Keck School of Medicine of USC

# PM 603: Structural Equation Modeling

Units: 4
Term: Fall 2023, Tues 10:00AM – 12:50PM
Location: SSB 117
Instructors: Jimi Huh (jimihuh@usc.edu)
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## Course Overview

### Course Description

This course will teach students statistical techniques for factor analysis, structural equation modeling, and other latent variable approaches. Latent variable approaches are appropriate for statistical models using unobservable variables (constructs, factors), often seen in health behavior, education, and sociology. The class culminates in a project paper that is typically geared toward the student's PhD research. Mplus software is used.

### Learning Objectives

Upon completion of this course, students will be prepared to:

1. Use factor analysis to assess underlying psychological constructs.
2. Understand the process of data dimension reduction.
3. Define and run multivariate statistical models, such as with path analysis.
4. Adopt correct Mplus procedures for the selected statistical approaches.
5. Combine observed and latent variables to produce a structural equation model.
6. Evaluate and describe the fit of such models.
7. Use a deliberate strategy to modify models, as appropriate.

### Course Preparation

| | |
|---|---|
| Prerequisites | PM511B or permission of instructor |
| Co-Requisites | NA |
| Recommended Preparation | The course assumes a background in generalized linear modeling, and familiarity with at least one statistical programming language. |

### Course Format

This course will follow a weekly lecture format, with the first part of class being devoted to an interactive live lecture and the second part consisting of lab-type activities such as programming. There will be weekly lab work and assignments, and a final project.

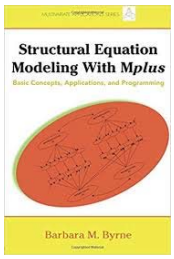
## Course Requirements

### Communication

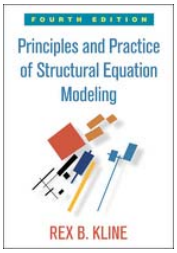
Blackboard (lecture slides, labs, data sets, assignment submission), USC e-mail (formal communication), Slack (informal communication)

### Required Textbooks

Note: Textbooks may be available through the USC Libraries (libraries.usc.edu)

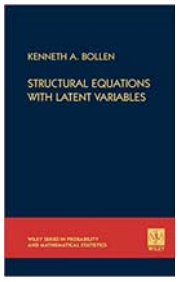



Byrne BM. Structural Equation Modeling with Mplus: Basic Concepts, Applications, and Programming. Routledge, 2013.




Kline R. Principles and Practice of Structural Equation Modeling, 4th Edition. The Guilford Press, 2015.

### Optional Textbooks




Bollen KA. Structural Equations with Latent Variables. Wiley, 1989.

### Required Software

Mplus Version 8.10 Combination Add-On
This course will be taught in Mplus. The product comes in a demo version and also has student pricing. We recommend checking with your department and/or lab to see if they offer this software. This program may also be available through USC Cloudapps (https://cloudapps.usc.edu).
We also use the Mplus User's Guide, available online (https://www.statmodel.com).

## Assessments

### Grading Breakdown

| Category | Percent |
|---|---|
| Assignments | 35% |
| Labs | 15% |
| Project Presentation | 10% |
| Project Paper | 40% |
| Total | 100 |

| Grade Range (%) | Letter Grade | Grade Range (%) | Letter Grade |
|---|---|---|---|
| [93, 100] | A | [73, 77) | C |
| [90, 93) | A- | [70, 73) | C- |
| [87, 90) | B+ | [67, 70) | D+ |
| [83, 87) | B | [63, 67) | D |
| [80, 83) | B- | [60, 63) | D- |
| [77, 80) | C+ | [0, 60) | F |

### Description of Assessments

**Assignments** Assignments will involve the practical application of class concepts on actual data, and a proposal for your course project. We may discuss assignments collaboratively in class on the due date—therefore, late assignments will generally not be accepted. Under rare circumstances late assignments may be accepted with instructor approval and points will be deducted. Assignments should be typed and legible. You may work with your peers, but any form of plagiarism is unacceptable, including copying results sections from books or producing the same explanations as your classmates.

