



EPsy 8261: Probability & Inference
Burton Hall 120, T,R 5:00 PM—6:15 PM
Spring 2011

EPsy 8261: Probability & Inference

Instructor and Teaching Assistants

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Course Description

EPsy 8261 is the first course of the two-semester Ph.D. level statistics sequence in Educational Psychology at the University of Minnesota. This course will cover statistical methods used in educational research. Topics will include exploratory data analysis, probability distributions used in hypothesis testing, one- and two-sample hypothesis testing and confidence intervals, one- and two-factor, between-subjects analysis of variance for fixed effects models, post hoc contrast testing, and a priori power and sample size calculations. The course will emphasize the conceptual framework underlying these methods along with their application to education related research. The use of statistical software will be emphasized throughout the course.

The course is applied, meaning the focus is on conceptual issues important in applied research. A consequence of this focus is that the mathematical bases of the methods will not be stressed (e.g. no mathematical proofs will be given in the course). The student wishing more mathematical rigor is referred to the masters' level or Ph.D. level sequence in the Department of Statistics.

Though this course is applied in nature, it is assumed that the student has at least a working knowledge of high school algebra. In addition, *it is assumed that the student has had at least one undergraduate-level or masters' level introductory statistics*



course. If a student feels nervous about mathematics and has never had a statistics course, it is recommended that the student drop this course and enroll in the masters' level course sequence EPsy 5261 & 5262 (although these courses are not preparatory courses for EPsy 8261). Alternatively, the nervous student might consider dropping this course and enrolling in an appropriate college-level algebra course.

Course Philosophy and Content

Most of our time in class will be spent learning how to do data analysis. When I believe that your understanding will be enhanced by knowing more about the mathematical underpinnings, I will offer (what I hope are) straightforward conceptual explanations that do not sacrifice intellectual rigor.

We will devote time to illustrating how to present results in words, tables and figures. Good data analysis is craft knowledge; it involves more than using software to generate reams of output. Thoughtful analysis can be difficult and messy, raising delicate problems of model specification and parameter interpretation. We will confront such issues directly, offering concrete advice for sound decision making.

Class participation is an important part of learning, even in a relatively large lecture course like EPsy 8261. If you have a question, it is likely that others do as well. I encourage active participation and course grades will take into account students who make particularly strong contributions.

Course Website

Readings, data files, etc. are available on the course website (<http://www.tc.umn.edu/~zief0002/8261.htm>). There are some important things to note about using the website. First, the website works best with a recent version of Mozilla Firefox, Google Chrome or Safari. Second, if you are using a Mac and seem to have problems downloading files, hold the option-key while clicking on the link. This should download the file to your desktop. If all else fails, the materials can be downloaded and printed in the *Educational Psychology Computer Lab* (see section below).



Textbook

There are two required textbooks for the course.

American Psychological Association. (2010). *Publication manual of the American Psychological Association (sixth edition)*. Washington, DC: Author.

Zieffler, A., Harring, J., & Long, J. D. (in preparation). *Comparing groups: Randomization and bootstrap methods using R*. New York: Wiley.

Zieffler, Harring, & Long (in preparation) will be the primary textbook for the course. This will be provided to you via the course website. I have also ordered the *Publication manual of the American Psychological Association (sixth edition)* as another reference and text for the course. Other texts (not required) that may be useful and would provide additional perspectives on the material being covered in class include:

Dalgaard, P. (2004). *Introductory statistics with R*. New York: Springer.

▷ A good R reference for many statistical methods.

Gentleman, R. (2009). *R Programming for Bioinformatics*. Boca Raton, FL: Chapman & Hall/CRC.

▷ For students who really want to develop their statistical programming skills (which can be very helpful on the job market).

Howell, D. C. (2009). *Statistical methods for psychology (seventh edition)*. Belmont, CA: Wadsworth.

▷ A good statistical reference for most methods used in the social sciences. (Fifth edition or later is reasonable)

Wackerly, D., Mendenhall, W., & Scheaffer, R. L. (2007). *Mathematical statistics with applications (seventh edition)*. Belmont, CA: Duxbury.

▷ A well known mathematical theory-based statistics book.

Statistical Computing & Technology

Statistical computing is an integral part of statistical work and subsequently EPsy 8261. To support your learning in this area, this course will emphasize the use of R. R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS (<http://www.r-project.org>). I assume that everyone is comfortable using a computer to perform basic statistical analysis (although I don't assume that you have necessarily used R).

