

EPSY 8268: Hierarchical Linear Modeling in Educational Research

Fall Semester, 2017

Tuesdays & Thursdays, 11:15 – 12:30

Instructor: Michael C. Rodriguez

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Web: <http://www.edmeasurement.net/8268>

Classroom: Peik Hall 335

Office: 170 Education Sciences

Office Hours: Monday 12-2

Or by appointment

Text:

Raudenbush, S.W., & Bryk, A.S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods* (2nd ed.). Newbury Park, CA: Sage.

Software (student version):

Raudenbush, S.W., Bryk, A.S., & Congdon, R. (2013). *HLM 7.01 for Windows. Student version*. [Computer software]. Skokie, IL: Scientific Software International, Inc.



<http://www.ssicentral.com/hlm/student.html>

The Course:

Conceptual framework of hierarchical linear models for nested data, their application in educational research. Nature/effects of nested data, logic of hierarchical mixed-effects linear and nonlinear models. Estimation/hypothesis testing in these models and model-checking. Prerequisites: [8252 or equiv] - Solid knowledge of regression models.

Primary Course Objectives:

By the end of the course, students will be able to

- read the applied literature on hierarchical linear modeling and applications of HLM and assess its completeness and adequacy
- conduct analysis of nested data with HLMs for continuous and categorical outcomes
- employ HLMs to address substantive research questions
- interpret results of HLMs, including all parameter estimates, variance components, and hypothesis test results
- conduct diagnostic analyses to evaluate the adequacy of a HLM

Other Resources

The course will rely on the HLM7 program by Raudenbush, Bryk, & Congdon (2011). Good introductory sites for HLM7 are

http://www.ats.ucla.edu/stat/hlm/seminars/hlm_mlm/608/mlm_hlm_seminar_v608.htm and http://www.sagepub.com/upm-data/47529_ch_3.pdf.

A free student version of HLM7 is available at <http://www.ssicentral.com/hlm/student.html>. This includes a full copy of the HLM7 Manual and help file, as well as all examples distributed with the full HLM7 edition, all of which can be run with the student version.

The student version of HLM7 includes all of the analysis capabilities of the full version, with some limits in terms of numbers of units per level. These include:

- For a level-3 model, the maximum number of observations that may be used at levels 1, 2 and 3 is approximately 8000, 1700 and 60, respectively. Note that the restriction applies to observations in the case of the level-2 file, for example, and not to the actual number of level-2 units to be included in the analysis.
- For a level-2 model, the maximum number of observations at the two levels is 8000 at level-1 and 350 at level-2 of the hierarchy.
- No more than 5 effects may be included in any HLM equation at any level of the model, and the grand total of effects cannot be 25 or higher.

Another widely used multilevel program is the lmer package in R. R is a free software environment for statistical computing and graphics (start at <http://www.r-project.org>).

Good general resources for R include *simpleR* (Verzani, 2002), a tutorial at <http://www.ats.ucla.edu/stat/r/seminars/intro.htm>, *R for dummies* (Meys & de Vries, 2012), *Discovering statistics using R* (Field, Miles, & Field, 2012), the Rkward website http://sourceforge.net/apps/mediawiki/rkward/index.php?title=Main_Page, and online tutorials available at <http://www.r-bloggers.com/list-of-free-online-r-tutorials/>.

A paper by Albright and Marinova (2010) provides an introduction to using HLM and R to fit multilevel models and can be downloaded from <http://www.indiana.edu/~statmath/stat/all/hlm/hlm.pdf>.

Note that computer syntax and programming will not be taught.

Other Texts:

[Gelman, A., & Hill, J. \(2006\). *Data analysis using regression and multilevel/hierarchical models*. Cambridge, UK: Cambridge University Press.](#)

Hox, J. (2010). *Multilevel analysis, techniques and applications*. New York, NY: Routledge.

Longford, N. (1993). *Random coefficient models*. Oxford, UK: Clarendon.

McCulloch, C.E., & Searle, S.R. (2001). *Generalized, linear, and mixed models*. New York, NY: Wiley.

Snijders, T., & Bosker, R. (2011). *Multilevel analysis: An introduction to basic and advanced multilevel modeling* (2nd ed). London, UK: Sage.

