



# **SCHOOL READINESS AND LATER ACHIEVEMENT: RESULTS FROM A META-ANALYSIS OF LONGITUDINAL STUDIES**

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Society for Research on Educational Effectiveness

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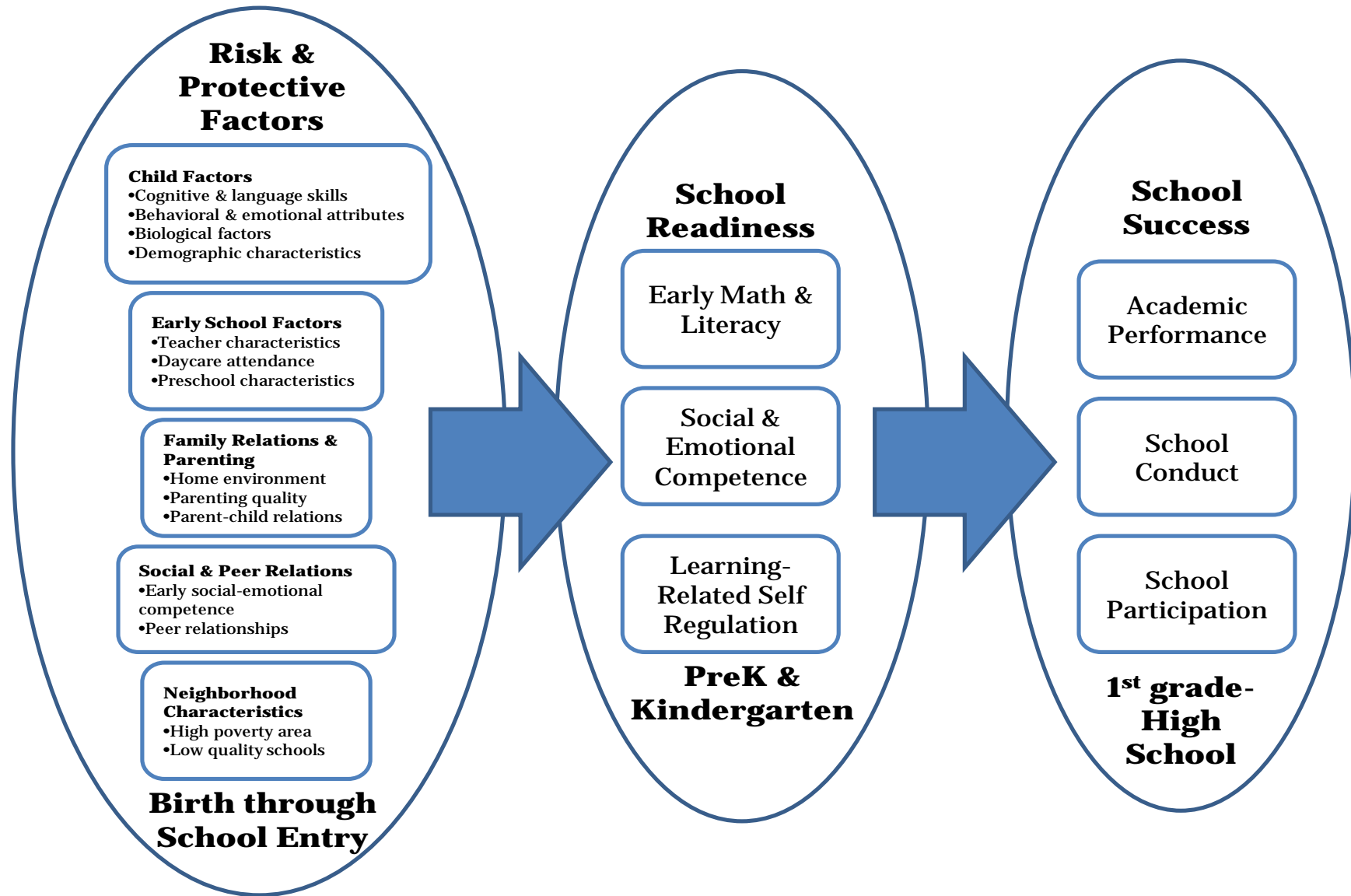
# Research Team

- Sandra Wilson, Principal Investigator
- Mark Lipsey, Principal Investigator
- Josh Polanin (IES Postdoctoral Fellow) and Alicia Hymel (Senior Research Specialist)
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  - **Institute for Education Sciences (R305A110074)**
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- This work was conducted in part using the high performance computing cluster at the Advanced Computing Center for Research and Education at Vanderbilt University.



