

Syracuse University

School of Education

EDU 647: Statistical Thinking & Applications

Fall 2019 Wednesday 4-7 p.m.

Huntington Hall 070B

Instructor:

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Office Hours: **Wednesday, 1-3pm** or by appointment

Teaching Associate:

TBD

I. Course Description

The purpose of this course is to facilitate SOE graduate students' understanding of basic statistical concepts and operations in the quantitative research tradition. A number of foundational issues will be addressed, including science and causality; constructs, variables, and research questions; measurement concepts; research design and research validity; descriptive statistics; and inferential statistics. We will use an integrated approach to understanding the interrelationships of theory, research design, measurement, and statistics in the context of planning, accomplishing, and evaluating quantitative research articles.

II. Course Objectives

At the conclusion of the semester, students will (hopefully):

- Understand the role of research design in establishing a warrant for causality.
- Understand basic measurement concepts, including reliability and validity of assessment instruments, and their relationship to research validity and statistical outcomes.
- Understand the role of theory in the development of research questions and design strategies.
- Have a working knowledge of basic research (e.g., latent variables, operational definitions) and statistical concepts (e.g., variance, effect size) that are central to quantitative research methods.
- Have a working knowledge of descriptive statistics, including measures of central tendency, variability, and relationship.
- Have a working knowledge of inferential statistical concepts including probability and statistical significance testing, and understand their role in social science.
- Have a working knowledge of the various basic statistical strategies that are used to analyze data and when to use each type, including t-tests, analysis of variance, chi-square, correlation, and multiple regression.
- Be able to accurately interpret statistical tables found in research articles.

- Have a working knowledge of various experimental and non-experimental research designs, and their strengths and limitations in regard to research validity.
- Evaluate published research that makes use of basic statistical approaches in your area of scholarship.

III. Accommodations and Policies

Special Needs

If you believe that you need accommodations for a disability, please contact the Office of Disability Services (ODS), <http://disabilityservices.syr.edu>, located at 804 University Avenue, room 309, or call 315-443-4498 for an appointment to discuss your needs and the process for requesting accommodations. ODS is responsible for coordinating disability-related accommodations and will issue “Accommodation Authorization Letters” to students with documented disabilities as appropriate. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

Our community values diversity and seeks to promote meaningful access to educational opportunities for all students. Syracuse University and I are committed to your success and to supporting Section 504 of the Rehabilitation Act of 1973 as amended and the Americans with Disabilities Act (1990). This means that in general no individual who is otherwise qualified shall be excluded from participation in, be denied benefits of, or be subjected to discrimination under any program or activity, solely by reason of having a disability.

You are also welcome to contact me privately to discuss your academic needs although I cannot arrange for disability-related accommodations.

Academic Integrity

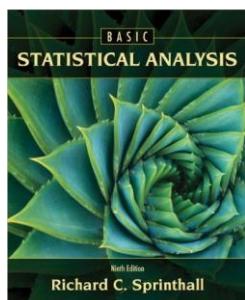
Syracuse University’s academic integrity policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The university policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same written work in more than one class without receiving written authorization in advance from both instructors. **The presumptive penalty for a first instance of academic dishonesty by an undergraduate student is course failure, accompanied by a transcript notation indicating that the failure resulted from a violation of academic integrity policy. The presumptive penalty for a first instance of academic dishonesty by a graduate student is suspension or**

expulsion. SU students are required to read an online summary of the university's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice. For more information and the complete policy, see <http://academicintegrity.syr.edu>.

Religious Observances policy

SU's religious observances policy recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any quiz, examination, critique, or work requirements that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice/Student Services/Enrollment/My Religious Observances from the first day of class until the end of the second week of class (http://supolicies.syr.edu/emp_ben/religious_observance.htm).

IV. Required Texts



1. Sprinthall, R.C. (2011). *Basic statistical analysis* (9th edition). Boston: Allyn & Bacon. (It will be referred to in Topical Outline as **BSA**)

2. We will also use a small number of supplementary readings. These readings will be available through Electronic Reserve on the class Blackboard site.

V. Course Requirements & Evaluation

Please bring a basic calculator to each class! Laptop computers are welcome as long as you refrain from web surfing unrelated to class content!

