EPsy 8261

Probability & Inference
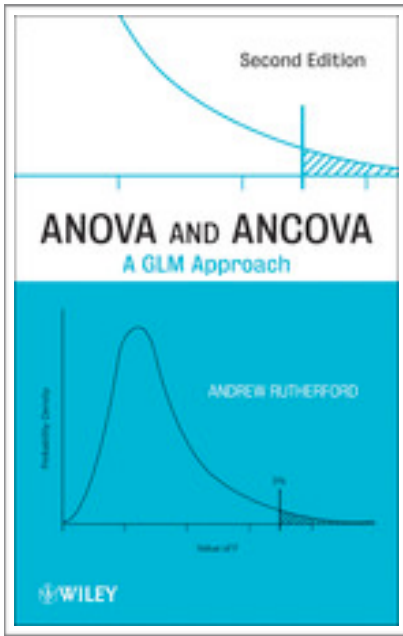
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Tuesday 9:00 AM–11:00 AM; and
by appointment

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. (See the course calendar for a more detailed list of topics that will be covered.) The course will emphasize the conceptual framework underlying these methods along with their application to education related research.

The course is applied, meaning the focus is on topics and issues pertinent to applied researchers, one of which is computing. We will devote time in class, especially during the beginning of the course, to learning the computational skills that are, in today's world, an integral part of statistical work.

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 master's degree-level introductory statistics course.

Textbook

The required textbooks for the course are *ANOVA and ANCOVA: A GLM Approach* and *Presenting your Findings: A Practical Guide to Creating Tables*. I also highly recommend purchasing the *R Cookbook*, the *R Graphics Cookbook* and the *Publication Manual of the American Psychological Association (6th edition)*. All of these books should be useful references for you in the future.

Required

Nicol, A. A., & Pexman, P. M. (2010). Presenting your findings: A practical guide for creating tables (6th edition). Washington, DC: American Psychological Association.

Rutherford, A. (2011). ANOVA and ANCOVA: A GLM approach (2nd edition) . New York: Wiley.

Optional

American Psychological Association. (2010). Publication manual of the American Psychological Association (6th edition). Washington, DC: Author.

Chang, W. (2013). R graphics cookbook. Sebastopol, CA: O'Reilly.

Teetor, P. (2011). R cookbook. Sebastopol, CA: O'Reilly.

Rutherford (2011) is the primary textbook for the course. It covers both traditional and GLM approaches to analysis of variance.
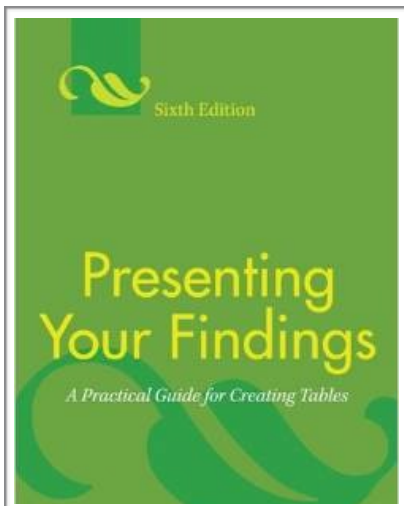
Nicol and Pexman (2010) provides multiple examples of APA styled tables for presenting statistical results.

Course Requirements

Students will complete 8–10 homework assignments. These assignments will help you learn the course material via structured application and practice. These assignments, each weighted equally, will make up the entirety of your grade for the course.

Submitted homework assignments must be typed—handwritten assignments will receive no credit. Any assignment that is submitted via e-mail without prior instructor approval will receive no credit. If approval is granted to turn in an assignment via e-mail the only acceptable format is a PDF file.

You are permitted to collaborate with other students in the course to complete the assignments. If you collaborate with others, please *turn in only one homework assignment with all your names on it*.

Although I believe you will learn more by collaborating with others, you do not need to join a group to ultimately be successful in this course.

For those students who work collaboratively, note that I am not willing to manage intragroup conflicts nor will I assign varying grades within a group. From past experience, student collaborations work most fluidly when everyone in the group has chosen the same grading option for the course (e.g., A/F, S/N, etc.).

