Application of Multivariate Meta-analytic SEM

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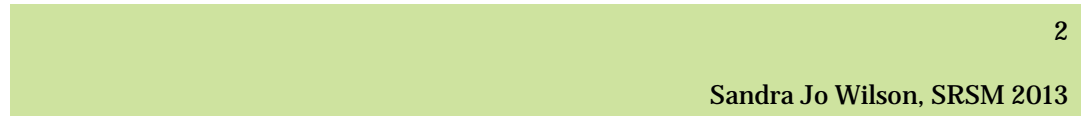
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The Meta-analysis

- Very large meta-analysis of longitudinal studies focused on studying the relative strength of risk factors for predicting later antisocial behavior, substance use, and school success or failure.

- Both longitudinal and cross-sectional correlations were coded from over 700 studies.
  - 73,000 cross-sectional correlations
  - 74,000 longitudinal correlations

- My particular question relates to predicting achievement from a variety of school readiness constructs.

The Concept
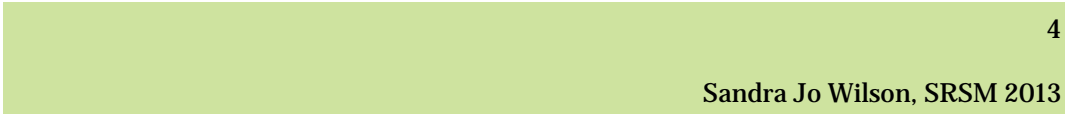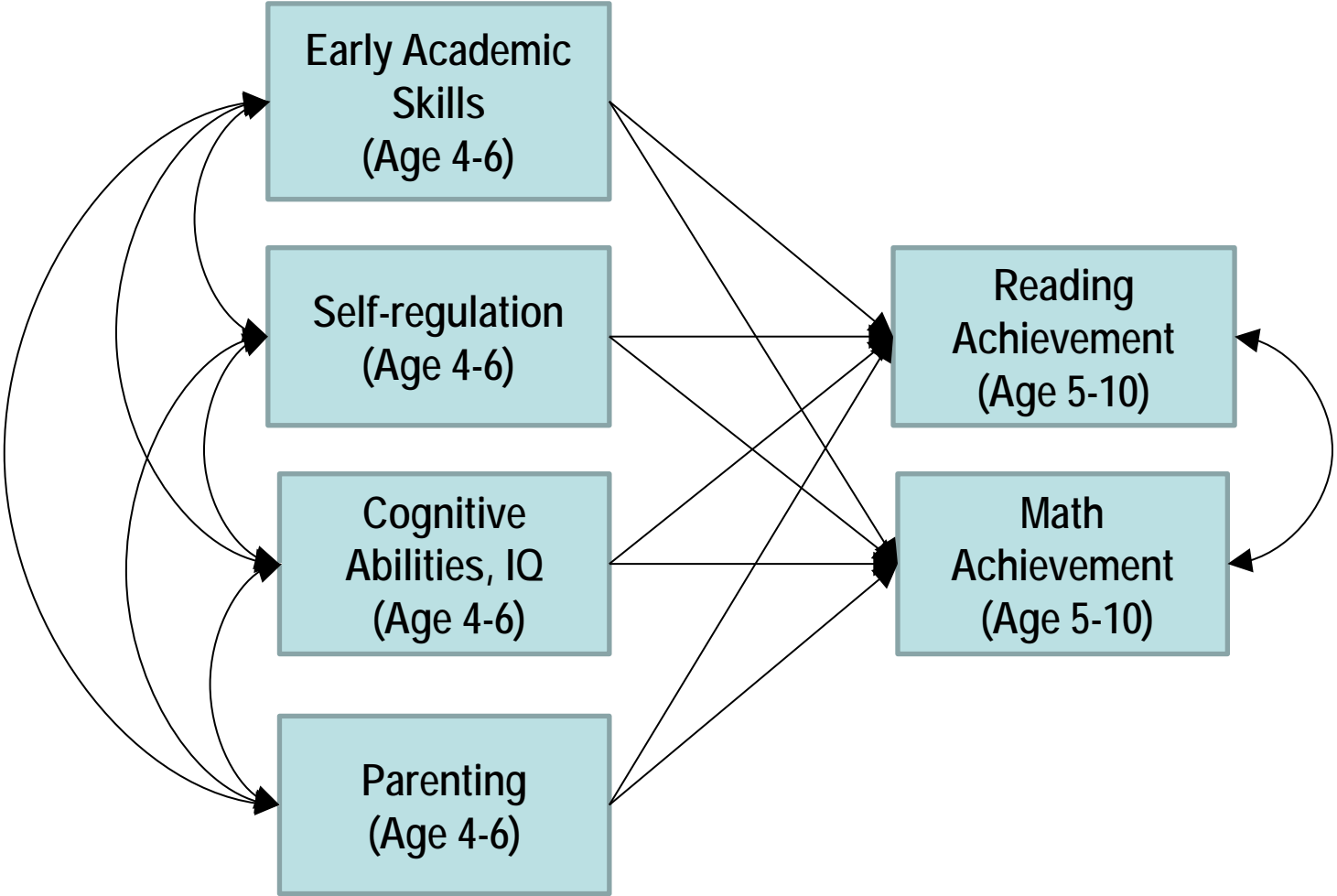
(eventual) Synthesized Correlation Matrix