Evaluation of students' work is based on a standard point system. A total of **500** points is possible and alphabetic grades are assigned according to the following numeric intervals:

A = 94% - and above	B = 83% - 87%	C = 73%-76%
A- = 91% - 93%	B- = 80% - 82%	C- = 70%-72%
B+ = 88% - 90%	C+ = 77% - 79%	F = 69% and below

Participation	25 points
Homework Four	75 points
Quiz 1 – September 25th (Week 5):	50 points
Article Critique 1– October 16th (Week 8):	25 points

Quiz 2 – October 30th (Week 10):	50 points
Article Critique 2 – November 20th (Week 13):	75 points
Final Exam (take home) – December 11th:	100 points

Class participation will include occasional homework assignments and consistent attendance and contribution in class. Homework assignments will include the task of finding and bringing contemporary articles in your area of study to class for group discussion. The quiz format will be multiple choice, T/F, & short answer. Class handouts (also to be posted on Blackboard) will provide additional information on the article critique assignments. The final exam is take home and you have two weeks to work on it.

VI. Topical Outline

August 28th – Week 1

Class overview: Readings, assignments, due dates, etc. Science and knowledge claims; science and causality; role of statistics in research; approach to research conceptualization that integrates design, measurement, and statistical analysis. Anatomy of a research article.

Readings: None

Homework #1 Rbase and Rstudio installation

September 4th – Week 2

Introduction to descriptive statistics: levels of measurement & measures of central tendency. Basic research concepts: constructs and indicators, variables and research questions.

Readings:

BSA(9th ed.) Chapter 1 & 2

September 11th – Week 3

Descriptive statistics: variability, the normal curve, & standard scores (z-scores & T-scores). Measures of variability: range, variance, standard deviation. Non-normal variable distributions: skewness.

Readings:

BSA Chapter 3, 4, & 5

Homework #2 Descriptive Statistics Using R

September 18th – Week 4

On measurement: test reliability and test validity, standard error of measurement, implications of measurement for statistical analysis. Prep for Quiz 1.

Readings:

BSA Chapter 17

September 25th – Week 5

After Quiz 1: Introduction to key concepts in inferential statistics: hypothesis testing, generalizing from sample to population, probability and probability distributions.

Readings:

BSA Chapter 6

*** **Quiz 1** ***

October 2nd – Week 6

Inferential statistics continued. Parameter estimates & hypothesis testing; standard error; alpha, beta, type I and type II errors; confidence intervals; power, effect size measures.

Readings:

BSA Chapters 7 & 8

October 9th – Week 7

Fundamentals of quantitative research methodology: experimental design & research validity. Internal & external validity.

Readings:

BSA Chapter 9

Campbell and Stanly (1989) – on blackboard.

October 16th – Week 8

Research validity continued: statistical conclusion validity and construct validity of research operations.

Readings:

Review BSA Chapter 9 and Campbell and Stanly (1989).

*** **1st Article Critique due** ***

October 23rd -- Week 9

The hypothesis of difference: t-distributions and t-tests, variance partitioning in t-tests, effect size measures in t-tests, types of research questions that are appropriate for t-tests.

Readings:

BSA Chapter 10

Homework #3 t-test using R

October 30th – Week 10 [Teaching Associate]

After Quiz 2: Understanding correlation as an inferential statistic, effect size measures in correlation, reading a correlation matrix table, types of research questions that are appropriate for using correlation analysis.

Readings:

BSA Chapter 11

Quiz 2

November 6th – Week 11

Analysis of variance (ANOVA): variance partitioning in ANOVA; simple, two-way, and repeated measures ANOVA, interaction in ANOVA, interpreting and graphing the interaction, effect size measures in ANOVA, types of research questions that are appropriate for use of ANOVA.

Readings:

BSA Chapter 12

Homework #3 T-test and ANOVA using R**November 13th – Week 12**

Non-parametric statistics: chi-square, logistic regression. Types of research questions appropriate for use of chi-square and logistic regression.

Readings:

BSA Chapter 13

Homework #4 Chi-square using R**November 20th – Week 13**

Multiple regression analysis: variance partitioning in multiple regression, regression equations, partial correlation and regression coefficients, flexibility of multiple regression (coding nominal variables), reading regression tables, types of research questions that are appropriate for use of multiple regression.

Readings:

BSA Chapter 14

2nd Article Critique due

November 27th – Week 14

*** No Class & Enjoy Thanksgiving Holiday! ***

December 4th – Week 15 (Final Class)

Choosing the correct statistical test: Integration of theory, measurement, design, and statistics to strengthen the knowledge warrant of research.

Readings: BSA Chapter 19**December 11th –Final Examination Day**

Final Take-Home Exam due