Course 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.

Unit	Topic
1	Introduction to R
2	ggplot2
3	ANOVA model
4	Inference for the ANOVA model (2-means)
5	ANOVA model assumptions
6	Effect size
7	Statistical power
8	*k*-means ANOVA
9	Unplanned contrasts
10	Multi-factor ANOVA (main-effects)
11	Multi-factor ANOVA (interaction-effects)

Evaluation of Student Performance

Course grades will be based entirely on performance on the homework assignments. Each homework assignment will contribute equally to the final course grade. If you are taking the course S/N, the minimum criterion to receive an S is 80% (the equivalent of a B− letter grade). Any student who does not complete all homework assignments without making prior arrangements with the instructor will receive a grade of F/N.
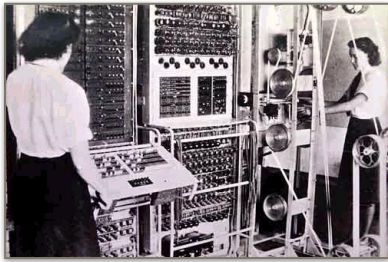
Cutoff	Grade	Cutoff	Grade	Cutoff	Grade
94%	A	84%	B	74%	C
90%	A–	80%	B–	70%	C–
87%	B+	77%	C+	64%	D

Class Participation

Students are expected to actively participate in the course. Active participation includes, but is not limited to, being engaged during the class, asking questions, providing additional insight and material, responding to other students and the instructor, and always being open and inquisitive. While not explicitly a part of the course grade, your participation in the course will play a role if you are between grades at the end of the semester.

Accessing Course Grades

Shortly after the course, you may access your grades online at http://www.onestop.umn.edu, or by calling the Gopher Student Line at 612-624-5200. Assignments will be handed back in class or during office hours. Uncollected assignments will be retained for six weeks after the course and then discarded.

Statistical Computing and Technology

Statistical computing is an integral part of "doing" statistics. Subsequently, it is also an integral part of 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). While I do spend time in class on using R for data analysis, there are also many resources available to help you learn R:

- The Teetor (2011) and Chang (2013) textbooks provide examples and syntax for many practical problems encountered in data analysis.

Computing and coding is integral to learning statistics. It will also help you to think about and solve problems from other domains in structured and creative ways.
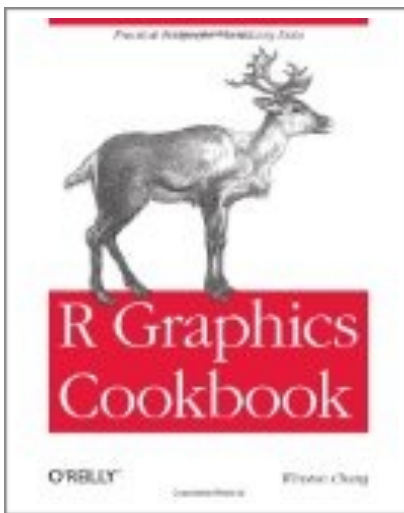http://code.org/

- You can find many tutorials and documents from the Web (especially through the Contributed Documentation link on the CRAN homepage). While students have found many useful materials online, I strongly encourage you to at least obtain the two documents simpleR and Using R for Data Analysis.

- There are several online courses that you can take, such as R Programming, to help you learn to broaden and enhance your knowledge of R. Coursera, edX, and iTunes U all offer courses that use R and are free of charge.

It is important to note that student difficulty with technology will not be acceptable as an excuse for late work (e.g., obtaining or using software, printing problems, etc.). Also, due to the variation in computer systems, the instructor and/or 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).

Downloading and Installing R

In order to download and install R your computer must be connected to the Internet. The latest version of R can be obtained from the R Project for Statistical Computing. After navigating to the website click on "CRAN" under "Download, Packages" on the left-hand side of the welcome screen. You must choose a server in your country of origin, called a CRAN mirror. After doing so, select the appropriate operating system for your computer—Linux, MacOS, or Windows. For Linux and MacOS, follow the directions at the top of the download page. For Windows, download the base package and install it like any other executable file. (On Windows machines you might need to have "administrator" privileges to successfully install and use the program.)

