

**Psychology 612**  
**Advanced Statistical and Research Methods for Psychology II**  
**SPRING 2008**

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<b>Office:</b>	David King 2064/2065
<b>Office Hours:</b>	Wed 11:10am-1:10pm and by appointment
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<b>Class Location:</b>	Fine Arts Building B108
<b>Class Date/Time:</b>	Wednesday 8:30am-11:10am
<b>Class website:</b>	<a href="http://mres.gmu.edu/PSYC612/">http://mres.gmu.edu/PSYC612/</a>

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## Teaching Assistants

TA	Secs	Office Hours
David Kidd dkidd3@gmu.edu	201 202	M 1-3pm
Richard Hermida rhermida@gmu.edu	203 204	M 4-6pm
Joseph Luchman jluchman@gmu.edu	205 206	M 4-6pm

Please refer to the lab syllabus for specific instructions on the locations and time for your assigned lab.

## 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

- Campbell, D.T. and Stanley, J.C. (1963/2005) *Experimental and quasi-experimental designs for research*. Houghton-Mifflin: Boston, MA. (ISBN: 0-395-30787-2)
- Carmines, E.G. and Zeller, R.A. (1979). *Reliability and Validity Assessment*. (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-017). Newbury Park, CA: Sage. (ISBN: 9780803913714)
- 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)
- Fox, J. (1991). *Regression diagnostics*. (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-079). Newbury Park, CA: Sage. (ISBN: 00-8039-3971-X)

- 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)
- Lewis-Beck, M.S. (1976). *Applied Regression: An Introduction*. (Sage University Paper Series on Quantitative Applications in the Social Sciences, No. 07-022). Newbury Park, CA: Sage. (ISBN: 0-8039-1494-6)

## 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 for 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*. Collins: 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 the (quasi) 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.

## 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.

## Grading Criteria

Grades will be determined by each student’s observed performance on five statistics modules - four required and one optional. Each student must perform the statistical procedures in the presence of a TA or the instructor and demonstrate proficiency. There will be no time limit on the performance but speed and fluency of your performance will be indicative of your proficiency. Students may complete a module (i.e., demonstrate proficiency) at any time during the semester and may retake a module after failure **once**. Due to limited resources, we must limit the number of retakes to one. Special consideration to individual cases may

be provided but do not expect more than two retakes. Performance on the modules will be graded on binary scale (2-levels) where level 0 represents a failure to complete the module and level 1 represents a passing grade for the module.

## Modules

The following five modules and their associated performance criteria constitute the curriculum and sole grading criteria for PSYC 612. The modules must be completed on an individual basis in the presence of one of the three TAs or the course instructor. <sup>1</sup> You may choose to complete any of the modules at any time - provided a TA or the instructor is available. There will be more details provided about these modules and how to demonstrate your proficiency throughout the course. 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.

- Multiple Regression and Correlation (MRC) - required**
  - explain the purpose of the procedure and its assumptions
  - compute simple bivariate analysis by hand ( $b$ ,  $\beta$ ,  $r$ , and  $R^2$ )
  - conduct bivariate analysis (SW)
  - conduct diagnostics (SW)
  - explain bivariate results
  - conduct multivariate analysis (SW)
  - conduct diagnostics (SW)
  - explain multivariate results
  - explain mechanics and methods
  - discuss design implications
  - discuss inference and relevant hypothesis tests
- Basic Psychometrics - required**
  - explain the purpose of the procedure
  - explain the assumptions underlying the approach
  - explain the mechanics and methods
  - compute alpha, item-total correlation, and test-retest by hand
  - conduct procedure (SW)
  - conduct diagnostics (SW)
  - explain results
  - discuss implications of the results
- Principle Component Analysis (PCA) - required**
  - 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) - required**
  - explain the purpose of EFA
  - explain the underlying assumptions

<sup>1</sup>In some cases, the module requires you to demonstrate you can do a procedure by hand. There is no reason you must perform this step in front of us. Please prepare a **hand written** document showing that you have performed the operations on a dataset of your choice.

- 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
- **Complex Designs and Analyses - optional**
  - explain the difference between nested and crossed designs
  - conduct a nested design analysis (SW)
  - explain the results
  - conduct a crossed design analysis (SW)
  - explain the results
  - explain what multicollinear means
  - conduct an analysis that contains multicollinearity (SW)
  - discuss the results of the analysis with multicollinearity
  - explain the difference between fixed and random effects
  - demonstrate how fixed and random effects would be analyzed (SW)

## 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.

## Grading

Grades will be assigned based upon a simple formula. Students who complete the required modules receive a "B" for a letter grade. Failure to successfully complete the required

modules results in a "C" grade. Students who successfully complete the required modules and complete the optional module receive an "A" grade. These are the only grades assigned in the class.

## Lecture Format

The lecture will consist of three 45 minute segments. The first segment will review the assigned readings, the second segment will highlight the material necessary to fully understand the assigned reading, and the final segment will present more advanced concepts for those students interested in extending their knowledge into these advanced topics. During the first 45-minute segment, I intend to cover the reading in a cursory fashion. That 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 45-minute segment focuses only on the aspects that are not explicitly covered in the readings but are essential for your full understanding. The final segment will address mathematical, conceptual, and philosophical aspects of the topic.

## Lab Format

The statistics lab content will largely parallel the course content. Please consult the course web site for changes in topics covered each week. Attendance at the lab is essential 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 the course work. 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

Lec:Date	Topic	Readings
1: 1/23	Introduction and Design	C & S
2: 1/30	Threats to Validity	C & S
NA: 2/5 LAST DAY TO ADD COURSE		
3: 2/6	MRC	Lewis-Beck
4: 2/13	MRC	Lewis-Beck
NA: 2/22 LAST DAY TO DROP COURSE		
5: 2/20	MRC Diagnostics	Fox
6: 2/27	MRC Diagnostics	Fox
7: 3/5	Psychometrics	Carmines
NA: 3/12 SPRING BREAK		
8: 3/19	Psychometrics	Carmines
9: 3/26	PCA	Dunteman
10: 4/2	PCA	Dunteman
11: 4/9	EFA	Kim
12: 4/16	EFA	Kim
13: 4/23	Advanced Topics	
NA: 5/2 PROPOSALS DUE TODAY		
14: 4/30	Advanced Topics	
NA: 5/12 PROPOSAL GRADES DUE TODAY		
5/12	LAST DAY TO COMPLETE MODULES	