	1	2	3	4	5	6
1. Early Skills (4-6)						
2. Self-regulation (4-6)	$\hat{r}_{x_1 x_2}$					
3. Cognitive (4-6)	$\hat{r}_{x_1 x_3}$	$\hat{r}_{x_2 x_3}$				
4. Parenting (4-6)	$\hat{r}_{x_1 x_4}$	$\hat{r}_{x_2 x_4}$	$\hat{r}_{x_3 x_4}$			
5. Reading (5-10)	$\hat{r}_{x_1 y_1}$	$\hat{r}_{x_x y_1}$	$\hat{r}_{x_3 y_1}$	$\hat{r}_{x_4 y_1}$		
6. Math (5-10)	$\hat{r}_{x_1 y_2}$	$\hat{r}_{x_2 y_2}$	$\hat{r}_{x_3 y_2}$	$\hat{r}_{x_4 y_2}$	$\hat{r}_{y_1 y_2}$	

Diversity of Study & Method Characteristics

- Within-studies
  - Different measures of the same predictor or outcome construct
  - Multiple cross-sectional or longitudinal waves within the larger age bands (and corresponding attrition)

- Between-studies
  - Sample characteristics
  - Age, wave-to-wave intervals, study timing
  - Attrition

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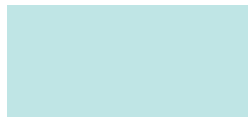
More complications

- Within-construct
  - Different ways of measuring the same construct
    - Self-regulation might be teacher reported or collected via one-on-one direct assessments.
    - Achievement might be collected via group-based standardized tests or individual direct assessments.
  - But, different measurement characteristics are associated with different constructs
    - Self-regulation constructs are rarely assessed with group-based standardized tests.
    - IQ and achievement are rarely assessed via teacher reports.

Analysis Plan

- First Stage
  - Some study characteristics might be similarly influential across the whole matrix (e.g., subject demographics, attrition, age, time interval, and study timing).
  - Using the entire set of studies, multi-level meta-regression models will be fit to identify the influence of within- and between-study moderators as well as within-construct moderators.
    - Interactions between cells or sets of cells and the covariates can tell us whether the moderators operate consistently across the matrix.

Stage 1 Adjustments

- Using the fitted models, expected correlation parameters using a standard profile of study characteristics will be computed.

  – Solve the regression equation using modal or average (or ideal) study characteristics and add the result to the residuals from the model.

- This produces a set of correlation parameters that have been standardized on the influential moderators.
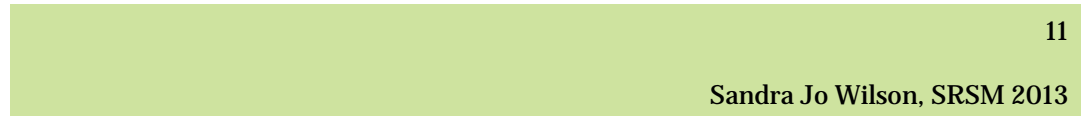
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Stage 2

- Because some potential moderators within cells may differ between cells and because we may find that relationships between Stage 1 moderators and effect sizes differ between cells, we expect there will be within cell heterogeneity remaining after Stage 1.

- Multi-level meta-regression models can then be fit separately for individual cells of the matrix to further adjust the correlation parameters.

- The result is a covariate-adjusted matrix of correlation parameters, which can be subjected to path analysis.

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Questions

- Is this a good idea?
- Is there a better way?

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