Course Title: **Quantitative Data Analysis**

Semester: Summer 2012

Credits: 3

**Catalog Description**

Quantitative data analyses require the use of statistics (descriptive and inferential) to summarize data collected, to make comparisons of data sets, and to generalize results obtained from samples back to the populations from which the sample were drawn. Knowledge about statistics and statistical analysis can help a researcher interpret data for the purpose of providing meaningful insights about the problem being investigated. Prerequisite: DPLS 720. 3 credits

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**Class Logistics**

Meeting place: Tilford 117

Meeting Dates: June 21, 28 July 5, 12, **19, 20**, 26

**Course Overview**

This course will explore the landscape of statistics, statistical thinking, and the analysis of phenomena using statistical method(s). We will begin the course with a very brief theoretical, conceptual, and discursive look at post-positivist epistemology and quantitative methodology. This beginning part of the conversation will also contrast quantitative methodology with qualitative methodology and explore the ‘scientific method’ and the development and use of research hypotheses. You will note that there is a considerable amount of reading for the first few classes. I recommend that you get an early start and begin to study these chapters well before the first meeting.

The emphasis in this course will be on statistics and selected methods of using statistics to make inferences and judgments about phenomena. Resources will be available on Blackboard. Class time, group work, and instructor led conversation will focus on the meaning and understanding of key concepts with the expectation that students will work on practice sets and reading on their own. Specific practice or application of those concepts (methods) will be carried out in group and individual projects.

The focus on this course is on understanding.

The mathematical and logical foundations of statistical concepts will be explored in a concrete and elementary way. It is hoped that this basic understanding will support the ability of students to make sense of statistics in both theoretical and practical terms.

The purpose of this course is to prepare doctoral students and candidates for the task of creating good solid research based on a quantitative methodology and becoming informed consumers of quantitative research.
The goals & objectives of this course are to:

- Understand and apply appropriate post-positivist\(^1\) and mixed methods research methodologies.
- Relate, understand, and apply post-positivist methodology to research questions relevant to leadership studies.
- Demonstrate a solid understanding of basic statistics through reading, talking, and writing about core statistical concepts.
- Formulate research questions and corresponding statistical hypotheses that can enhance understanding of a given phenomena.
- Create or use existing databases to seek answers to research questions or to test hypotheses.
- Select appropriate statistical techniques (methods) for a given question or hypothesis statement.
- Apply statistical procedures to test hypotheses using appropriate statistical application(s).
- Correctly interpret statistical application output.
- Communicate findings verbally and in written format.
- Intelligently interpret a variety of quantitative discourse in research articles.

**A note on the question of intelligence, capacity, skill & reading the texts:** Math and statistics remain a difficult topic for many in our society to understand, become comfortable with, and regularly use as part of their critical thinking. I think that this is going to fundamentally change as the information revolution continues to ‘outsource’ or ‘off-load’ many of the cognitive elements of what we have historically understood as intelligence and mental or cognitive capacity. The particular types of intelligence associated with short term memory, symbolic pattern recognition, and speed of processing information are all being consistently augmented by technology. Certainly the postmodern and poststructural critique of power, oppression, and control is related to this conversation. The short version of my thinking around this indicates that in general the information revolution is freeing humanity up to express in a legitimate and dignified way the full range of human intelligence and creativity and at the same time share more widely the positive aspects of propositional and logical thought.

Math and statistics are rigorous, detailed, and deep domains of thought. Some people are absolutely brilliant, gifted, and fit for this type of mathematical and complex logical thought. Most of us can, with hard work, diligent practice, and discipline master the rudiments of the field and become competent statisticians or mathematicians. Some of us, however, (and in my view because of inadequate teaching) continue to struggle with basic mathematical and statistical concepts and never develop the skill or confidence to make sense of the field or ask intelligent questions about it. We ‘freeze up’.

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\(^1\) Post positivism is understood here to reflect the recognition by researchers with a commitment to scientific naturalism that language and consciousness are nonetheless implicated in the interpretation and realization of the structure of reality.
It is also the case (again, in my view) that some of the people that totally freeze up in math or work diligently to understand it flourish in other domains. Many other domains. It is a fact that so called ‘scientific thinking’ (led by math and physics but followed by the natural sciences) has the most legitimacy in the academy. This legitimacy is tied historically to gendered (male) interests, economic interests, power, and technical innovation. It is highly abstract even in its corporeal manifestation (e.g., an i-pad). But this is only part of the picture of human consciousness and intelligence. My hero, GH Mead wrote and spoke about reflective human consciousness in general as being ‘scientific thinking’ and that the goal of democratic society was to foster and facilitate this skill in every person.

What this means for this course and for using statistics in research in leadership studies is that we are able to understand more and more and to consider the application of very complex ideas and concepts in ways that were very difficult for most people just a few years ago.

But this competence requires a rethinking of how we approach the task of ‘coming to know’ something. It is my view that spending hours and hours to study, practice, and memorize abstract and highly complicated chains of algorithmic reasoning with no clear context for application is not generally productive. Certainly not in the context of the DPLS. So this course will not be done in quite that manner. It will be a highly interactive and collaborative discussion of core concepts and ideas and their relationship to the literature in leadership studies and the social sciences. However we will do problems and practice selected techniques. Those will become clear as the course progresses. What is absolutely vital for us, however, is that we read the texts and do the problems.

**Reading Math/Statistics**

It is my view that reading is no simple skill. Reading competence is relative to the genre being read. I read some things fluently and immersively. Other genres are fundamentally challenging to me. The only way that I can learn to read foreign genres is through reading and talking about the reading with others. But I have to read. This is nowhere more crucial than in math/statistics. You must read the texts painstakingly! You must make reading notes and question each paragraph, diagram, and list of numbers/equations. You must talk about your understanding and provoke yourself and others to great clarity and depth of meaning. When you do the problems expect that your will have to go back over the text and the examples to continually compare and check your understanding with the text. We will talk about this and about my suggestions for reading at our first meeting.

