Psychology 612
Advanced Statistical and Research Methods for Psychology II
SPRING 2010

Instructor:	Patrick E. McKnight, Ph.D.
Office:	David King 2064/2065
Office Hours:	Wed 11:10am-1:10pm and by appointment
Phone:	(703) 993-8292
E-mail:	pmcknigh@gmu.edu
Class Location:	SciTechII 15
Class Date/Time:	Tues & Thurs 9:00am-10:15am
Class website:	http://mres.gmu.edu/PSYC612/
TA:	Kristen Jones
TA email:	kjonesz@gmu.edu
TA Office:	Robinson B215
TA Office Hours:	Tues 2pm-3pm

Course Overview

Psychology 612 is the second course of a two-course sequence that serves to introduce psychology graduate students to statistics, research methodology, research design, and measurement. Traditional graduate psychology statistics courses emphasize statistical techniques as a matter of declarative knowledge. Students are expected to know each procedure and its "appropriate" application. An alternative approach tends toward technical discourse (e.g., matrix algebra, formula memorization, and hand calculations) and requires greater attention to minute detail and mathematical vernacular. A less used but equally suitable approach treats statistics as a method of principled argument. The method I use for this course is a hybrid of the three approaches. You will be expected to know the statistical terminology, apply your knowledge in a both carrying out the procedures as well as interpreting the results, and then you will be expected to use the results in a manner consistent with scientific discourse.

Course Objectives

The purpose of this course is to further your *introduction* to data analysis, research design, and measurement. Your course work to date ought to have prepared you well by covering measures of central tendency, measures of dispersion, measures of association, and measures of difference. Due to time constraints, I do not intend to review these terms or their purposes so I urge every student to review that material **prior** to this course. What I do intend to cover is a comprehensive view of univariate, bivariate and multivariate statistics - why we use statistics, why you should learn these tools, and what are the most important features to learn and understand. You will gain practical skills in interpreting, applying and explaining statistical procedures. The combination of an interactive lecture and a weekly laboratory will offer each student the opportunity to see the procedures, conduct the procedures yourselves, and then teach one another what you learned. This approach is the common medical model of education - see one, do one, and teach one - that results in better retention and deeper understanding.

Course Pre-requisites

Students are required to earn a "B" or better in PSYC 611 (or equivalent) to enroll in PSYC 612. Additionally, students ought to understand the following concepts and terms: measures of central tendency (e.g., mean, median, mode), measures of dispersion (e.g., variance, standard deviation, range), tests of difference (e.g., t-tests, ANOVA), measures of association (e.g., correlation, covariance), tests of association (e.g., multiple regression, chi-square), and research design. Students who recognize that they are not prepared to take the course will be **strongly** encouraged to take a more introductory course.

Required Textbooks

☐ Field, A. (2005). *Discovering Statistics Using SPSS.* Newbury Park, CA: Sage. (ISBN: 978-0761944522)

☐ Dunteman, G.H. and Lewis-Beck, M.S. (1989). *Principal component analysis.* (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-069). Newbury Park, CA: Sage. (ISBN: 9780803931046)

☐ Kim, J. and Mueller, C.W. (1978). *Introduction to factor analysis: What it is and how to do it.* (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-013). Newbury Park, CA: Sage. (ISBN: 0-8039-1165-3)

☐ Iacobucci, D. (2008). *Mediation Analysis.* (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-156). Newbury Park, CA: Sage. (ISBN: 9781412925693)

☐ Klockars, A.J. and Sax, G. (1986). *Multiple comparisons.* (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-061). Newbury Park, CA: Sage. (ISBN: 9780803920514)

Optional Textbooks

Students who struggle with general writing or basic understanding of statistical terminology may benefit from Zinsser's book "On writing well" and Gonick and Smith's humorous "The cartoon guide to statistics", respectively. I recommend both books to all students since we all struggle with writing and basic concepts. These books present both topics in very easily digestible formats.

☐ Zinsser, W. (2006). On writing well, 30th Anniversary Edition: The classic guide to writing nonfiction. Colllins: New York.

☐ Gonick, L and Smith, W. (1994). The cartoon guide to statistics. HarperCollins: New York.

Students who are interested in more than just the general "nuts and bolts" of the standard statistical procedures ought to consult the following books. Many of the points I make in class come from these books but it is always best to read them from a more original source.

☐ Abelson, R.P. (1995). Statistics as principled argument. Lawrence Erlbaum Associates, Hillsdale, NJ. (ISBN: 0-8058-0528-1).

