**PSY 653 Module 6: Time series and the analysis of longitudinal data**

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Use the following experimental design to complete the tasks below:

200 college students’ GPAs were assessed at 6 different timepoints (i.e., 1200 data points total) over the course of one semester. We are interested in investigating if and how GPA may have changed across the semester. In addition to GPA, the study also measured each student’s self-reported sex identity and their job status (i.e., working part-time or full-time jobs in addition to their academic responsibilities). The datafile for this activity is named “Longitudinal.csv”.

We will conduct two sets of models to (a) examine how GPA changes over the six timepoints and (b) examine how GPA changes over the six timepoints and across participant sex identity.

*The data contains the following variables:*

**student** = participant ID number (N = 200)

**occas** = A 6 level factor indicating the time point (0-5)

**gpa** = Grade Point Average (0-4)

**job** = participant job status (0 = part-time employment status and 1 = full-time employment status)

**sex =** self-reported sex identity (0 = male, 1 = female)

1. Create a new R notebook and load the following libraries: psych, tidyverse, lme4 and lmerTest (Note: you will likely need to install lme4 & lmerTest)
2. Read in the datafile “Longitudinal.csv” and get variable descriptives
3. Use the aggregate() function to examine how the mean value of GPA may vary across the six timepoints
4. Use ggplot to visualize how GPA changes over time in the *full* sample
   1. Briefly interpret the graph. Why is it important to visualize the data in this way?
5. Use ggplot to visualize how GPA changes over time for *each individual* participant
   1. Briefly interpret the graph. Why is it important to visualize the data in this way?
6. Use ggplot to visualize how GPA varies across both the six timepoints and by sex identity
   1. Briefly interpret the graph. Why is it important to visualize the data in this way?
   2. Based on the three plots you just created, do you think you have justification to test for a linear effect of time on GPA? What about a quadratic effect?
7. Test the intercept-only model (i.e., the baseline model) for GPA
   1. Interpret the model output
8. Test a linear growth model to determine how GPA changes across the six timepoints
   1. Interpret the model output. Do results indicate the presence of a linear effect?
9. Now we will add a covariate to the model: sex identity. Test the baseline model for GPA that also includes sex as a covariate
   1. Interpret the model output and calculate the ICC value.
10. Test a linear growth model to determine how GPA changes across the six timepoints and by sex identity
    1. Interpret the model output and calculate the ICC value. Do results indicate the presence of a linear effect when sex is included as a covariate?
11. Write 3-4 sentences explaining what this series of models suggests about relations between GPA, time, and sex identity among college students.