**Labs** Weekly labs will involve the practical application of material learned in class, with time to work on problems and discuss in a group setting. Each week's lab session will be accompanied by a short multiple-choice and/or true-or-false quiz to ensure understanding of the week's content. The two lowest lab scores will be dropped.

**Project** The course project will involve synthesizing information you have learned from class and applying it to your own data. Students should obtain a data set, describe their research question, and formulate an analytic approach. Let an instructor know if you have difficulty obtaining a data set. Further instructions will be posted on Blackboard.

**Project Presentation** Students will give a 15-20 minute presentation of their term paper. The presentation will include a brief introduction, conceptual model, data set, results, and discussion. The presentation can be partly used to workshop feedback from classmates and instructors, but students should have a majority of the analyses and results to share.

**Project Paper** Students will submit a final paper using statistical techniques learned throughout the semester. The paper will include all sections of a traditional academic manuscript, but with heavier emphasis on the methods and results sections. Further instructions will be posted on Blackboard.

## Course Schedule

| | Topics | Byrne | Kline | Due |
|---|---|---|---|---|
| **Class 1** T 8/22 | **Course Introduction.** SEM principles, matrix algebra | 1 | | |
| **Class 2** T 8/29 | **Path Models.** Mediation effects, inconsistent mediation, parameter standardization, Mplus tutorial | 2 | 7 | HW1 |
| **Class 3** T 9/5 | **Exploratory Factor Analysis.** Shared variance, common factor model, geometric conceptualization | 3 | | HW2 |
| **Class 4** T 9/12 | **Confirmatory Factor Analysis.** The measurement model, covariance matrix hypothesis testing, model specification & identification (pt1), model evaluation (pt1) | 4, 5 | 13 | HW3 |
| **Class 5** T 9/19 | **Structural Equation Modeling I.** Model specification & identification (pt2), MIMIC models, model evaluation (pt2) | 6 | 11, 12 | HW4 |
| **Class 6** T 9/26 | **Structural Equation Modeling II.** Model modification, model comparison | 6, 7 | | Proposal |
| **Class 7** T 10/3 | **Structural Equation Modeling III.** Convergence, validity, multi-trait multi-method (MTMM) | 8 | | HW5 |
| T 10/10 | **Fall Recess.** | | | |
| **Class 8** T 10/17 | **Moderation Effects.** The multiple groups approach, measurement invariance | 9 | 16 | HW6 |
| **Class 9** T 10/24 | **Latent Growth Curve Modeling I.** Longitudinal research, diagnostics, SEM notation | 11 | 15 | * |
| **Class 10** T 10/31 | **Latent Growth Curve Modeling II.** Functional form of growth parameters, time-varying covariates, parallel process models | 11 | 15 | HW7 |
| **Class 11** T 11/7 | **Multilevel SEM.** Within- & between-groups effects, diagram notation | 12 | 17 | * |
| **Class 12** T 11/14 | **Mixture Modeling.** Latent class/profile analysis, latent transition analysis | | | HW8 |
| **Class 13** T 11/21 | **Class Presentations** | | | HW9 |
| **Class 14** T 11/28 | **Class Presentations** | | | |
| F 12/8 | **Class Paper Due** | | | |

*Students should use these weeks to make substantial progress on their final paper and presentation.

## Statement on Academic Conduct and Support Systems

**Academic Conduct:**
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

**Support Systems:**
*Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call*
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/

*National Suicide Prevention Lifeline - 1-800-273-8255*
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call*
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. https://engemannshc.usc.edu/rsvp/

*Sexual Assault Resource Center*
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

*Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086*
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

*Bias Assessment Response and Support*
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

*The Office of Disability Services and Programs*
Provides certification for students with disabilities and helps arrange relevant accommodations. http://dsp.usc.edu

*Student Support and Advocacy – (213) 821-4710*
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

*Diversity at USC*
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. https://diversity.usc.edu/

*USC Emergency Information*
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, http://emergency.usc.edu

*USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime*
Provides overall safety to USC community. http://dps.usc.edu