

## EPSY 8282 – Statistical Analysis of Longitudinal Data

Description: 3 credits; prerequisites: EPSY8261 and EPSY8262 or equivalent.  
Traditional/modern approaches to analyzing longitudinal data. Dependent t-test, repeated measures ANOVA and MANOVA. Linear mixed models, multilevel models, generalized models.

Time/Location: 9:45–11:00, Tu,Th, Ford 130

Instructor: Aaron Rendahl  
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arendahl@stat.umn.edu

Website: <http://www.stat.umn.edu/~arendahl/Teaching/EPSY8282>

Office hours: 11:15–12:15 on Tuesdays and Thursdays and 1:15–2:15 on Wednesdays, in 366 Ford

Text: *Modeling Longitudinal Data* (2005) by Robert E. Weiss. It is available as an online resource through the library; a hard copy can be purchased directly from its online resource page for \$25. We will be covering the first ten chapters.

Computing: The R software environment, including the lattice and nlme libraries, will be used for all computing. See [r-project.org](http://r-project.org).

## Course Outline, Goals, and Assignments

Students should be able to...

**Use exploratory graphics to show elements of a longitudinal data set and build intuition for building a quantitative model. (C1–C2)**

Jan 18: Introduction

Jan 20: R intro / basic plots

Jan 25: profile plots

Jan 27: correlation plots

*Homework 1 due Jan 28*

**Explain why simple analyses on longitudinal data may be inappropriate. (C3–C4)**

Feb 1: simple analyses

Feb 3: critiques of simple analyses

*Homework 2 due Feb 11*

**Understand the multivariate normal model and its covariance matrix, fit basic models in R, and make appropriate inferences. (C5–C6)**

Feb 8: the basic model and its covariance matrix

Feb 10: simple random effects

Feb 15: testing contrasts

Feb 17: likelihood ratio tests

Feb 22: model selection

Feb 24: design considerations and computing issues

*Homework 3 due Feb 25*

**Add covariates to a model, including time, and decide between various alternatives. (C7)**

Mar 1: mean specification

Mar 3: covariate specification

Mar 8: specifying time/covariate interactions

Mar 10: adjusting for baseline

*Homework 4 due Mar 25*

**(Spring Break)**

**Choose an appropriate covariance matrix for the model. (C8)**

Mar 22: overview of different types

Mar 24: fitting different types

Mar 29: overview of non-constant variance

Mar 31: fitting non-constant variance

Apr 5: random times

*Homework 5 due Apr 8*

**Fit more complex random effect models. (C9)**

Apr 7: random effects and hierarchical models

Apr 12: the marginal model and shrinkage

Apr 14: combining random effects model and a modeled covariance matrix

*Homework 6 due Apr 22*

**Use residuals and case diagnostics to evaluate a model. (C10)**

Apr 19, Apr 21

**Combine the previous elements to completely analyze a longitudinal data set.**

Apr 26, Apr 28, May 3, and May 5

*Final project due by Sat May 14 at 3:30 p.m.*

This schedule may be modified as needed to better match the interests and needs of the class.

## Course Grading

Grading will be based on six homework assignments (75%) and a final data analysis project (25%). Each will be graded on the A–F scale (with +/-), and the final grade determined by averaging the scores. To pass the course, all assignments and the final project must be completed with at least a D grade. Assignments turned in without reaching that level may be resubmitted. Grades will be assigned following the University Senate grading policy.

**Collaboration:** You are encouraged to collaborate with other students on the homework, however, you are required to turn in only your own work. A single group solution is not permitted. In practice, what this often looks like is to work side-by-side with one or more other students, each on your own computer, sharing suggestions and techniques, but always typing in commands yourself and phrasing responses in your own words. You should always feel that you could recreate your work without the other students present. Collaborators of this type should be acknowledged on the final document. Turning in assignments that you did not do yourself will be considered cheating and will be grounds for failure. See the section on Academic Integrity.

**Attendance:** Attendance in class is expected. If you will be unable to attend on a particular day, please notify me by email.

**Incompletes:** An incomplete will be given only in cases of extreme hardship. Lack of attendance is not grounds for an incomplete. If you think you might need to request an incomplete, please talk to me as soon as possible. See University Policy.

