**APSTA-GE 2040 Advanced Topics in Quantitative Methods:** Marc Scott

**Multi-Level Modeling – Growth Curves (2 points)**  Fall 2019

Lecture: Tuesdays 3:30-6:10 pm (first 7 weeks)[[1]](#footnote-0) Office: 207 Kimball Hall

Location: Bobst LL-138 Phone: 212-992-9402

Office Hours: Tuesdays 2:30-3:30 pm, and by appointment email: marc.scott@nyu.edu

Text: Singer & Willett, *Applied Longitudinal Data* Analysis (optional, but recommended)

Software: R or STATA

Note: This course will use NYU Classes. Email is the preferred form of communication. If you call my office phone, it is best to email me as well. If you can begin the subject of your email, “APSTA-GE: 2040” that will help me to prioritize it.

COURSE OVERVIEW: This is a course on models for multilevel growth curve data. These data arise in longitudinal 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 longitudinal designs (these are often called growth curve models). The course assignments will use state of the art statistical software to explore, fit and interpret the models.

COURSE PREREQUISITE: APSTA-GE 2004 (Advanced Modeling I: Topics in Multivariate Analysis) or equivalent. ***Consult with the instructor if you wish to substitute an alternative.***

COURSE OBJECTIVES:

* Gain mathematical vocabulary attached to these concepts: statistical model and data generating process; multilevel model (MLM); random and fixed effects; variance components
* Read and write the equations associated with MLMs
* Fit and interpret MLMs using STATA or R statistical software
* Perform goodness of fit tests via simulation and residual diagnosis
* Use model selection techniques to choose appropriate covariance models

SOFTWARE: Students should have mastery of EITHER STATA or R at the level of an intermediate regression class so that they can pick up the MLM conceptually and add new software commands to their repertoire easily. STATA should be at the level of this e-book: <https://stats.idre.ucla.edu/stata/webbooks/reg/> R should be at a similar level. Two resources are: <https://www.datacamp.com/courses/free-introduction-to-r> (free intro) and <https://www.datacamp.com/courses/r-for-sas-spss-and-stata-users-r-tutorial> (this one costs money).

COURSE REQUIREMENTS:

Participation: 20% You are expected to attend class and participate in class discussions. Some of the participation will be formalized through online discussions.

Homework problems: 50% There will be 4 problem sets that will require some computing, analysis, and interpretation.

Project: 30% There will be a data analysis project (using US election data) instead of a final exam.

DATA ANALYSIS PROJECT: A curated dataset is provided to the students, along with a series of questions that evaluate mastery of the course objectives stated above. Some questions cover core concepts (in lieu of a final exam), while others require introspection and synthesis of findings. Students work in groups to foster debate and communication skills. Separate and group evaluations are made using a rubric built into the assignment (students are assigned to specific questions; a complete write up is made by all members of the group).

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

COURSE READINGS: Weekly readings from the optional course text will be suggested. We cannot review material from the book during lecture, so it is essential for you to ask any questions about it in class. In addition, there may be some supplemental readings in the form of journal articles or book chapters.

LATE ASSIGNMENT POLICY: Assignments are to be handed in on time.

PARTICIPATION: Class time is divided into lecture, question and answer and practical experience. Participation in each of these activities is tracked during the semester using a simple rubric (1=absent; 2=present/minimally active; 3=active). Always active students receive 100% for participation while always absent would receive 0%.

BASIS OF GRADE: After weighting participation, homework and project by the above fractions and converting to a 100% basis, letter grades are assigned as follows:

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| --- | --- | --- | --- | --- |
| A: 95-100  | B+: 86.5-89.99  | C+: 76.5-79.99 | D+: 65-69.99  | F: Below 60 |
| A-: 90-94.9 | B: 82.5-86.49 | C: 72.5-76.49 | D: 60-64.99  |  |
|  | B-: 80-82.49 | C-: 70-72.49 |  |  |

SCHEDULE

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| --- | --- | --- | --- |
|  | Week | *Topic* | *S&W Chapters* |
|  |  |  |  |
|  | Sept. 3 | Intro to multi-level modeling as distinct from OLS regression; data structures; introduction to model building.  | 1,2,3 |
|  | Sept. 10 | Growth curve models: specification, simulation, fitting | 3 |
|  | Sept. 17 | More complex random effects distributions; model-based predictions, including BLUPs | 3 |
|  | Sept. 24 | Exploratory techniques; model comparison/selection, GAMM (intro) | 2,4 |
|  | Oct. 1 | Time-varying predictors; variance components (estimation, interpretation); Between & within “explained variance”; residuals | 5, 6 |
|  | Oct. 8 | Case Study: Election 2016 [primarily group work] |  |
|  | Oct. 15 | NO CLASS |  |
|  | Oct. 22 | Heterogeneous error structures; GLMM (intro) OR some project work | 7 |

ASSIGNMENT SCHEDULE

|  |  |  |
| --- | --- | --- |
|  | Week | *Assignment*  |
|  | 1 | Read Handout 1 before class |
|  | 2 | Read Handout 2 before class |
|  | 3 | HW #1 DUE; Read Handout 3 before class |
|  | 4 | HW #2 DUE; Read Handout 4 before class |
|  | 5 | Read Handout 5 before class |
|  | 6 | HW #3 DUE; Read Handout 6 before class; familiarize yourself with the election2016 dataset |
|  | 7 | No Class, but HW #4 DUE |
|  | 89  | Read Handouts 7a, 7b. Final Proj. Due (Oct. 29) |

OPTIONAL COURSE PRACTICUM: Students are strongly encouraged to enroll in APSTA-GE 2041, a practicum in multi-level growth curve models, offered in the second half of this term, in which guided research projects using the skills developed in this course are developed more fully.

STUDENTS WITH DISABILITIES:

Academic accommodations are available for students with disabilities.  Please visit the Moses Center for Students with Disabilities (CSD) website at [www.nyu.edu/csd](http://www.nyu.edu/csd) and click on the Reasonable Accommodations and How to Register tab or call or e-mail CSD at (212-998-4980 or mosescsd@nyu.edu) for information.

MENTAL HEALTH AND WELLNESS:

If you are experiencing undue personal and/or academic stress during the semester that may be interfering with your ability to perform academically, The NYU Wellness Exchange (212 443 9999) offers a range of services to assist and support you. I am available to speak with you about stresses related to your work in my course, and I can assist you in connecting with The Wellness Exchange. The Wellness Exchange offers drop-in services on campus on a regular basis. You can find more information at <https://www.nyu.edu/students/health-and-wellness/wellness-exchange.html>. Additionally, if you anticipate any challenges with completing the assignments, readings, exams and other work required in this course, I encourage you to register with The Moses Center (212 998 4980) in advance so that you may be granted the proper academic accommodations.

ACADEMIC INTEGRITY:

All students are responsible for understanding and complying with the NYU Steinhardt Statement on academic integrity. The statement is available at <https://steinhardt.nyu.edu/statement-academic-integrity>.



1. The class meets for 7 weeks of lecture during the first half of the semester. An optional practicum class (APSTA-GE 2041) meets during the last 7 weeks. See last page of this syllabus for details. [↑](#footnote-ref-0)