# Presentation Overview

- Describe the rationale for the meta-analysis and the main research objectives.
- Discuss the larger meta-analysis project and some of its methodological quirks.
- Present the initial results.





## Research Objectives

- Identify potentially malleable aspects of children's functioning measured around the beginning of school.
- Examine the independent relationships of each of these school readiness indicators to later school performance.



## Study Eligibility and Coding

- Longitudinal panel studies conducted in the U.S. with at least two waves of data collection were eligible.
  - Minimum interval between waves was Fall-Spring semester.
- Samples of children from birth through high school were included.
- Study coding included subject characteristics (e.g., age, gender, racial/ethnic composition, risk, SES), measurement wave and timing characteristics, attrition, and measurement characteristics of predictors and outcomes.
- Results today use about 5,000 correlations from 284 studies and include over 100,000 children.



# Study Findings

- Study findings recorded as product moment correlations
  - Cross-sectional relationships among the predictor variables
  - Longitudinal predictor-outcome relationships
- All effect sizes were coded so that positive correlations indicated that higher risk was associated with a worse outcome or lower risk was associated with a better outcome. Correlations are positive when:
  - Prosocial behavior predicts grades
  - Low externalizing problem behavior predicts better reading achievement



## Problem: Deciding which measures represent the same construct

- Many different operationalizations of the same constructs, often with different labels and claims about the underlying constructs they purport to measure.
- Difficult to study predictive relationships systematically because research presents great variability and inconsistency in construct labels and measures.
- We are primarily interested in the constructs and the relationships between them, not how they are measured.
- Correlations between measures that might guide identification of those indexing the same or different constructs are heavily influenced by the characteristics of the samples on which they are measured and the nature of the measurement operationalizations.





# Handling the Complexity

- Two-fold strategy for handling measurement/construct complexity
  - Conceptual sorting of measures into construct categories
  - Statistical adjustments to standardize the correlations across measurement characteristics



School Readiness Indicator	Description
Early Reading Skills	Measures of reading readiness, early or pre-reading skills (e.g., Metropolitan Reading Readiness Test).
Early Math Skills	Measures of early math skills, number skills, quantitative concepts, spatial relations, etc. (e.g., Numbers from the Metropolitan Readiness Test)
Problem Behavior	Measures of aggressive or disruptive behavior and measures of undifferentiated problem behavior (e.g., Child Behavior Checklist Total)
Social Adjustment	Social and interpersonal skills, social competence, adjustment to peer group, social acceptance, and the like.
Visual-Perceptual/Visual-Motor Skills	Measures of visual-perceptual (matching, visual discrimination) or visual-motor skills (copying, shape completion, block design), or both.
Self-regulation	Includes both questionnaires and direct assessments of effortful control, attention, persistence, concentration, on- or off-task behavior, and the like. Also includes clinical measures of attention problems, often combined with hyperactivity (e.g., Conners' Hyperactivity Index).
Work-related Skills	Measures of school functioning, classroom competence and cooperation (e.g., TCRS Competence, SSRS Cooperation)