EPSY 8268 Topic & Reading Schedule 2017
 Tuesdays/Thursdays / 11:15-12:30PM / Peik Hall 335

September		
Topics and Assignments:		
5	Background	Review of the statistical analysis paradigm and regression assumptions. Review of GLM-based regression estimators, OLS and WLS;
7	RB 1-2 Osborne (2000) [HLM advantages] Woltman (2012) [tutorial]	Logic of HLM Introduction to multilevel models; TIMSS data; examples of multilevel models; linear mixed models; design-based vs model-based inference; one-way random effects ANOVA
12	RB 3 Meink & Rodriguez (2013) [cluster <i>r</i>] Myung (2003) [MLE]	Estimation & hypothesis testing variance component estimation and hypothesis testing
14		Creating HLM data files: How to set up data files in SPSS and R
19	RB 4 Enders & Tofighi (2007) [centering] Rodriguez (2004) [TIMSS]	An illustration Unconditional model; Random intercept models; centering issues; standardizing fixed effects {Assignment 1: HSB}
21		
26		{Assignment 2: non-HSB data, Means as outcomes}
28		
October		
3	RB 5 Lee & Bryk (1989) [social distribution]	Applications in organizational research Parameter estimation in multilevel models; explained variance; model checking; comparing fitted models {Assignment 3, Intercepts & slopes as outcomes}
5	Braun, Jenkins, & Grigg (2006) [charter schools] Garner & Raudenbush (1991) [neighborhood effects]	
10		Heterogeneous Level-1 variance Compositional effects Effects of individual organizations (groups)
12		Model misspecification

17	RB 6 Taylor (2003) [reading growth] Harwell et al. (2013) [high school math]	Applications in individual change {Assignment 4}
19		Complex data and alternatives
24	RB 8	Three-level models {Assignment 5: Sustaining Effects Study, Ch.4}
26	Jameel (n.d.) [power] Spybrook (2011) [OD]	Applications of two- and three-level models with random intercepts and slopes; deviance test for model building; a priori power/sample size calculations using the Optimal Design software
31	RB 9 Hahs-Vaughn (2005) [using weights]	Assessing the adequacy of HLM Handling missing data, design weights {Assignment 6}
November		
2	RB 10	Hierarchical generalized linear models {Assignment 7: Thai Study, Ch.8 binomial; TCHR1+THCR2, Ch.8 ordinal}
7		
9	RB 11	Latent variables regression {Assignment 8: NYS, Ch.11}
14	Albano & Rodriguez (2013) [eirm]	Measurement models
16	RB 7 Rodriguez (2005) [MA of correlations]	Applications in variance-known models (meta-analysis) {expect.dat, Ch.11}
21		{Critique due this week for possible resubmit}
23	<i>Thanksgiving</i>	
28	RB 12	Cross-classified random effects models {Project due for possible resubmit} {attain data, Ch.13; & growth data, Ch.15}
30		
December		
5	Presentations	
7	Presentations	
12	Presentations	
13	<i>Last Day of Classes</i>	

RB = Raudenbush and Bryk,

Requirements:

Readings. You are encouraged to read the assigned portions of the textbook prior to discussion in class. We will not cover all of the material in the text during class discussion—you are responsible for material covered in the textbook and class.

Quizzes. Throughout the course, there will be a few quizzes. The quizzes will be used for class discussion only – these are not counted in final grades.

Class Assignments.

- There are eight analysis exercises based on examples in Raudenbush & Bryk each worth 15 pts (60% of the total grade). The analyses exercises can be completed in small groups (no more than 3 per group); each group should submit one single assignment. Two of the exercises may be resubmitted for full credit, as long as they are initially completed and graded prior to Thanksgiving. Exercises are due one week following their assignment (the date for which they are listed on the syllabus schedule is their assignment date).
- A written critique of a published HLM study worth 20 points (15%). The written critique may be completed in a small group (no more than 3). We will use the AERA [Standards for Reporting on Empirical Social Science Research](#) as a guide for the critique. The critique is due by December 13.
- A final project worth 30 points (25%). The final project should be completed alone – as this is an important opportunity to practice a complete HLM analyses. The final project may be resubmitted for full credit – as long as the first submission is received prior to Thanksgiving. The final project is due by December 13.

In total, here is a summary of course evaluation tools:

- Analyses exercises, approximately 120 points, 60% of course grade
- HLM article critique, 40 points, 15% of course grade
- Final project, 50 points, 25% of course grade

Format for Submitting Assignments via EMAIL:

Submit assignments in Word format, in an email message with EPSY8226 in the subject line, using the following document naming system:

Lastname-EPSY8268-assignmentname-yearmonthday.docx

For example: **Kaler-EPSY8268-assign1v1-20170919.docx**

This indicates a document from Kaler for assignment 1 version 1 2017 September 19.

Note on Grading Policy:

Evaluation of successful achievement of the course objectives is based on a grading policy that is focused on learning. The focus is on achievement of the learning objectives. For this reason, some assignments can be resubmitted for evaluation of understanding and learning.

Instruction:

Most class sessions will include lecture on key points of the day's topic(s) and a period of questions and answers. Several sessions will include small group work (e.g., time to review text book material and others presented in class). As the instructor, I assume the following responsibilities: to present material in a clear and contextualized format, to provide opportunity for students to pursue additional clarification in and out of class, to develop and employ fair and meaningful assessment activities, to use results of evaluation activities for instructional feedback and course planning, and to provide opportunities for recourse if students believe they have been unfairly evaluated.