**Make-up policy:** While it is expected that you will keep up with the coursework, flexibility in completing assignments will be given as needed.

**Returning Assignments:** Assignments will be returned in class or may be picked up in office hours. Any assignments not picked up by the end of May will be discarded and no longer available. The final project may be picked up from my office, or arrangements can be made to have it mailed to you.

**Academic Integrity:** Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Academic dishonesty is defined by University policy and specific guidelines for this course are given above. If you have questions regarding the expectations, please ask. Academic dishonesty in any portion of the academic work for this course shall be grounds for awarding a grade of F or N for the entire course. All violations will be reported to the Office for Student Academic Integrity.

## Mission Statements

### 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.

### Educational Psychology Department

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.

### Psychological Foundations of Education/Quantitative Methods in Education

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.

## University Policies

See <http://onestop.umn.edu/onestop/faculty/Teaching/Policies.html> for a list of policies related to teaching with links to those policies. Also see <http://www1.umn.edu/usenate/usen/policies.html> for University Senate policies related to Teaching/Education.

### Accommodations

It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have documented disability conditions (e.g., physical, learning, psychiatric, vision, hearing, or systemic) that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact Disability Services and their instructors for a confidential discussion of their individual need for academic accommodations. Disability Services is located in Suite 180 McNamara Alumni Center, 200 Oak Street. Staff can be reached by calling 612-626-1333 voice or TTY.

### 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 or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website at <http://www.mentalhealth.umn.edu>.

### Classroom Conduct

All students at the University have the right to a civil, productive, and stimulating learning environment. In turn, instructors have a responsibility to nurture and maintain such an environment. Lively, even heated, discussion is not disruptive behavior. Both instructors and students have a fundamental obligation to respect the rights of each other and an equally fundamental obligation to respect the instructional setting as a place for civil, courteous behavior. Teaching and learning are vital to the mission of the University. The University believes teaching responsibilities to be of primary importance for its instructors (faculty, graduate teaching assistants, instructors, teaching specialists, etc.) such that performance by instructors shall be taken into consideration in determining salary increases, tenure, retention, and promotion.

See <http://www1.umn.edu/usenate/policies/classexpectguide.html>

and [http://www1.umn.edu/regents/policies/academic/Student\\_Conduct\\_Code.pdf](http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.pdf).

### Academic Misconduct

Scholastic misconduct is broadly defined as "any act that violates the rights of another student in academic work or that involves misrepresentation of your own work." Scholastic dishonesty includes, (but is not necessarily limited to): cheating on assignments or examinations; plagiarizing, which means misrepresenting as you own work any part of work done by another; submitting the same paper, or substantially similar papers, to meet the requirements of more than one course without the approval and consent of all instructors concerned; depriving another student of necessary course materials; or interfering with another student's work. See [http://www1.umn.edu/regents/policies/humanresources/Academic\\_Misconduct.pdf](http://www1.umn.edu/regents/policies/humanresources/Academic_Misconduct.pdf)

Academic dishonesty in any portion of the academic work for a course shall be grounds for awarding a grade of F or N for the entire course.

### Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature when: (1) submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic advancement in any University activity or program; (2) submission to or rejection of such conduct by an individual is used as the basis of employment or academic decisions affecting this individual in any University activity or program; or (3) 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. University policy prohibits sexual harassment. Complaints about sexual harassment should be reported to the University Office of Equal Opportunity, 419 Morrill Hall.  
See <http://www1.umn.edu/regents/policies/humanresources/SexHarassment.pdf>.

## University Senate Grading Policy

Grades will be assigned following University policy:

- A achievement that is outstanding relative to the level necessary to meet course requirements.
- B achievement that is significantly above the level necessary to meet course requirements.
- C achievement that meets the course requirements in every respect.
- D achievement that is worthy of credit even though it fails to meet fully the course requirements.
- S 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.
- I (Incomplete) 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. Requires a written agreement between instructor and student.

Academic dishonesty in any portion of the academic work for a course shall be grounds for awarding a grade of F or N for the entire course.

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.

See <http://www.fpd.finop.umn.edu/groups/senate/documents/policy/gradingpolicy.html>.

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This publication/material is available in alternative formats upon request. Please contact the Educational Psychology Department, 250 Education Sciences Building, 612-624-6083.

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