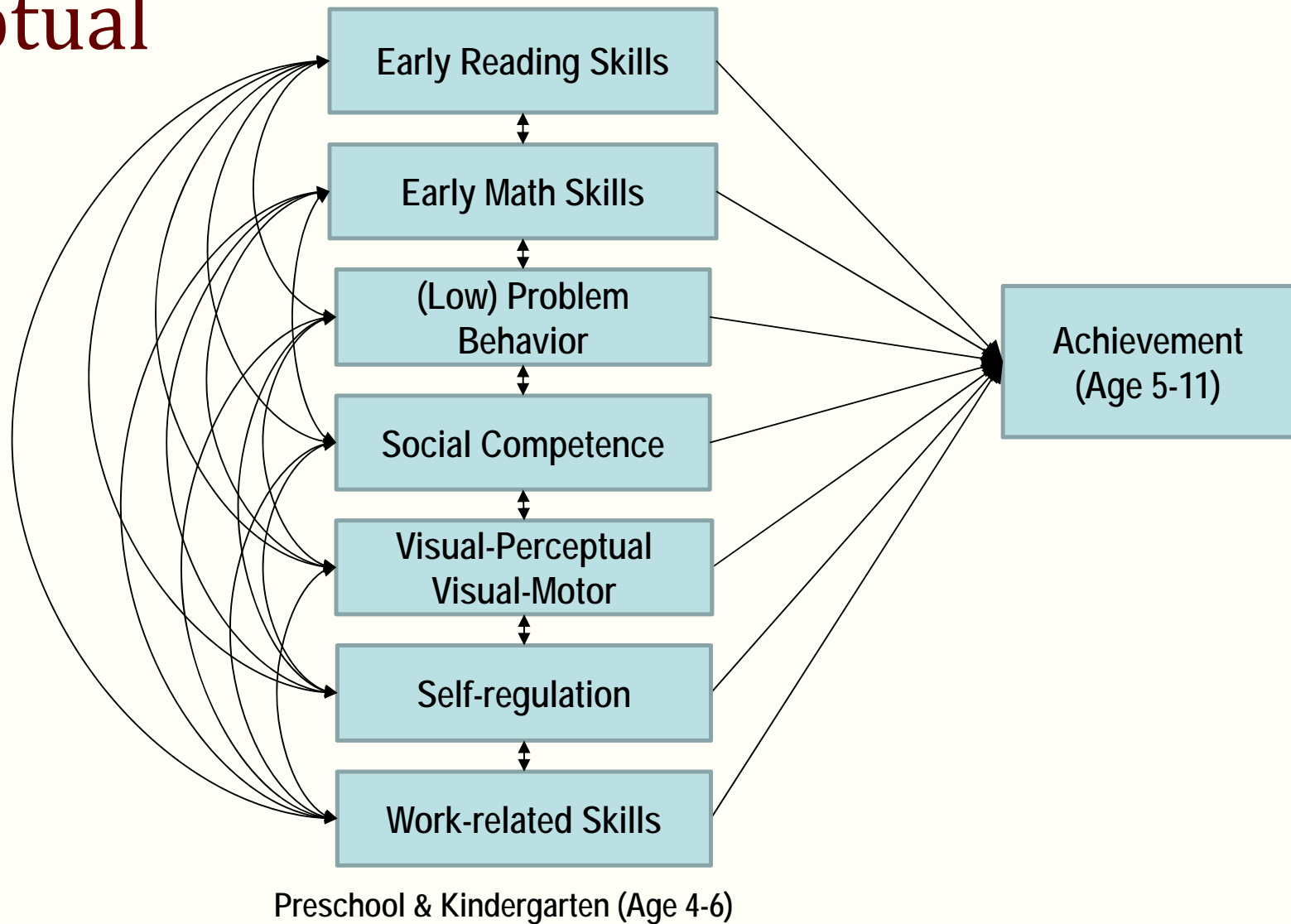


# School Performance Outcomes

School Performance Outcomes	Description
Total Achievement	Total or composite scores from standardized achievement tests, including both school- and researcher-administered assessments.
Grades, GPA	School grades or GPA; combined single-subject grades and overall GPA.
Reading/ELA Achievement	Standardized tests or reading or language arts achievement; includes clear reading measures and composites of reading with other ELA skills.
Math Achievement	Standardized tests of math achievement; includes total math scores, and math subcomponents (e.g., Woodcock-Johnson subtests).



