MSSE 591 Capstone Data Analysis

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Course Description:
This course is designed to provide graduate students in science education with a background in basic descriptive and inferential statistics. By the end of the course, students will be able to choose the most appropriate method to both describe their data and display that data in a clear and concise manner. Students will be able to perform hypothesis tests using a variety of parametric and non-parametric methods with an understanding of the assumptions and limitations of each method as applied to the analysis of capstone data. Students will be able to perform one-way analysis of variance tests in addition to chi-square tests for categorical data. Through the examination of the appropriate use of each of these statistical tools, students will be able to better design their capstone projects so as to maximize the likelihood of addressing their research topics.

Learning Outcomes:
Students will be able to:
- Describe how statistics relates to the fields of math and science
- Describe the 4 common measurement scales
- Describe the 4 classes of variables
- Describe, calculate and use the measures of central tendency and spread
- Describe the distributions of data using measures of central tendency and spread
- Describe the 'normal distribution'
- Understand the relationship between percentile ranks, standard scores and the normal distribution
- Understand what a sampling distribution is
- Use a sampling distribution to make inferences about a mean and means
- Use a sampling distribution to make inferences about a proportion and proportions
- Articulate the difference between the t-distribution and the normal distribution, including heuristic understanding of degrees of freedom
- Use the t-distribution for one-sample tests and paired data tests
- Use the t-distribution for two-sample tests and the problem of pooled variance
- Use the Mann Whitney (Wilcoxon rank-sum) test as an alternative to the two-sample t-test
- Use the Wilcoxon signed-rank test as an alternative to the paired data t-test
- Define and use the randomization/permutation test for data
- Correctly identify the appropriate test when presented with data
- Articulate the appropriate use of Chi-Square Tests for MSSE Capstone Data Analysis
- Define and use both a Chi-Square Goodness of Fit Test and a Chi-Square Independence Test

Course goals:
There are two primary course goals: 1) to increase student statistical literacy as they explore techniques for the analysis of the data generated by capstone projects, and, 2) use learned literacy to recognize the principles of sound experimental design.
Course Delivery:
The course will be asynchronously hosted on D2L (Brightspace). Video lectures will be posted each week; these are short video casts on single topics addressed in our homework. Instructor will post links to supplemental resources as well.

It is tremendously helpful in statistics to hear topics addressed from different perspectives. All homework, readings and project sets will be posted at the start of the course along with due dates and grading rubrics.

To aid in collaboration, students will all join in an active discussion of each week’s work in a digital discussion group.

Assignments:
1) Article Summaries: Each week, students will explore a primary source relevant to the application of statistics to the field of education research. A short one-page article summary is due every Sunday.

2) Homework Problems will be assigned from the end of each chapter with occasional supplemental problems focused on education research. Homework is due every Sunday.

3) Projects: During six weeks, students will be given three data sets on which they will conduct a statistical analysis and write a short statistical summary for each.

4) Discussion: Discussion groups are intended to clarify students’ understanding through collaboration with other people. The focus of discussions will always be supporting students understanding and, as such, is a participation grade. Each homework will have a few reflection questions that will encourage students to think critically about how they can increase statistical literacy in the classroom in addition to assisting students in their own research.

5) Collaboration: Students are encouraged to work with one another at all stages of the course. Though each student will submit their own work to the instructor, students will be encouraged to collaborate with each other.

Grading:
Article Summaries: 6 summaries - 25 points each
Homework: 6 assignments - 50 points each
Projects: 3 projects - 100 points each
Discussions: 6 weeks - 25 points each