinations: two preliminary and one final exam = 300 points (20%)
Total Points Possible: 800 points (100%)

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**Make-ups and Late Work:**

Make-ups will be given only in emergency situations. If you must miss an assignment or quiz, make arrangements with me **prior to the due date**.

**Technical Notes:**

All assignments should be submitted using MS WORD or EXCEL. I maintain a Moodle course shell that contains messages, quizzes, readings, video resources and background notes. Please check the course shell regularly. If you haven’t already, avail yourself to online **Moodle training**.
fully appreciate the power of Moodle course management software. The University of Montana provides Microsoft Office 365 ProPlus for free to UM students. Students may install the full suite of software on up to five computers – PC or Mac – and five mobile devices – Apple iOS, Android and Windows Mobile. For more information visit UM’s IT software support site. Need a place to store your work and get easy access at a variety of locations? Use UM Box, a cloud storage site with unlimited capacity.

Classroom Comportment:
The computer lab in Room 112 is crowded and the class is expected to be quite full. Please be considerate of your classmates. Do not engage in extraneous talking or other distracting behaviors during class. Use of cell phones, laptops, and other electronic devices for purposes other than class participation is distracting and inconsiderate.

Code of Conduct:
Students are expected to be respectful of one another and abide by the University’s student code of conduct. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. Familiarize yourself with the Student Conduct Code.

Communication:
Please note that I will use only your official UM email to communicate with students as required by federal law. Email is the preferred way to contact me - voicemail will take longer to reach me. It is your responsibility to make sure you read messages sent to your UM email address in a timely manner.

Accommodations:
The University of Montana assures equal access to instruction through collaboration between students with disabilities, professors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommason Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.
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<td>Introduction to Statistics and Excel</td>
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<td>Dec. 17</td>
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