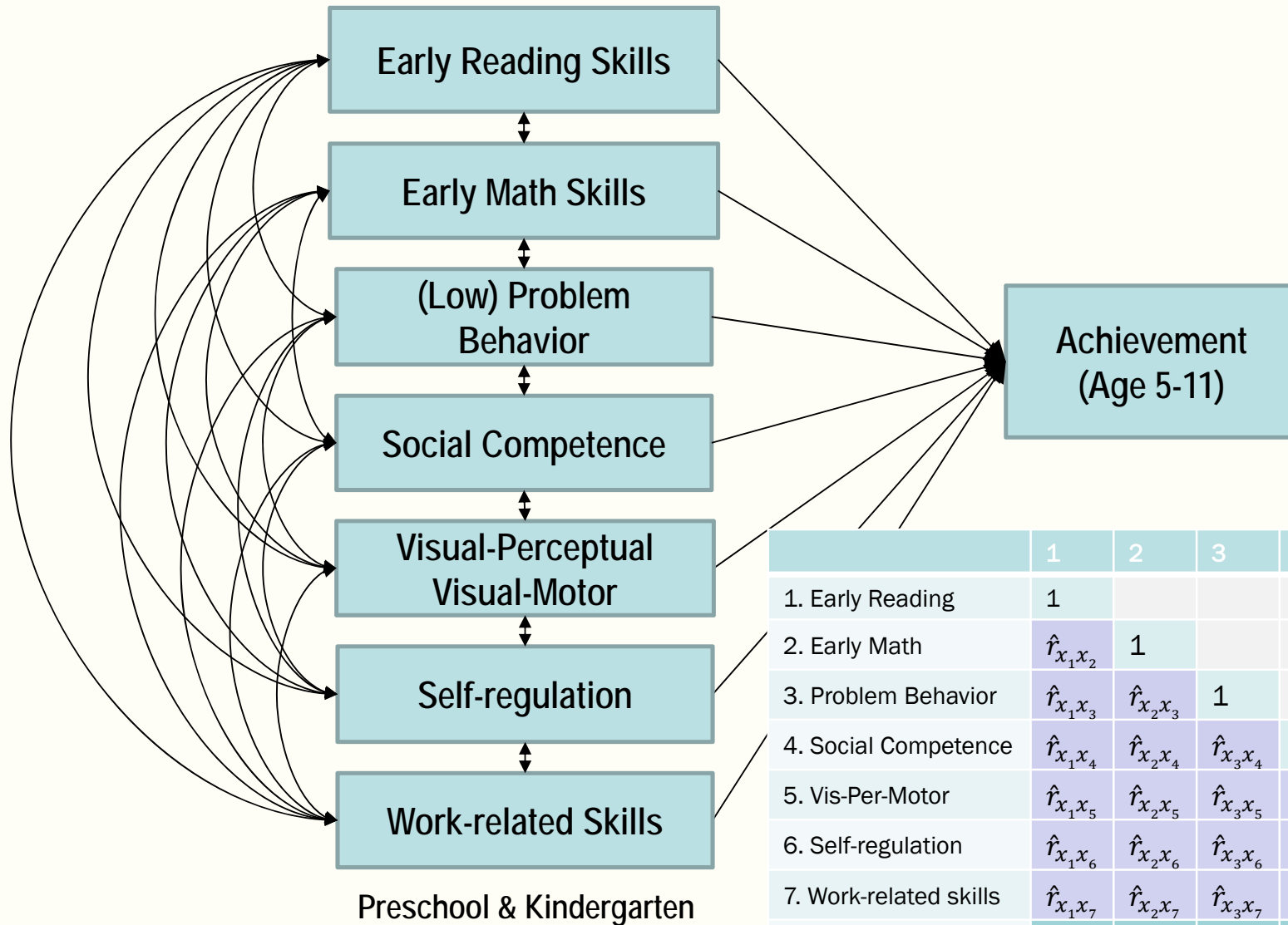
# Conceptual Model





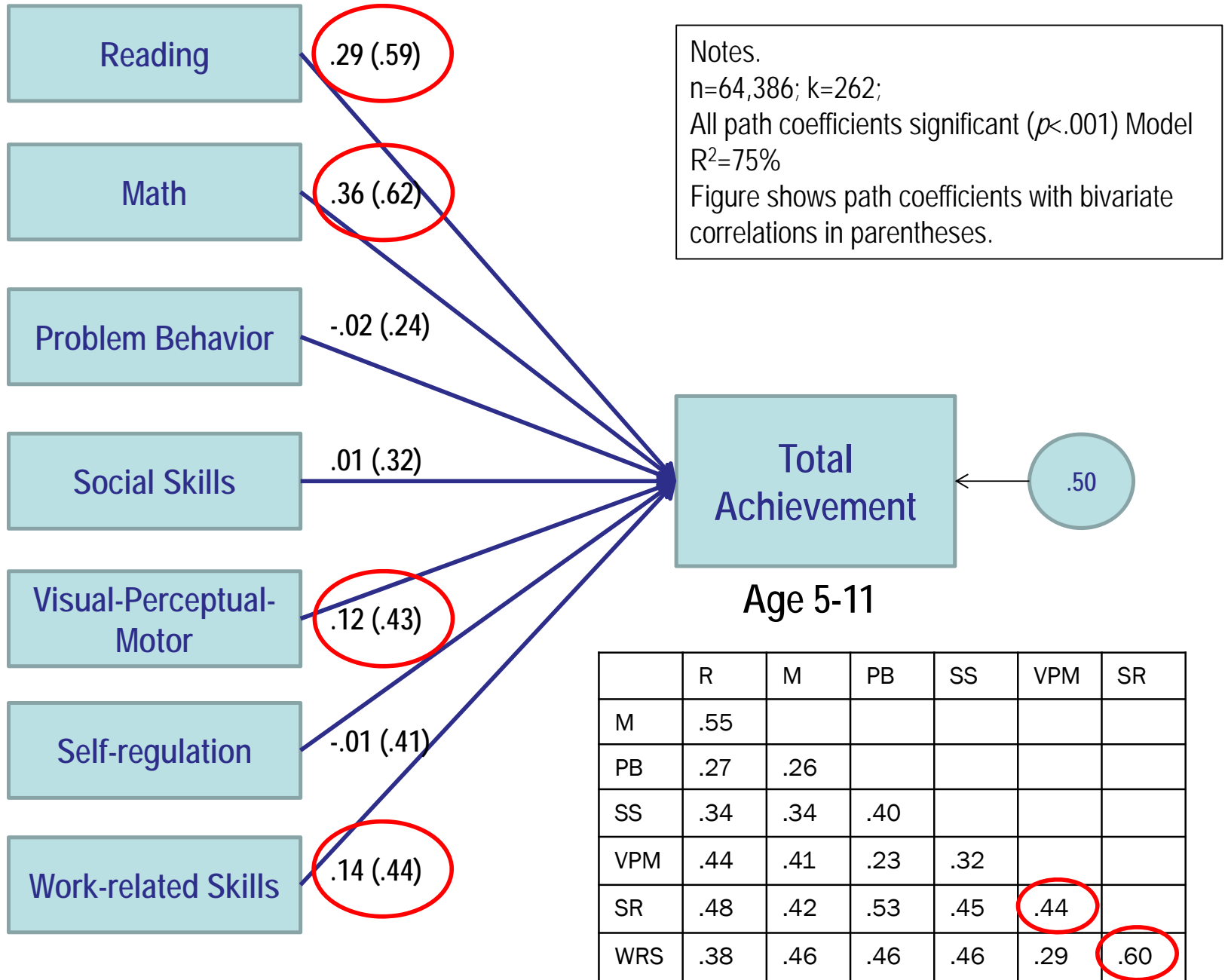
# Analysis Plan

- Estimate meta-analytic path models predicting later academic performance from school readiness indicators measured in preschool or kindergarten.
- Caveat: these are not causal models.

