Statistical Methods I: Probability and Inference
Epsy 8261

Summer 2006, T,Th 9:05am-11:35am, 123 Burton Hall

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About the Course

EPsy 8261 is the first course of the two-semester Ph.D. level statistics sequence in Educational Psychology at the University of Minnesota. The course introduces you to fundamental methods of data description and statistical analysis (see the topic list below). The descriptive title of this course, *Probability and Inference*, is a bit misleading. A much better descriptive title would be *Description and Inference*. *Probability and Inference* is misleading because probability theory will not be a focus of the course. Rather, probability theory will be introduced as required to understand the concepts of statistical inference, which is the major focus of this 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.*

Another consequence of the applied nature of the course is the necessary lab work. You are required to work nine several labs using the Statistical Package for the Social Sciences (SPSS). SPSS is a menu-driven computer program commonly used in the social sciences for data analysis.

Though this course is applied in nature, it is nonetheless a math course. It is assumed that the student has at least a working knowledge of high school algebra (e.g. you should know things such as $x^2 = x \cdot x$, , etc.). 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 Topics: The following is a list of topics that will be covered with the corresponding chapters from Howell (2002).

Topic	Howell Chapter
Introduction, Describing Distributions	1,2
The Normal Distribution	3
Sampling Distributions	4
Confidence Intervals and Hypothesis Testing under Normality	4
Confidence Intervals and Hypothesis Testing with the *t* distribution	7
Power Analysis and Required Sample Size	8
Simple Analysis of Variance (ANOVA)	11
Multiple Comparisons Among Treatment Means	12
Correlation and Regression	9

Course Website: Supplemental notes, lab assignments, data files, etc. are available on the course website. There are some important things to note about using the website. First, the website works best with a recent version of Microsoft Internet Explorer, or Safari (Mac). 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)***.**

Software: You will need Adobe Acrobat Reader (http://www.adobe.com/downloads) or Preview (Mac) to read and print all the materials. This program is free and comes already installed on most new computers. You will also need access to the statistical package, SPSS. This software is available to use in the Educational Psychology Computer Lab. A full working version of SPSS 14 is available for purchase through the university for about $188 (recommended especially for Ph.D. students). For ordering information see http://www.usc-umn.com/acb/webpage.cfm?&DID=6&WebPage_ID=3. The product is called *SPSS Graduate Pack 14 for Windows*. There is also a version for the Mac at the same price.

Due to the variation in computer systems and the difficulty in assessing problems via email, I may not be able to assist in trouble shooting all problems the university Academic and Distributed Computing Services (ADCS) at http://www1.umn.edu/adcs/help/ , or your systems administrator (if you have one).

Textbook (Required): Howell, D. C. (2002). *Statistical Methods for Psychology*, 6th edition. Pacific Grove, CA: Duxbury Press. ISBN 0-534-37770-X.

Additional Textbooks (Not Required): Moore, D. S. (2000). *The Basic Practice of Statistics*. New York: Freeman.

Agresti, A., & Finlay, B. (1997). *Statistical Methods for the Social Sciences, 3rd Edition.* Upper Saddle River, NJ: Prentice Hall.

Lab Assignments

There will be several graded computer lab assignments to be worked outside of class using the SPSS software package. In working the lab assignments, you are expected to pull together the material from lecture, the text, and the supplemental notes where applicable. You are allowed to consult with one another about the lab material (e.g. work in groups), but *each student must hand in original work*. Please see the section on plagiarism below. The lab assignments and data sets are available from the course website. The

lab assignments are guided, but general help with SPSS is available from both the SPSS Help Menu and the TA. *The TA can only help you produce the output. The TA will not help you answer the lab questions*.

Lab Assignments and Plagiarism*:* It is important that the student synthesize the pertinent information when writing up the labs. Synthesis does not occur when large blocks of text are copied from the textbook or my notes and used to answer the lab questions. The university has policies against such behavior calling it "scholastic misconduct." *It is understood that the student will have to use some verbatim phrases and definitions from the textbook or notes*. This is not considered a case of scholastic misconduct. For example, the textbook may have a sentence reading "The mean of the IQ distribution is $\bar{X}$." If the output indicates that $\bar{X} = 101$ and you are asked to provide the mean of the IQ distribution, it is perfectly lawful for you to write "The mean of the IQ distribution is 101." *What must be avoided is extensive verbatim copying of information from the textbook or my notes when answering the longer questions in the labs*.

Finally, you are allowed, even encouraged, to consult with one another about the lab material. *However, each student must hand in original work*. It is not acceptable for a student to hand in an exact copy of another student's work. Again, such behavior falls under "scholastic dishonesty", which is defined below. From the Office of Student Academic Integrity we have the following:

"(1) Scholastic Dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis."

Late Labs: There will be a penalty for late labs. *Total points possible will be reduced by 25% for each day (not class session) that a lab is late.* Please familiarize yourself with the due dates listed for the labs.

Educational Psychology Computer Lab: The Peik Hall Computer Labs (Peik Hall 325 and Peik Hall 355) will have some open times during the week and I will announce those times when they are made known to me. All lab assignments are written for SPSS version 14 or later. All the machines in the computer lab of Peik Hall 325 have SPSS 14 (or later). There are other various computer labs on campus that have the SPSS software. You are encouraged to visit the (ADCS) website to locate these computer labs, http://www2.publabs.umn.edu/indexe.html.

Exams & Quizzes

In addition to the graded labs, you will be required to take a total of two in-class exams and five in-class quizzes. Calculations will be required for some questions, but the quizzes and exams are open book and open note. A calculator with at least a square root key is required for the exams. It is recommended that you write down all pertinent equations on one or two sheets for the exams.
These assessments are not cumulative in the traditional sense, but the course material is somewhat cumulative by nature.