While I do teach some R programming during class time, there are also a lot of resources to help you learn how to program on your own at your own pace:



- The R code that produces the output included in each set of notes can be downloaded from the course website as a script file.
- You can download many tutorials and documentation from the Web (especially through the [Contributed Documentation](#) link on the R homepage). While students have found many useful materials online, I strongly encourage you to at least obtain the document called [simpleR](#).

EPsy 8261 is technologically intensive, both during instruction and for homework. Student difficulty with obtaining or operating the various software programs and technologies will not be acceptable as an excuse for late work. Due to the variation in computer systems and the difficulty in assessing problems via email, the instructor and TA may not be able to assist in trouble shooting all problems you may have. In these cases, contact the university [Academic and Distributed Computing Services \(ADCS\)](#) or your systems administrator (if you have one).

Homework Assignments

To help you develop your analytic and computational skills, you will complete 9 homework assignments. Each assignment has you complete several problems from the end of the textbook chapters. Any necessary data sets will be available from the course website. General help with R is available from both myself and the TA. *We can only help you produce the output. We will not help you answer the homework questions.*

Students are encouraged to work collaboratively and consult with one another on the homework assignments. If you work collaboratively, please turn in only one assignment for your group—no more than three students per group.

Each assignment will be graded using a holistic approach. Any writing should be clear and concise, integrating substance and statistics. Further information on grading can be found on the [Evaluation of Student Labs](#) document available on the course website.

Because we strive to read and return your assignments quickly, all assignments must be turned in on time. *Late assignments will not be graded and will contribute 0 to your course grade.* Extensions will be granted only in the case of personal emergency (e.g., illness, death in the family). If you find yourself in this position, please contact me before the assignment deadline to discuss alternative arrangements.

No labs will be accepted via e-mail or turned in to the instructor's or TA's mailbox without prior instructor approval. Any lab submitted in either of these manners without prior approval will be thrown away or deleted, and will be considered to have been not submitted with the appropriate penalties applied. If approval is granted to turn in a lab via e-mail, the only acceptable format is a PDF file.



Calendar

The calendar below lists the tentative dates of the lecture topics and the due dates for the homework assignments. These dates can change at the instructor's discretion.

Session	Date	Topic
1	Jan. 18	Introduction
2	Jan. 20	An Introduction to R
3	Jan. 25	An Introduction to R
4	Jan. 27	Data Representation and Preparation
5	Feb. 1	Data Representation and Preparation
6	Feb. 3	Data Exploration: One Variable <i>Chapter 1 Problems Due</i>
7	Feb. 8	Data Exploration: One Variable
8	Feb. 10	Exploration of Multivariate Data: Comparing Two Groups <i>Chapter 2 Problems Due</i>
9	Feb. 15	Exploration of Multivariate Data: Comparing Two Groups
10	Feb. 17	Exploration of Multivariate Data: Comparing Two Groups <i>Chapter 3 Problems Due</i>
11	Feb. 22	Exploration of Multivariate Data: Comparing Many Groups
12	Feb. 24	Exploration of Multivariate Data: Comparing Many Groups <i>Chapter 4 Problems Due</i>
13	Mar. 1	Exploration of Multivariate Data: Comparing Many Groups
14	Mar. 3	Randomization & Permutation Tests
15	Mar. 8	Randomization & Permutation Tests
16	Mar. 10	Randomization & Permutation Tests <i>Chapter 5 Problems Due</i>
	Mar. 15	No Class—Spring Break
	Mar. 17	No Class—Spring Break
17	Mar. 22	Bootstrap Tests



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Session	Date	Topic
18	Mar. 24	Bootstrap Tests <i>Chapter 6 Problems Due</i>
19	Mar. 29	Bootstrap Tests
20	Mar. 31	Bootstrap Tests
21	Apr. 5	Bootstrap Intervals and Effect Sizes
22	Apr. 7	Bootstrap Intervals and Effect Sizes <i>Chapter 7 Problems Due</i>
23	Apr. 12	No Class
24	Apr. 14	Bootstrap Intervals and Effect Sizes
25	Apr. 19	Planned Contrasts
26	Apr. 21	Planned Contrasts <i>Chapter 9 Problems Due</i>
27	Apr. 26	Planned Contrasts
28	Apr. 28	Unplanned Contrasts
29	May 3	Unplanned Contrasts <i>Chapter 11 Problems Due</i>
30	May 5	Unplanned Contrasts
	May 12	<i>Chapter 12 Problems Due</i>