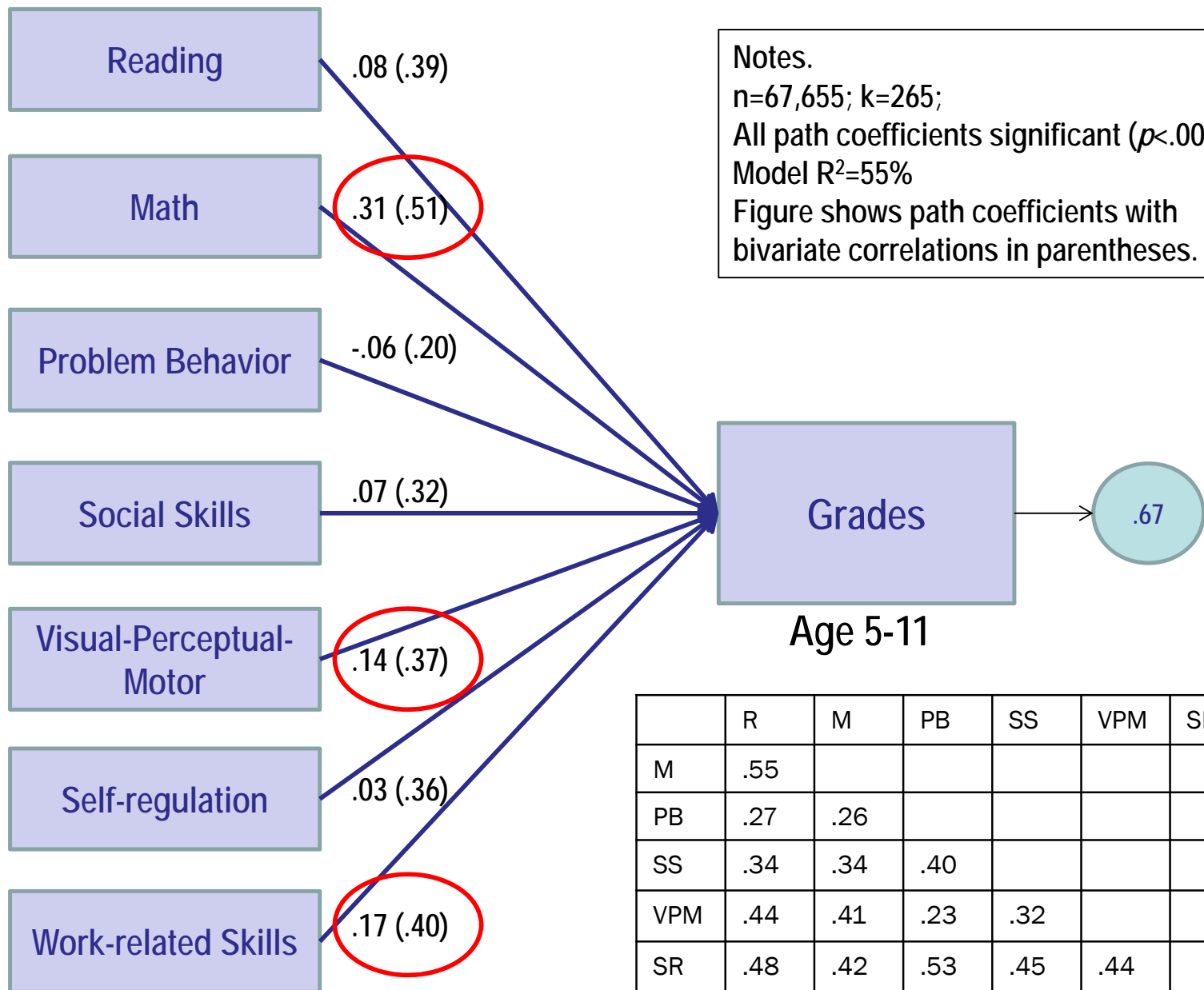


	1	2	3	4	5	6	7	8
1. Early Reading	1							
2. Early Math	$\hat{r}_{x_1x_2}$	1						
3. Problem Behavior	$\hat{r}_{x_1x_3}$	$\hat{r}_{x_2x_3}$	1					
4. Social Competence	$\hat{r}_{x_1x_4}$	$\hat{r}_{x_2x_4}$	$\hat{r}_{x_3x_4}$	1				
5. Vis-Per-Motor	$\hat{r}_{x_1x_5}$	$\hat{r}_{x_2x_5}$	$\hat{r}_{x_3x_5}$	$\hat{r}_{x_4x_5}$	1			
6. Self-regulation	$\hat{r}_{x_1x_6}$	$\hat{r}_{x_2x_6}$	$\hat{r}_{x_3x_6}$	$\hat{r}_{x_4x_6}$	$\hat{r}_{x_5x_6}$	1		
7. Work-related skills	$\hat{r}_{x_1x_7}$	$\hat{r}_{x_2x_7}$	$\hat{r}_{x_3x_7}$	$\hat{r}_{x_4x_7}$	$\hat{r}_{x_5x_7}$	$\hat{r}_{x_6x_7}$	1	
8. Achievement	$\hat{r}_{x_1y}$	$\hat{r}_{x_2y}$	$\hat{r}_{x_3y}$	$\hat{r}_{x_4y}$	$\hat{r}_{x_5y}$	$\hat{r}_{x_6y}$	$\hat{r}_{x_7y}$	1