Technology:

Technology is becoming increasingly important in education and we will pursue learning with the aid of technology in several ways. Students will be allowed to submit assignments electronically. Students are encouraged to investigate related web sites to support their reading and assignment work. Additional readings and resources are provided at the class website. During discussions of data analysis, computer demonstrations will be conducted in class to illustrate various HLM topics and methods. During the second week of the course, one class session will be held devoted to conduct hands-on computing using software to complete the HLM analysis exercises.

Diversity:

The College of Education and Human Development is committed to have every course contribute to our understanding of diversity, including but not limited to: age, creed, disability, ethnicity, gender, global perspectives, international background, language background, learning differences, marital status, multicultural perspectives, national origin, public assistance status, race, religion, sex, sexual orientation, and veteran status. Each of these characteristics plays a role in educational and psychological research. They are factors that contribute to individual and group differences -- they (may) affect the constructs we set out to measure and the way we interpret and report research results. These issues will be addressed throughout the course and will be used as topics of debate and considerations of model specification, as we continue to understand the role of individual and group differences.

Late Work and Incompletes

No points will be deducted for late work. It is up to you to stay on track. An incomplete (I) will be assigned only if agreed to prior to the last week of class. If at the end of the semester course work is incomplete and no prior notification has been given, the grade based on points obtained at that time will be awarded. No options will be given at that point to submit incomplete work.

Makeup Work for Legitimate Absences:

Students will not be penalized for absence during the semester. For complete information about the university absence policy, please see:

<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Returning Papers, Exams, and Projects

Given the size of the class and the extensiveness of student projects, I will try to return work within one week of the due date. If necessary, you may pick up work prior to the following class period if agreed upon. If, at the end of the semester, you would like to receive remaining work through U.S. mail, submit a self-addressed stamped envelope. Otherwise, you may pick up final projects once grades are submitted in the Psychological Foundations' office in 250 Education Sciences Building with a student ID. Papers will be available there until February 1. Uncollected papers will be destroyed just prior to fall semester the following year.

Academic dishonesty: 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.

University Grading Policy

<https://policy.umn.edu/education/gradingtranscripts>

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.

Letter Grade	Percentage
A	95-100%
A-	90-94.9%
B+	85-89.9%
B	80-84.9%
B-	75-79.9%
C+	70-74.9%
C	65-69.9%
C-	60-64.9%

How to Access Your Grades

Go to OneStop for Students (<http://onestop.umn.edu/onestop/>), click on Grades & Transcripts; on the right side under Quick Links, click on Grades/Unofficial transcript.

Workload Expectation (Policy: [Expected Student Academic Work per Credit](#))

The Senate affirms the standard (first adopted by the University Senate on February 16, 1922, and reaffirmed 1993) that one semester credit is to represent, for the average University of Minnesota undergraduate student, three hours of academic work per week (including lectures, laboratories, recitations, discussion groups, field work, study, and so on), or approximately 45 hours of work over the course of an enrollment period. Expectations of faculty and students will be made clear. 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.

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/regents.umn.edu/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/education/instructorresp>.

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.

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://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html> for University policies related to Teaching and Learning – Student Responsibilities.

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, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

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.

<http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Appropriate Student Use of Class Notes and Course Materials

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>

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://regents.umn.edu/sites/regents.umn.edu/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action

The University provides 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://regents.umn.edu/sites/regents.umn.edu/files/policies/Equity_Diversity_EO_AA.pdf

Disability Accommodations

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact Disability Resource Center at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with Disability Resource Center and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

<https://diversity.umn.edu/disability/>.

Mental Health and Stress Management:

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 via the Student Mental Health Website:

<http://www.mentalhealth.umn.edu>.

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 and conduct relevant research. 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.* When conducting research, pertinent institutional approvals must be obtained and the research must be consistent with U. policies.

Reports of concerns about academic freedom are taken seriously. There are individuals/offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of CEHD, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

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

College of Education & Human Development Mission Statement

The mission of the University of Minnesota College of Education and Human Development is to contribute to a just and sustainable future through engagement with the local and global communities to enhance human learning and development at all stages of the life span.

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.

Quantitative Methods in Education Mission Statement

To prepare students to become cutting-edge professionals in educational measurement, evaluation, statistics, and statistics education, through excellence in teaching, research, and service; and through investigating and developing research methodology in education.

Six Intellectual Principles of Ph.D./Ed.D./Master's Research Education

(Currently under review)

1. *Scholarly Formation*
2. *Communication*
3. *Leadership and Collaborative Skills*
4. *Global Context*
5. *Professional Responsibility*
6. *Personal and Professional Management Skills*

The College Commitment to Diversity and Inclusion:

We affirm the contributions of all people in our community. Diversity and equity are at the core of our mission in the College of Education and Human Development.

We explicitly reject bias, discrimination, and exclusion on the basis of race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression.

We all are responsible for recognizing, confronting, and addressing bias and discrimination and diligently working for positive change in support of equity and diversity.