Grading

Each assignment will be given a holistic grade and feedback. This grade will be then given a score as follows,

Points	Grade	Points	Grade	Points	Grade
6	A	3	B	0	C or Below
5	A-	2	B-		
4	B+	1	C+		

You will be evaluated on the basis of your performance on the homework assignments only. Your course grade is computed based on the sum of your 9 homework scores. The following criteria are used as an initial guideline:

Total	Grade	Total	Grade
50–54	A	27–35	B
45–49	A-	18–26	B-
36–44	B+	17 or Below	F

Your class participation will be used as way of determining grades if you are between two grades.

Shortly after the course, you may access your final grade online at <http://www.onestop.umn.edu>. To access your grade via telephone, call the Gopher Student Line at 612-624-5200. Uncollected labs will be retained for one semester after the course, and then discarded.



Questions regarding grading are to be directed *only to the instructor*. Please do not contact the TA regarding grading. Any assignments graded by the TA will be under the instructor's strict parameters and thus the instructor is responsible for all issues regarding grading.

Students fulfilling the Educational Psychology statistics core requirement are not allowed to take this course as satisfactory/unsatisfactory. If a student is not fulfilling a core requirement, he/she may choose to take the course on a satisfactory/unsatisfactory basis. Satisfactory performance requires an average of B- or better, and completion of all assignments.

Incompletes for this course will be given on a case-by-case basis. The University's Senate Committee on Educational Policy states, the I (incomplete) shall be assigned "at the discretion of the instructor when, *due to extraordinary circumstances* (e.g., hospitalization), a student is prevented from completing the work of the course on time." Note the italicized phrase in the previous sentence. The most valid reason for an incomplete is an unforeseen event that gravely interferes with a student's ability to perform at an adequate level. Incompletes will not be given for avoidable problems such as unwise planning. The complete language covering the incomplete can be found in the online [Policy Library](#).

Scholastic Dishonesty

Please read the university's policy on "scholastic dishonesty". Attention to this policy is particularly important in a course like EPsy 8261, in which collaboration with other students is encouraged and the writing component is intensive. Make sure that you give appropriate credit and citations as necessary. This helps avoid the natural questions that arise when textual similarities are detected during grading. I cannot overemphasize the need for all students to monitor their own behavior. The consequences for plagiarism — an F for the course — are appropriately severe.

Educational Psychology Computer Lab

The Peik Hall Computer Labs (Peik Hall 325 and Peik Hall 355) will have some open times during the week, including all day on Fridays. All the machines in the computer lab of Peik Hall 325 have R. There are other various computer labs on campus that have this program installed. You are encouraged to visit the [Office of Information Technology \(OIT\)](#) website to locate these computer labs.



Mission Statements

Quantitative Methods in Education (QME)

The Quantitative Methods in Education (QME) track offers educational opportunities in both quantitative and qualitative methods with a broad array of introductory and advanced coursework. Students who choose QME as their track within educational psychology may specialize in any of four areas: measurement, evaluation, statistics, and statistics education. The goal of QME is to provide students with broad but rigorous methodological skills so that they may conduct research on methodologies, may help to train others in methodology, or will have the skills necessary to conduct research in related fields.

Psychological Foundations of Education Program Mission Statement

To apply and generate knowledge of psychological processes and methodological procedures involved in learning and teaching for the betterment and improvement of humans in a wide range of situations.

Department of Educational Psychology Mission Statement

Educational psychology involves the study of cognitive, emotional, and social learning processes that underlie education and human development across the lifespan. Research in educational psychology advances scientific knowledge of those processes and their application in diverse educational and community settings. The department provides training in the psychological foundations of education, research methods, and the practice and science of counseling psychology, school psychology, and special education. Faculty and students provide leadership and consultation to the state, the nation, and the international community in each area of educational psychology. The department's scholarship and teaching enhance professional practice in schools and universities, community mental health agencies, business and industrial organizations, early childhood programs, and government agencies.

Adopted by the Dept. of Educational Psychology faculty October 27, 2004.

College of Education & Human Development Mission Statement

The new College of Education and Human Development is a world leader in discovering, creating, sharing, and applying principles and practices of multiculturalism and multidisciplinary scholarship to advance teaching and learning and to enhance the psychological, physical, and social development of children, youth, and adults across the lifespan in families, organizations, and communities.