Predictors at Ages 4-6



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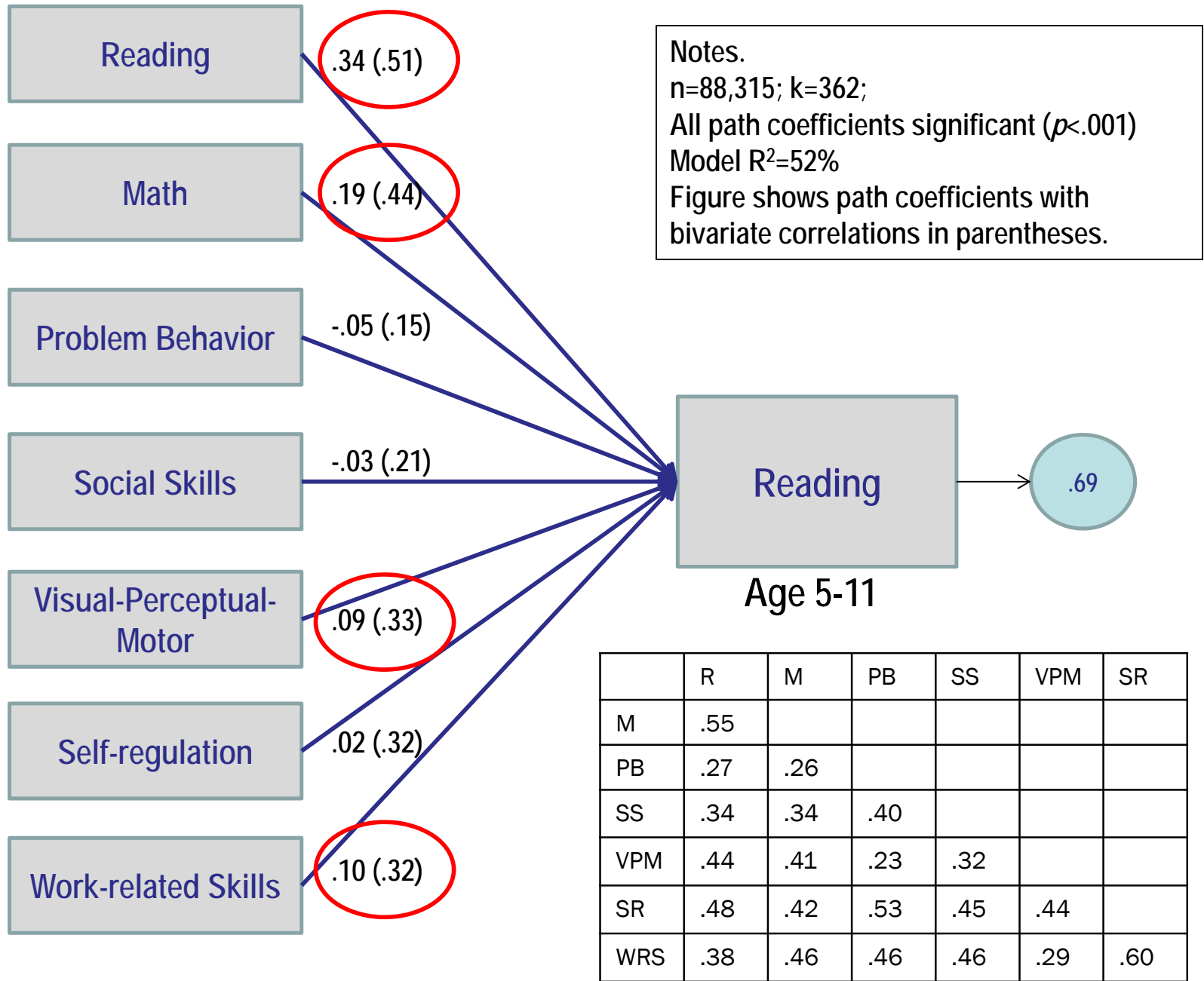


Notes.  
 n=67,655; k=265;  
 All path coefficients significant ( $p < .001$ )  
 Model  $R^2 = 55\%$   
 Figure shows path coefficients with bivariate correlations in parentheses.

