Psychology 319 – Structural Equation Modeling
Course Introduction

James H. Steiger

Department of Psychology and Human Development
Vanderbilt University

Psychology 319 – Structural Equation Modeling
Course Introduction

Administrative Details

- Psychology 319, *Advanced Structural Equation Modeling*, is a course that is designed to appeal to students seeking a higher level treatment than our introductory SEM course, Psychology 314, while still remaining accessible to students who haven't taken any course in SEM or are taking a refresher course.

Administrative Details

- My personal website is at `http://www.statpower.net`. All course readings and information will be posted at the site under the Psychology 319 link.
- Class meetings will be here in Hobbs 107, according to the following schedule:
  1. 1:10–2:25 Lecture
  2. 2:25–2:40 Break
  3. 2:40–3:45 Lecture
  4. 3:45–4:00 Wrap-Up
- Course grading will be based on weekly homework assignments.
- My nominal office hours are T R 11:00-12:00.

Administrative Details

- You will need R Version 3.0 or later installed on your computers, and you should also install the most recent version of RStudio.
- We will be using the commercial software package, *MPlus 7.1*, in the course to perform analyses. If you do not have a copy of *MPlus* available to you, you can download the free student version from the *Mplus* website.
- We may, for historical reasons, also do a few analyses with *LISREL*, one of the early SEM commercial programs. You can download a free student version of *LISREL* from the SSI website.
- The full version of *MPlus* is running in the Quantitative Lab on the second floor (Hobbs 205). Check and see if you have proxcard access to that room. If you do not, please let me know.

The Foundation of Structural Equation Modeling

- Structural equation modeling in its modern form can handle an astonishing array of analyses, some of them extraordinarily complex.
- But at its foundation, SEM is based on a very simple idea.

The Foundation of Structural Equation Modeling

- Think back to your introductory statistics course.
- In the early going, you learned some fundamental rules about the way lists of numbers behave.
- In particular, suppose you have a list of numbers X equal to 1,2,3.
- This list of numbers has a mean of 2 and a standard deviation of 1.

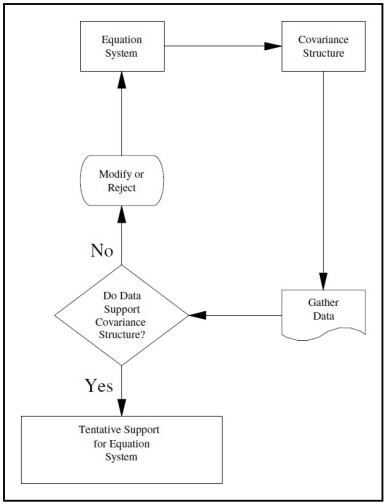
The Foundation of Structural Equation Modeling

- Now, suppose you were to take these 3 numbers and multiply them by 4. Then the mean would become 8, and the standard deviation would become 4, the variance thus 16.
- *And it would have to be this way.*
- The point is, if you have a set of numbers X related to another set of numbers Y by the equation $Y = 4X$, then the variance of Y must be 16 times that of X
- So you can test the *regression model* that Y and X are related by the equation $Y = 4X$ indirectly by comparing the variances of the Y and X variables.
- This fact remains true regardless of whether you express the model as a linear equation, or whether you conceive of it in an isomorphic representation known as a *path diagram*.

The Foundation of Structural Equation Modeling

- This idea generalizes, in various ways, to several variables inter-related by a group of linear equations.
- The rules become more complex, the calculations more difficult, but the basic message remains the same — you can test whether variables are interrelated through a set of linear relationships by examining the variances and covariances of the variables.

The Foundation of Structural Equation Modeling



Understanding SEM with Continuous Variables

- The first part of the course deals with the classic models and methods for analyzing path models involving continuous variables.
- A key to understanding how SEM works in the continuous case is to have the skills to derive precisely what *covariance structure* is implied by a particular model.
- In developing the tools to acquire this understanding, we begin by reviewing the key facts about means, variances, covariances, and correlations as developed with scalar algebra in Psychology 310.
- These facts are essential, but scalar algebra is an inefficient medium for manipulating them.
- Matrix algebra, tailored for statistical applications, provides us with a much clearer path to understanding how regression models and covariance structures are related.