

APSTA-GE 2042 Advanced Topics in Quantitative Methods: Marc Scott
Multi-Level Modeling – Nested and Longitudinal Data (2 points) Spring 2022

Lecture: Tuesday 4:55-7:20pm (2nd 7 weeks of term) Office: 207W Kimball Hall
Location: Silver, Room 414 Phone: 212-992-9407
Primary Course Assistant: Kwan Bo (Joseph) Shim (ks6017@nyu.edu) email: marc.scott@nyu.edu
Office Hours: Tuesday 3:45-4:40pm, Kimball 2nd Floor Conference Room
TA Office Hr.: Wednesday: 12-1pm, via Zoom.
Optional Texts: Bryk and Raudenbush, *Hierarchical Linear Models: Applications and Data Analysis Methods*; Rabe-Hesketh and Anders Skrondal, *Multilevel and Longitudinal Modeling Using Stata (Volume 1)*.
Software: R
Note: This course will use NYU Brightspace. **Email is the preferred form of communication.**

COURSE OVERVIEW: This is a course on models for multilevel nested data. These data arise in nested designs, which are quite common to education and applied social, behavioral and policy science. Traditional methods, such as OLS regression, are not appropriate in this setting, as they fail to model the complex correlational structure that is induced by these designs. Proper inference requires that we include aspects of the design in the model itself. Moreover, these more sophisticated techniques allow the researcher to learn new and important characteristics of the social and behavioral processes under study. In this module, we will develop and fit a set of models for nested designs (these are sometimes called hierarchical linear models). The course assignments will use state of the art statistical software to explore, fit and interpret the models.

COURSE PREREQUISITE: APSTA-GE 2003; APSTA-GE 2004 or 2122 recommended

COURSE REQUIREMENTS:

Participation:	20%	You are expected to attend class and participate in class discussions. The bulk of the participation points are determined by a weekly Brightspace Forum with Topic Questions, also given in a Google Doc. Weekly participation in this monitored forum is required for participation credit and it will be “scaled” to reflect amount/quality of participation.
Shiny Apps:		You are expected to review these outside of class time. They are intended to making concrete many of the abstract ideas. We will sometimes use office hours or even class time to review them. See Brightspace for the timing of these with respect to the Handouts.
Homework problems:	35%	There will be 4 problem sets that will require some computing, analysis, and interpretation. There are two aspects to homework: i) online entry of responses ; ii) Attachment of PDF to confirm your work. This is due before class as per the schedule, below. iii) We post solutions/suggestions 24 hours later; iv) You annotate and resubmit your PDF 48 hours later based on those. Rmd templates including annotation examples are on Brightspace (assignments).
Simulation-Project:	15%	There will be a simulation-based project, likely involving missing data.
Project:	30%	There will be a large data analysis project (and write-up) instead of a final exam. Completed in teams.

COURSE HANDOUTS: Handouts will be available on NYU Brightspace. It is the student’s responsibility to download and review the notes before coming to class.

COURSE READINGS: There is no assigned text for this course, but students are encouraged to purchase AT LEAST ONE of the two optional texts mentioned above. Bryk & Raudenbush (BR) is considered one of the ‘classic’ texts in MLMs. HANDOUTS for every class are annotated lecture slides – you should make every effort to read these before class and then again afterwards, to be sure that you fully understand the material. We only cover a portion of each handout in class, so ask questions in class, in office hours, or through email.

Suggested readings are posted in the schedule – they are useful readings, *but only roughly match* the weekly topics. Rabe-Hesketh & Skrondal (RS) is a newer book that is linked to the STATA package, and

thus could prove a very useful reference. It has good discussion of the topics as well, but in more technical terms. Chapter 1 of RS is a good review of regression, and we will cover parts of chapters 2-4, 10 & 11. Readings from two chapters of the Sage Handbook of MLM will be made available through Classes.

Late assignment policy: **Assignments are to be handed in on time (10% grade penalties will be imposed every day of lateness – please plan accordingly).**

SCHEDULE for Spring 2022

<i>Date</i>	<i>Topic</i>	<i>Book chapters</i>	<i>Readings</i>
March	22 The logic of hierarchical models; Model specification; variance components; Maximum Likelihood Estimation	BR 1,2; RH 2	Handout 1; Chap 1 MLM Handbook (skip tech. parts)
	29 What are random effects? Different notations/conceptualizations	RH 2,3	Handout 2; Chap. 2 MLM Handbook
April	5 Model selection using likelihood ratio tests; Random slopes/implicit interactions; HW 1 due	BR 3,4; RH 4	Handout 3; Peugh
	12 Random slopes (redux), BLUPs, types of residuals; HW 2 due		Handout 4
	19 Non-linearity; non-nested models; targeted variance, pseudo-R ² ; Nested longitudinal data (intro.); HW 3 due	BR 4,5; RH 2,4 and RH 10,11 (2 nd Ed) or RH 8,9 (3 rd Ed.)	Handouts 4 & 5; Cheng, et al.
May	26 Nested longitudinal data (wrap-up)	BR 8	Handout 5
	3 Centering; hybrid models; The choice between fixed and random effects; HW 4 due	BR 5; RH 3	Handout 6
	6 Simulation-project due (this is a Friday)		
	13 FINAL PROJECT due (this is a Friday)		