☐ van Belle, G. (2002). Statistical rules of thumb. Wiley-Interscience: New York. (ISBN: 0-4714-0227-3)

Additional Reading

At times I will post additional readings that are optional (and free) for all students. Many of these readings provide excellent examples of the topics we discuss in class. Please see the course website for links to the electronic versions of these readings.

Grading Criteria

Grades will be determined by each student's observed performance on four statistics modules. Each student must perform the statistical procedures in the presence of the TA or the instructor and demonstrate proficiency. There will be a 15 minute time limit on the performance; speed and fluency of your performance will be indicative of your proficiency. Students may complete a module (i.e., demonstrate proficiency) at any time after the last module lecture but no later than 3 weeks following that lecture. Each student may retake **one and only one** module after failure. Due to limited resources, we must limit the number of retakes to one and the retake must be completed within the time frame specified above. Special consideration to individual cases may be provided but do not expect more than two retakes or more than a week grace period. Performance on the modules will be graded on ternary scale (3-levels) where level 0 represents a failure to complete the module, level 1 represents a passing grade for the module, and level 2 represents a passing grade with the optional reading **well-integrated** into your responses. We will not prompt you to integrate the reading. Instead, you must come prepared to discuss how the reading pertains to the task you perform. Please note the following plea: there are approximately 35 students in my section (PSYC 612 - 001) and four modules for each of you to complete. If you each require 15 minutes per module and nobody needs to retake a module my TA and I need to devote 17.5 hours each. Spread out over the semester, the time committment can easily be accomplished during our office hours - if and only if (iff) everyone works with us by 1) preparing in advance for the module, 2) scheduling your module completion early, and 3) helping us by being flexible with your schedule. I prefer to use these modular presentations of ability rather than multiple choice tests because I find the latter force you to memorize but not learn how to preform under realistic situations.

Modules

The following four modules and their associated performance criteria constitute the curriculum and primary grading criteria for PSYC 612. The modules must be completed on an individal basis in the presence of either the TA or the course instructor. You may choose to complete any of the modules at any time within the window of opportunity noted above subject to TA or instructor availability. There will be more details provided about these modules and how to demonstrate your proficiency throughout the course and lab. The core competencies listed below with an "SW" require the use of a computer software statistics package. I recommend you use SPSS unless you have a compelling reason to use another package.

Data Reduction

☐ **Principle Component Analysis (PCA)**
    ☐ explain the purpose
    ☐ discuss the underlying assumptions of the procedure
    ☐ conduct a PCA on at least 10 variables (SW)
    ☐ conduct diagnostics (SW)
    ☐ explain results
    ☐ discuss implications of the results

☐ **Exploratory Factor Analysis (EFA)**
    ☐ explain the purpose of EFA
    ☐ explain the underlying assumptions
    ☐ discuss the various options available in EFA
    ☐ conduct an EFA on at least 10 variables (SW)
    ☐ conduct diagnostics (SW)
    ☐ explain the results
    ☐ discuss implications of the results

Hypothesis Testing

☐ **Non-parametric Tests**
    ☐ explain why you would use these tests
    ☐ conduct at least three procedures (SW: 1 minute)
    ☐ conduct parametric alternatives (SW: 1 minute)
    ☐ explain results
    ☐ discuss implications

☐ **Mediaton and Moderation**
    ☐ explain and contrast each term
    ☐ explain how you would test for each
    ☐ conduct a test of mediation (SW: 1 minute)
    ☐ conduct a test of moderation (SW: 1 minute)
    ☐ explain results
    ☐ discuss implications

☐ **Planned and Multiple Comparisons**
    ☐ explain the general concept of comparisons
    ☐ distinguish between planned and multiple comparisons
    ☐ discuss the various options available for each
    ☐ describe how you would run multiple comparisons
    ☐ conduct a planned comparison (SW: 1 minute)
    ☐ explain the results
    ☐ discuss implications of the results

Data Management and Analysis

☐ **Missing Data**
    ☐ explain missing data
    ☐ provide a specific example
    ☐ discuss prevention strategies
    ☐ diagnose missing data (SW: 2 minutes)
    ☐ discuss handling procedures
    ☐ contrast the various options
    ☐ explain how you would report results

- ☐ **Exploratory Data Analysis**
    - ☐ explain the purpose of EDA
    - ☐ demonstrate at least three procedures (SW)
    - ☐ explain implications and next step