The suggested study strategy for the exams and quizzes is to work the exercises in the back of the Howell chapters. Answers to some questions are provided in the back of the Howell book. You may purchase an exhaustive answer key from the publisher of the book (Duxbury, http://www.duxbury.com/default.htm).

Missed Exams or Quizzes: All students are expected to take the exams and quizzes on the specified dates and no make-up exams or quizzes are planned. *You must contact me before an exam or quiz if you are going*

to be absent. If you do not contact me before the exam or quiz, it will be at the instructor's discretion as to whether or not you will be allowed to make up the exam or quiz.

Calendar

The calendar below lists the dates of the lecture topics and the due dates for the labs and the exams. Note that July 4 (Tuesday) is a university observed holiday, and there will be no class on that day.

Session	Date	Topic	Chapter
1	13-Jun	Intro, data sets, describing distributions/Graphical methods	1,2
2	15-Jun	Measures of central tendency and types of distributions/The normal distribution	2, 3
	15-Jun	**Quiz #1**	
3	20-Jun	Areas under the normal curve/Sampling Distributions, Probability	3, 4
	20-Jun	**Lab #1 Due**	
4	22-Jun	Sampling Distributions	4
	22-Jun	**Quiz #2**	
5	27-Jun	CI for mu under normality	4
6	29-Jun	H0 testing under normality	4
	29-Jun	**Quiz #3**	
7	6-Jul	Error Probabilities and Effect size	7
	6-Jul	**Lab #2 Due**	
8	11-Jul	One sample t-test and CI based on t	7
9	13-Jul	**Exam #1**	
10	18-Jul	Two-sample t-test and CI based on t	7, 8
11	20-Jul	Power	11
	20-Jul	**Lab #3 Due**	
	20-Jul	**Quiz #4**	
12	25-Jul	One-Way	11
13	27-Jul	One-Way/Multiple Comparisons	11, 12
	27-Jul	**Quiz #5**	
14	1-Aug	Multiple Comparisons	12
	27-Jun	**Lab #4 Due**	
15	3-Aug	Correlation and regression	9
	3-Aug	**Exam #2**	

Grading

Your final grade will be determined by a combination of exams and quizzes (60%) and lab assignments (40%). The quizzes, exams and labs will be the only basis for your grade. Grades will be assigned by the following standards:

Percentage	Letter Grade Range
88-100%	A- to A+
75-87%	B- to B+
65-74%	C- to C+
0-64%	Fail

Students at the low end of the percentage range will receive the low-end grade equivalent. Students at the high end will receive the high-end equivalent. Needless to say, those in the middle of the range will receive the middle-range grade equivalent.

Labs will be handed back in class or during office hours. Exams will be handed back to review during class, but may not be kept. If a student wishes to review their exam further, they may do so during office hours. Shortly after the course, you may access your grades online at www.onestop.umn.edu. To access your grades via telephone, call the Gopher Student Line at 612-624-5200. Uncollected labs and the exams will be retained for one (1) semester after the course, and then discarded.

Questions regarding grading: Questions regarding grading are to be directed only to me. Please do not contact the TA regarding grading. The TA will grade all exams and labs under my strict parameters and thus I am responsible for all issues regarding grading.

Extra Credit: Extra credit" assignments or exams will not be available, so please do not request such things.

S/N (Satisfactory/Not Satisfactory) Grading and Incompletes: *Students fulfilling the Educational Psychology statistics core requirement are not allowed to take this course as S/N.* If a student is not fulfilling a core requirement, he/she may take this course S/N with the following understanding of a minimum requirement for an "S." Quoting from the university grading policy, "achievement required for an S is at the discretion of the instructor." Because this is a Ph.D. level course, the minimum criterion for an S in this course will be the equivalent of a letter grade of B- (*not C- as in many undergraduate courses*), which translates into a minimum of 78%.

Incompletes for this course will be given on a case-by-case basis. The University's Senate Committee on Educational Policy says that "the I (incomplete) shall be assigned at the discretion of the instructor when, due to *extraordinary circumstances*, the student was 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 at http://www1.umn.edu/usenate/policies/gradingpolicy.html (Section III(1)).

Diversity Statement

The University of Minnesota is an equal opportunity educator. It is university policy to provide, on a flexible and individualized basis, *reasonable* accommodations to students who have disabilities that may

affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact me when possible to discuss their individual needs for accommodations.

Mission Statements

I am a member of the Research Methodology Program, which offers a concentration in statistics, measurement, evaluation (quantitative and qualitative), and statistics education. The Research Methodology Program website is http://education.umn.edu/EdPsych/Foundations/methodology/

The Research Methodology Program is in the Psychological Foundations of Education Program area, which is in the Department of Educational Psychology, which is in the College of Education and Human Development (whew! No test on that!). Each of the three top layers (college, department, area) has a mission statement listed below.

College of Education & Human Development Mission Statement

The mission of the College of Education and Human Development is to generate knowledge about teaching, learning, and human development, and to apply that knowledge to improve education for all individuals.

Department of Educational Psychology Mission Statement

The broad mission of the Department of Educational Psychology is to:

- create and disseminate new knowledge about successful educational practices.
- preserve the established and time honored practices of the past.
- promote the welfare and development of all students from all abilities and backgrounds.

Within this mission, the department's priorities are to:

- prepare graduate students to take leadership in research, teaching, professional practice, and service.
- train new and practicing teachers in the instructional applications of psychological theory.
- foster an appreciation of the role that educational psychology can play in solving educational problems.
- work with schools and individuals to help them achieve their goals.

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.