Instructor

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Course Overview

This two-day course will provide an introduction to multilevel models (also known as hierarchical linear models [HLM] and random-coefficient, random-effects, or mixed-effects models). Multilevel models are used when the units of observation (e.g., students) are grouped (or “nested”) within clusters (e.g., schools). In such clustered data, observations for the same cluster cannot be assumed to be mutually independent for given covariate values as required for conventional regression models. To allow for the fact that responses within the same cluster tend to be more similar to each other than to responses from other clusters, hierarchical models include cluster-specific random effects. Longitudinal or repeated measures data can also be thought of as clustered data with measurement occasions clustered within subjects; hierarchical models for longitudinal data are also known as growth curve models.

The intended audience for this course is anyone who has completed an introductory course on regression, and wishes to become familiar with the concepts and procedures of multilevel models, possibly as preparation for more advanced study. Special attention will be paid to sociological, educational, and psychological applications, though the course will provide an appropriate introduction for applications in any social or behavioral science.

The focus of the course will be on understanding statistical models and their assumptions, as well as practical aspects of specifying and estimating models to address research questions and interpreting and reporting on the findings.

Course Structure

By the end of this course, participants should have a basic familiarity with the scope and purpose of multilevel models, and should be able to identify situations in which different kinds of multilevel models can be appropriately applied. Participants will also gain a basic familiarity with the specification, estimation, and interpretation of multilevel models in Stata.

The course will begin with a brief but vigorous review of the core principles and assumptions of parametric statistical models in general, and linear regression in particular. We will then discuss the motivations for multilevel models, the concepts of fixed and random effects, and the various types of multilevel models (including variance component models, random intercept models, and random coefficient or mixed models). We will consider a variety of examples, both organizational and longitudinal, and will focus on the connections between statistical models and substantive research questions.
Due to the brevity of the course, we will consider only linear models (which are appropriate for continuous response variables). Also, we will limit our attention to models with two levels. The basic concepts covered here can later be generalized to more complex situations. The instructor will be available to facilitate such efforts by suggesting additional resources tailored to individual interests.

Expectations

Participants in this course are expected to have a familiarity with basic issues in research design and statistics commensurate with what is normally covered in a two-semester quantitative method sequence (i.e., through multiple regression). Familiarity with the basics of social science measurement (e.g., instrument design, item formats, item analysis, reliability and validity) will be helpful, but is not a requirement. Though knowledge of calculus and matrix algebra will make it easier to understand some of the technical issues at a deep level, we will not assume that participants have such knowledge (and indeed, such knowledge is not necessary for the average user of multilevel models).

To get the most out of the course, participants should have Stata installed on their laptops. If you are a university student, you can obtain a Stata/IC 12 license for $65 (six months) or $179 (perpetual) through the GradPlan.

There are other software programs that fit multilevel models, and the use of Stata is not a requirement if a participant has a preferred software package. However, a fair amount of the course will focus on getting models to run in Stata.

Assignments

The primary deliverables associated with the course will be three problem sets, due by July 5. We will begin all three of these in the course as exercises; students will then be expected to complete the problem sets following the course.

The three problem sets are designed to integrate the use of Stata to specify and estimate models, the interpretation of model output, and the broader interpretation of the connections between statistical models and research questions. Each of the three problem sets will focus on a specific topic: (1) variance-component models, (2) random-intercept models, and (3) random-slope models. Detailed feedback will be sent to each participant, with the option to revise and receive one additional round of feedback.

Recommended Readings


All three of the above-listed books provide excellent introductions to multilevel models. I would recommend that you pick only one of them (at least to begin with). They are listed in order of my personal preferences. Rabe-Hesketh and Skrondal not only provide an introduction to multilevel models that is simultaneously clear and rigorous, but their book is well-integrated with Stata 12, showing the commands for the models as they are introduced. Singer and Willett focus specifically on multilevel models for longitudinal data, and their book is arguably the best-organized from a pedagogical point of view. Raudenbush and Bryk is a classic, and is especially well-suited for students with a strong mathematical background.

Reasonable Accommodation

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, or refer to www.colorado.edu/disabilityservices

Religious Observances

I will make every effort to accommodate all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or other required attendance, provided 7 days advance notification of the conflict is given. For additional information on this policy, see http://www.colorado.edu/policies/fac_relig.html

Classroom Behavior, Discrimination and Harassment, and Academic Honesty

Students and faculty each have responsibility for maintaining an appropriate learning environment. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See polices at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

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limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academics/honorcode/