Extending the General Linear Model
- ☐ **GLM**
    - ☐ define the GLM
    - ☐ explain how the GLM can be applied
    - ☐ conduct an ANOVA in the GLM (SW)
    - ☐ conduct a regression model via GLM (SW)
    - ☐ demostrate how you might analyze logitudinal data (SW)
    - ☐ explain the results
    - ☐ contrast these procedures

Project Proposal

Doctoral students and interested masters level students (i.e., optional) must complete a project proposal that will be graded by your advisor. The proposal serves as a basis for a second year project to be submitted at the completion of your second year in the program. The specific guidelines for the proposal come from your advisor. I suggest you start right away discussing your ideas with your advisor. Proposals are due to your advisors no later than May 1st and grades from your advisors are due no later than May 15th. Please note that your advisor must oversee your work on the proposal. I am happy to assist where statistics and methodology are concerned but first consult your advisor and the course TA's before asking me for specific help.

Human Subjects Training

One final requirement for PSYC 612 is the successful completion of the Collaborative Institutional Training Initiative (CITI) program. The program consists of an online exam that ensures that all persons who engage in work with human subjects understands the inherent risks you may expose those subjects to and how to avoid those risks. Additional information is available at the following URL: (http://www.gmu.edu/research/ORSP/HumanTraining.html). All students must show documentation that CITI course was completed to fulfill the PSYC 612 requirements. **Please email me your completion date no later than the last week of class.**

Grading

Grades will be assigned based upon a simple formula. Students who complete the required modules and attend the lecture/lab receive a "B" for a grade. Failure to successfully complete these requirements results in a "C" grade. Students who successfully complete the requirements and integrate the optional readings into **every successful module** receive an "A" grade. These are the only grades assigned in the class. I reserve the right to offer "benefit of the doubt" points to those on the cusp.

Lecture Format

Each lecture consists of three 20 minute segments. The first segment covers the assigned readings, the second segment highlights the material necessary to fully understand the assigned reading, and the final segment offers more advanced concepts for those students interested in learning advanced topics. During the first 20-minute segment, I intend to cover the reading in a cursory fashion. My cursory coverage will not help you if you have not read the assigned readings **prior to class**. I strongly encourage you to read the material **before** lecture so this time can be maximally productive for your educational experience. The second 20-minute segment focuses only on the aspects that are not explicitly covered in the readings but are essential for your full understanding. I strongly encourage you to read my notes prior to lecture, print them out before class, and bring them to class so you may take notes on my notes. During the final 20-minute segment, I will address mathematical, conceptual, and philosophical aspects of the topic. You may excuse yourself for the last segment if you so desire, however, if you with to integrate the optional readings into your modules you may find it helpful to remain.

Lab Format

The statistics lab content strictly parallels the course content. Please consult the course web site for changes in topics covered each week. Attendance at the lab is essential and required for you to master the skills discussed in the lecture and it serves as an excellent opportunity to test yourselves on the modules.

Academic Honesty

I must state for the record that cheating of any kind will be dealt with by rules set forth in the University Honor Code (see http://www.gmu.edu/catalog/apolicies/index.html). I prefer never to have any academic integrity problems arise during the semester. The aim of graduate education is to learn material that many others have not learned and master this material to ensure your future success. The degree you receive reflects the hard work you put into your courses. Please do not cheat yourself by misrepresenting your effort. Do the work or accept the consequences. Spend your effort learning the material and avoid being overly grade conscious. With a concerted effort to learn, you will not be tempted to cheat.

Disability Accommodations

If you are a student with a disability and you need academic accommodations, please see me and contact the Disability Resource Center (DRC) at 703-993-2474. All academic accommodations must be arranged through that office.

Tentative Schedule

Week/Date	Module	Topic	Readings
0	1	Introduction	
1	1	PCA	Field c15
	1	PCA/EFA	Dunteman
2/2		LAST DAY TO ADD COURSE	
2	1	EFA	Kim
3	2	Non−parametrics	Field c13
2/19		**LAST DAY TO DROP COURSE**	
4	2	Mediation	Iacobucci
5	2	Moderation	
6	2	Multiple Comparisons	Klockars
7 3/8		SPRING BREAK	
8	2	Planned Comparisons	
9	3	Missing Data	
10	3	EDA	Field c3
11	3	EDA	
12	4	GLM Intro	
13	4	GLM	
5/1		**PROPOSALS DUE TODAY**	
5/12		**PROPOSAL GRADES DUE TODAY**	
5/12		**LAST DAY TO COMPLETE MODULES**	

I will post Additional optional readings (required if you wish to get an "A") on the course web site. Please check the web site every week for those readings.