**Grading:**

The grading emphasizes your individual learning achievement in this course.

- Complete all assignments correctly, participate in class actively: = A
- Complete all assignments, participate in class passively = A-
- Complete all assignments, minimal class participation = B

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2 See the literature on intelligence in general and multiple intelligence in particular. There is a highly contested debate in academia about this subject and it is a fascinating look into paradigmatic assumptions. Gardner’s classic book is a good place to start: Gardner, H. (2011). Frames of mind. (3rd edition). Basic Books. NY
Assignments & Tasks

• Please see Blackboard for Course Assignments – these should all be posted by June 1, 2012.

• The Course Project will require that each individual imagine, design, test, and write up a mock study using real or imagined data to complete a quantitative research project. See Blackboard for specifics - Assignments > Course Projects - 30% of grade.

• Course Participation: Participants will be expected to attend all sessions. If you miss a meeting please inform me via email or phone prior to the missed meeting. Missing more than two meetings will result in an incomplete and require either taking the course again or auditing it at some future time. Participation > 10% of grade.

• Problem Sets – These assignments must be completed autonomously but can be reviewed and revised in the in-class workgroups. See Blackboard > Assignments > Problem Sets for specifics - 60% of grade.

• Readings and reading based assignments – In this course we will use two text based sources – see below, with suggested readings outlined in the course plan below. It is expected that all students will complete all the reading assignments prior to each class meeting. These readings will form the basis for assignments, class discussions, and exploration of the concepts. The Learning from Data text is meant to be both a resource and a primary source of clarification for basic statistical concepts. Selected concepts will be more thoroughly explored in class (e.g., standard deviation, error, variables, probability, p values, t-tests, etc.

Technology Note:
For this course we will be using the Microsoft Excel 2007 (or later) Data Analysis add-in or the Mac Excel 2004 Data Analysis add-in. (note: newer versions of Excel on Mac do not include the Data Analysis add-in). **It is your responsibility to acquire the appropriate add-in and have it loaded and fully functioning on a laptop computer at our first meeting.** I will be using and referring to Excel 2007 throughout the course. Also note that our work with Excel will be in conjunction with Beverly Dretzke’s book referenced below.

If you do not have access to a PC/Microsoft/Excel 2007 or later laptop computer or are a Mac user and are unable to acquire the appropriate add-in please let me know prior to the beginning of the class. We will have access to School laptops and those will be available at each meeting.

Required Readings


Other readings and web resources will be required and posted on Blackboard or handed out in class.
Course Schedule

Pre-course-Reading & Pre-course-Work: Read and complete Dretzke Chapters 1-5 (see Problem Sets on Blackboard for both Dretzke & LFD Assignments). Read Learning from data (LFD) Chapters 1 - 4 and do problems.

Session Outline (all Chapter designations refer to Learning From Data):
Class Meetings will roughly conform to the following schedule:

- Opening Discussion
- Lecture
- Work Groups
- Group Discussion

1st Meeting – Why Statistics? Discussion of Chapters 1-4. This class is devoted to an overview of basic statistics ideas. You are encouraged to read the chapters thoroughly and consult other statistics resources to make sure you are ready for this conversation. You will be expected to operate Excel as per the Dretzke tutorials in Chapters 1 - 5. We will go over the Dretzke material in class – particularly the pivot tables to make sure we are all on the same page. You will also be expected to take data from the LFD text and create frequency distributions, extract and familiarize yourself with measures of central tendency and variability, and use standard scores and the standard normal distribution. Your first Dretzke and LFD assignments are due on or before our first class. Please email me homework assignments.

If you feel that you are in over your head right off the bat I encourage you to contact me and refer to ancillary resources to help develop the basic core skills for doing statistics. An excellent resource that I will use throughout the course is the Kahn Academy at http://www.khanacademy.org/

2nd Meeting – Introduction to Inferential Statistics. Discussion of Chapters 5-7.

This class is an overview of statistical inference, probability, and sampling distributions. The material in this class is foundational for the rest of the course and will be referred to repeatedly. We will pay particular attention to the logic of the sampling distribution as it is at the heart of inferential statistics. You are encouraged to read and re-read these chapters as they will become the support for your understanding in the rest of the course. We will spend ample time discussing questions and confusion that results from these topics. Please review Chapters 1 – 4 as well. All LFD and Dretzke problems are due on or before class.

3rd Meeting – Sampling Distributions & Hypothesis Testing. Discussion of Chapters 7 - 10
We will continue to discuss sampling distributions but also talk about hypothesis testing, power and parameter estimation. These topics will be integrated with our previous discussion of frequency distributions, sampling theory, and the standard normal curve.

In this class we will use the z statistic to test hypotheses about binomial phenomena and then move into the use of the t statistic to infer from a population when none of the population parameters are known. This will require a revisiting of the sampling distribution and a solid understanding of the standard error. We will also discuss the comparison of two independent samples representing two populations.

5th Meeting – Applications of Inferential Statistics. Discussion of Chapters 14 -16.
Topics for discussion in this class are random sampling, random assignment and causality. We will also discuss dependent samples and the F statistic.

6th Meeting – Comparing Means (ANOVA). Discussion of Chapters 17-19.
The topic of this class will be ANOVA and an introduction to factorial designs.

Our final meeting will be devoted to regression, correlation, and non-parametric analysis using the Chi Square statistic.

All completed problem sets and course projects are due August 3rd.