Downloading and Installing RStudio

RStudio is an integrated development environment (IDE) for R. RStudio combines an intuitive user interface with powerful coding tools to help you get the most out of R. RStudio Desktop is free and can be downloaded at http://www.rstudio.org/download/.

There are several resources to help you learn R. Chang (2013) is an excellent resource that is filled with examples for using R to create plots of data. See more at http://www.cookbook-r.com/

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. See http://policy.umn.edu/Policies/Education/Education/CLASSROOMPED.html.

Campus Computer Labs

IT@UMN manages numerous computer labs on the Twin Cities campus. Students from all colleges may drop in to use the computer labs during open hours. The IT@UMN website contains information pertaining to the location, hours, and software available for each of the computer labs.

Email

Email is the primary source of communication among instructors, teaching assistants, and students for this course. As such, you will be expected to check your email frequently (i.e., at least once per day). As per the University of Minnesota policy,

> *Students are responsible for all information sent to them via their University assigned email account. If a student chooses to forward their University email account, he or she is responsible for all information, including attachments, sent to any other email account.*

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.

Department of Educational Psychology

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 Department. of Educational Psychology faculty October 27, 2004.

College of Education and Human Development

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.

University of Minnesota Policies and Procedures

Academic Freedom and Responsibility

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.* Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor (Andrew Zieffler; zief0002@umn.edu), the Department Chair (Geoff Maruyama; geoff@umn.edu), your adviser, the associate dean of the college (Kenneth R. Bartlett; bartlett@umn.edu), or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost (Arlene Carney; carne005@umn.edu).

Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Disability Accommodations

The University is committed to providing quality education to all students regardless of ability. Determining appropriate disability accommodations is a collaborative process. You as a student must register with Disability Services and provide documentation of your disability. The course instructor must provide information regarding a course's content, methods, and essential components. The combination of this information will be used by Disability Services to determine appropriate accommodations for a particular student in a particular course. For more information, please reference Disability Services: http://ds.umn.edu.

Stress management is an important piece of the skill set needed for success in graduate school. Pet Away Worry & Stress (PAWS) is one of the many resources available to students. Find out more at http://www.bhs.umn.edu/services/wellness-paws.htm.

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://www1.umn.edu/regents/policies/administrative/Equity_Diversity_EO_AA.html.

Mental Health Services

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

Respecting Intellectual Property

Students may not distribute instructor-provided notes or other course materials, except to other members of the same class or with the express (written) consent of the instructor. Instructors have the right to impose additional restrictions on course materials in accordance with copyright and intellectual property law and policy. Students may not engage in the widespread distribution or sale of transcript-like notes or notes that are close to verbatim records of a lecture or presentation. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.

Scholastic Dishonesty

You are expected to do your own academic work and cite sources as necessary. Failing to do so is 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; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class—e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Senate Academic Workload Policy

One conventional credit is hereby defined as equivalent to three hours of learning effort per week, averaged over an appropriate time interval, necessary for an average student taking that course to achieve an average grade in that course. It is expected that the academic work required of graduate and professional students will exceed three hours per credit per week or 45 hours per semester.

Senate Grading Policy

The University of Minnesota's grading policy is available online. For additional information, please refer to http://policy.umn.edu/ Policies/Education/Education/GRADINGTRANSCRIPTS.html.

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

A	4.000	Represents achievement that is outstanding relative to the level necessary to meet course requirements
A–	3.667	
B+	3.333	
B	3.000	Represents achievement that is significantly above the level necessary to meet course requirements
B–	2.667	
C+	2.333	
C	2.000	Represents achievement that meets the course requirements in every respect
C–	1.667	
D+	1.333	
D	1.000	Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S		Represents achievement that is satisfactory, which is equivalent to a C− or better
F/N		Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (see also I).
I	Incomplete	Assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospital- ization, a student is prevented from completing the work of the course on time. Requires a written agree- ment between instructor and student.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a

sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: http://www1.umn.edu/regents/policies/humanresources/ SexHarassment.html

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/ files/policies/Student_Conduct_Code.pdf. Note that the conduct code specifically addresses disruptive classroom conduct.