

# Introduction to this Course: Advanced Longitudinal Models

- Topics:
  - What to expect this semester
  - Requirements and responsibilities
  - Course software
  - Course topics

# What To Expect This Semester

- Building on PSQF 6271, this course will continue to expand your knowledge of **longitudinal models** → analysis of *repeated* observations from the same sampling *unit*
  - “Units” can (still) be anything: persons, schools, countries, animals...
  - “Repeated” can span any length of time (milliseconds to days to years)
  - “Units” need not be independent; outcomes need not be (fully) observed
- This will (still) NOT require anxiety-provoking behaviors like:
  - Calculating parameters by hand—computers are always better, and more advanced statistical methods cannot be implemented by hand anyway
  - Deriving formulas or results—it’s ok to trust the people who specialize in these areas to have gotten it right and use their work (for now, at least)
  - Memorizing formulas—it’s ok to trust the computer programmers who have implemented various statistical techniques (less so in R, though)
- It will (still) require learning and using **new language and logic**
  - **Language:** words, notation (symbols and equations), program syntax
  - **Logic:** decision guidelines for matching data and questions to models

# What To Expect This Semester

- I believe that **everyone is capable** and **can significantly benefit**\*\* from learning more types of quantitative methods!
- **Philosophy:** Focus on accessibility + mastery learning
  - This is why I don't use infrequent high-stakes tests to assess learning
- **Materials:** Unit = lecture + example(s); 8 units planned
  - **Lecture** slides present concepts—the (wordy) **what** and the **why**
  - **Example** documents: reinforce the concepts and demonstrate the **how using software**—STATA or R (your choice); a lot of *Mplus*!
  - All available at the [course website](#) (hosted outside of ICON)

\*\* **Benefits** include but are not limited to: Better research, more authorship opportunities, and actual money

# Course Requirements

- **Everything** is take-home, open-note, and untimed (except presentation)
- Late\* work will be accepted (–2 for HW; –1 for FA)
  - *\*Extensions granted if requested at least 2 weeks in advance*
  - HW due dates **may be pushed later** (to ensure approximately 1 week after covering the material before it's due), but never sooner
- **3 formative assessments (FA, 9 points) in ICON:** Top-of-head questions and story problems for structured review (will discuss answers in next class)
  - 3 points for an honest attempt to complete each FA (mostly without feedback)
  - An opportunity for you to request topics for further clarification and review
- **4 homework assignments (HW, 61 points):** Review + data analysis
  - **Written HW 1:** Answer questions as review (effort draft + accuracy draft)
  - **Online HW 2–4:** Unique canned datasets (made with a common story)
    - Practice data analysis based directly on examples given (no googling required)
    - **Computation** sections: Instant feedback, infinite attempts
    - **Results** (interpretation) sections: Delayed feedback, single attempt
- **1 project (30 points):** Apply what you've learned and present it to class!

# Our *Other* Responsibilities

- My job (besides providing materials and assignments):
  - **Answer questions** via email, in individual meetings, or in group-based zoom office hours—you can each work on homework during office hours and get (near) immediate assistance (and then keep working)
- Your job (in descending order of timely importance):
  - **Ask questions**—preferably in class, but any time is better than none
  - **Frequently review** the class material, focusing on mastering the vocabulary (words and symbols), logic, and procedural skills
  - Don't wait until the last minute to start homework, and don't be afraid to **ask for help if you get stuck** on one thing for more than 15 minutes
    - Please email me a screenshot of your code+error so I can respond easily
    - Start from my example syntax files (Find & Replace is your friend!)
  - **Do the readings** for a broader perspective and additional examples (best after lecture; readings are for the whole unit, not just that day)
  - **Practice** using the software to implement the techniques you are learning **on data you care about**—this will help you so much more!

# More About Your Experience in this Class

- **Attendance:** Strongly recommended but not required
  - **You choose each class:** In-person “roomer” or online “zoomer”
  - **Masks** are \*STRONGLY encouraged\* for in-person attendees
  - **Please do not attend in-person if you might be sick!**
  - You won't miss out: I will post **YouTube-hosted recordings** (audio + screenshare only) for each class at the [course website](#)
  - **Ask questions aloud or in the zoom chat window (+DM)** (even if you are attending class in person as a “roomer”)
- **Changes** will be sent via email by 9 am on class days
  - I will change to zoom-only if I am exposed to Covid!
  - I will change to zoom-only for dangerous weather
  - NOTHING is more important than our health and safety...

# Class-Sponsored Statistical Software

- To help address the needs of different Iowa degree programs, I will show “**univariate**” examples using **STATA and R** software
  - “**Univariate**” → predict one longitudinal (observed) outcome at a time (as can also be done using SAS MIXED, SPSS MIXED, HLM, or MLwiN)
  - If you have **STATA or R tips**, please share them with me!
- **STATA** (aka, Stata) = “Software for Statistics and Data Science”
  - **STATA** is popular in fields that use **large, weighted survey data** (e.g., sociology, political science, public health, EPLS at Iowa)
  - STATA syntax and documentation is easier and more standardized
- **R** = free implementation of what was initially the “S” language
  - R packages are only as good as their authors (so little quality control)
  - Syntax and capabilities are idiosyncratic to the packages (so grrrrrr)

# Class-Sponsored Statistical Software

- **Mplus** will be used for “**multivariate**” examples (in which more than one longitudinal outcome is predicted at once)
  - Please verify your access to Mplus in the Ulowa Virtual Desktop!
- **Broader framework** for longitudinal models that includes:
  - Traditional multilevel models (**MLMs**, but without REML)
  - (Single-level) structural equation models (**SEMs**)
  - Multilevel structural equation models (**M-SEMs**)
- Why not other (M-)SEM-capable programs? 3 reasons:
  - **Lack of key features:** TSCORES for unbalanced time, random slopes in SEM and M-SEM, residual lagged variables (using Bayes)
  - **Pragmatism**—each model is complex enough as it is!
  - Using one program will facilitate **connections** across model formats



# This Semester: Advanced Longitudinal Models

- **Background:** reviewing what you already know + foreshadowing
  - Longitudinal multilevel models with time-invariant predictors
  - Alternative time metrics (in accelerated longitudinal designs)
  - From MLM to SEM and M-SEM (using Mplus syntax and output)
  - Modeling change in latent factors (instead of observed outcomes)
- **Time-varying predictors:** distinguishing between from within
  - Univariate approach (for fluctuation; via variable- or constant-centering)
  - Multivariate approach (for fluctuation, then for change)
  - Commonality in multivariate change (factor-of-curves models)
  - Lagged effects (auto-regressive and cross-lagged relations)
- **Extensions for complex sampling:** adding levels or groups
  - Intensive longitudinal data (in three-level models)
  - Longitudinal analysis of time-invariant and time-varying groups

Ideal  
Project  
Options