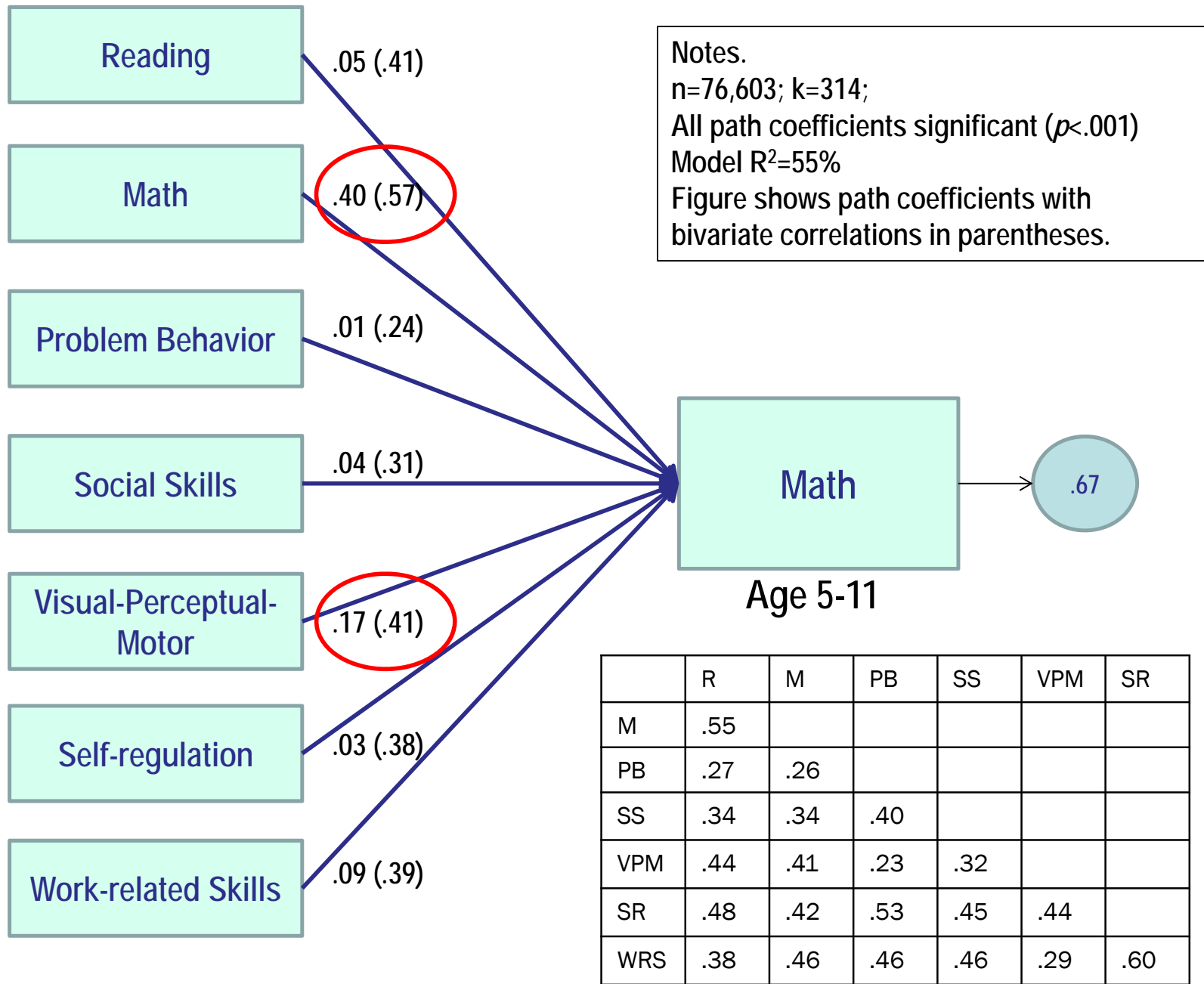
	R	M	PB	SS	VPM	SR
M	.55					
PB	.27	.26				
SS	.34	.34	.40			
VPM	.44	.41	.23	.32		
SR	.48	.42	.53	.45	.44	
WRS	.38	.46	.46	.46	.29	.60



Predictors at Ages 4-6



Predictors at Ages 4-6





## Summary

- Early academic skills are the strongest predictors of later performance on both standardized tests and grades.
- Early mathematics skills were more strongly predictive of later math achievement than early reading skills, but also of total achievement and grades.
- Social skills and problem behaviors were not strongly predictive of later academic achievement.



## Summary (cont.)

- Visual-perceptual and visual-motor skills showed consistently strong predictive relationships with later achievement, especially math.
- Work-related skills were predictive of later achievement, especially grades.
- Self-regulation did not show a strong independent relationship with later achievement.



# Putting the Results in Perspective

Path Coefficients		
	Reading	Math
Visual-Perceptual-Motor	.09	.17
Work-related Skills	.10	.09

coefficients in standard deviation units

Average Gains on Standardized Tests		
Grade Transition	Reading	Math
K - 1	1.52	1.14
1 - 2	.97	1.03
2 - 3	.60	.89
3 - 4	.36	.52
4 - 5	.40	.56
5 - 6	.32	.41

effect sizes in standard deviation units

Adapted from Bloom, Hill, Black, and Lipsey (2008). Spring-to-spring differences. The means shown are the simple (unweighted) means of the effect sizes from all or a subset of seven tests: CAT5, SAT9, Terra Nova-CTBS, Gates-MacGinitie, MAT8, Terra Nova-CAT, and SAT10.



## Concluding Thoughts

- Early academic skills, visual-perceptual/visual-motor skills, and work-related skills all appear to be important predictors of children's longer term achievement outcomes.
  - Early academic skills (especially math) are clear targets for preschool and kindergarten classrooms.
  - There may be distinct cognitive skills that are important (like visual-perceptual/motor skills), but perhaps the manifestation of those skills in the classroom (in the form of work-related skills) is also important.



# Future Directions

- The inter-correlations among the predictors makes it difficult to isolate individual skills.
  - Our next steps will focus on subdividing the broad predictor categories into circumscribed subcategories, examining the relationships within those subcategories, and their predictive relationships with achievement.
- Measures of and labels for constructs need additional work.
  - We can break down some of the broader categories into their component skills, separate the types and forms of the measures themselves, and conduct factor analysis to see how component skills relate to each other and to the outcomes (imagine a multi-trait/multi-method analysis with criterion variables).
- More work to be done with different age and interval spans and with constructs not examined here.



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**Thank you!**

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