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Mathematics Development from Pre-K Through 7th Grade in Urban, High Poverty Students

Dale C. Farran
Kelley Durkin
Jessica Ziegler
Peabody Research Institute
Vanderbilt University

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Background: Original Building Blocks Scale-Up Study

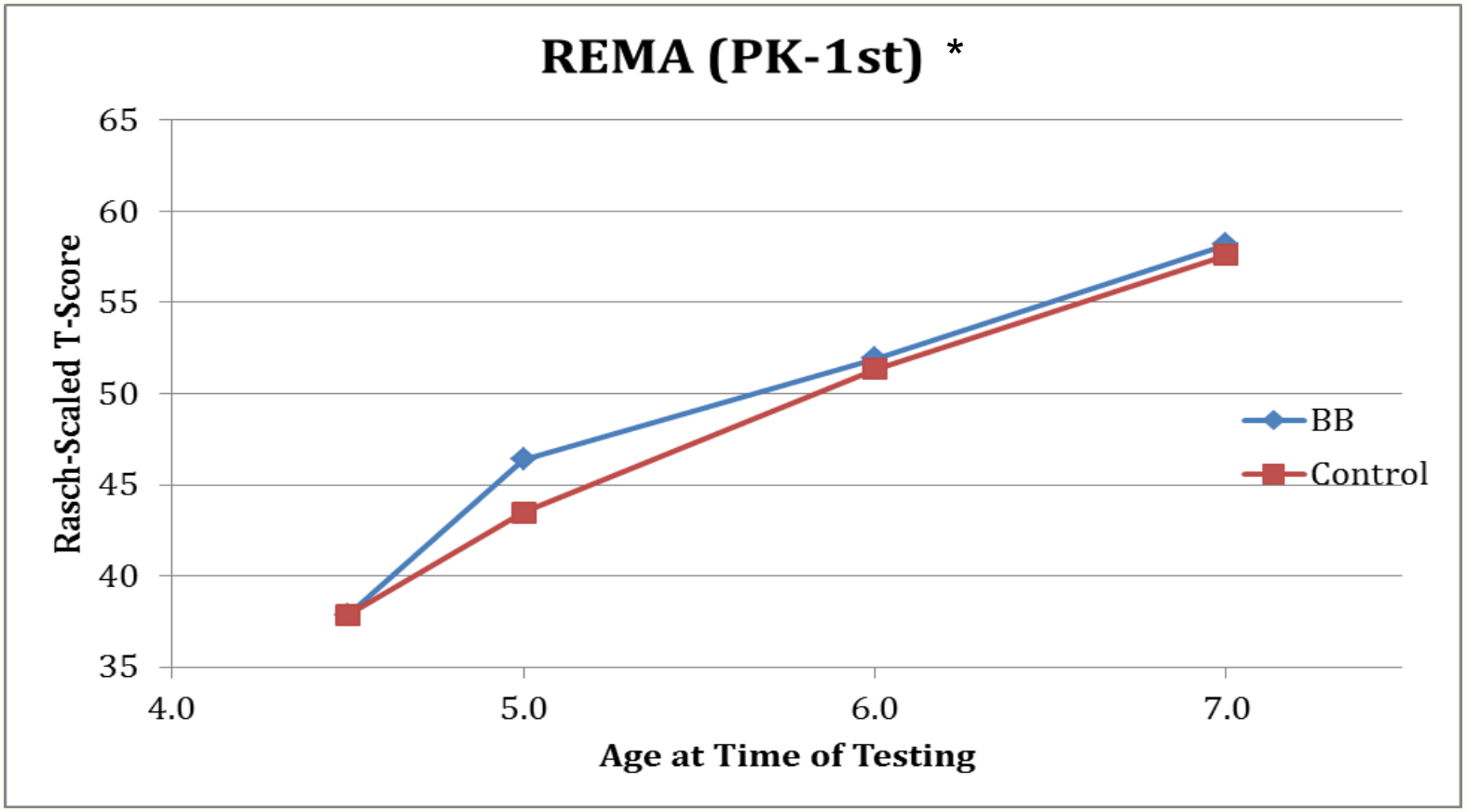
- The *Building Blocks for Math Pre-K Curriculum* (Clements & Sarama, 2007) was designed to help young children learn math

- Nashville was 1 location of a multi-site scale-up study funded by the Institute of Education Sciences, **R305K050157**
  - 2006-2007 Training year for teachers
  - 2007-2008 Children attended Pre-K, Full Implementation

Original Building Blocks Scale-Up Sample

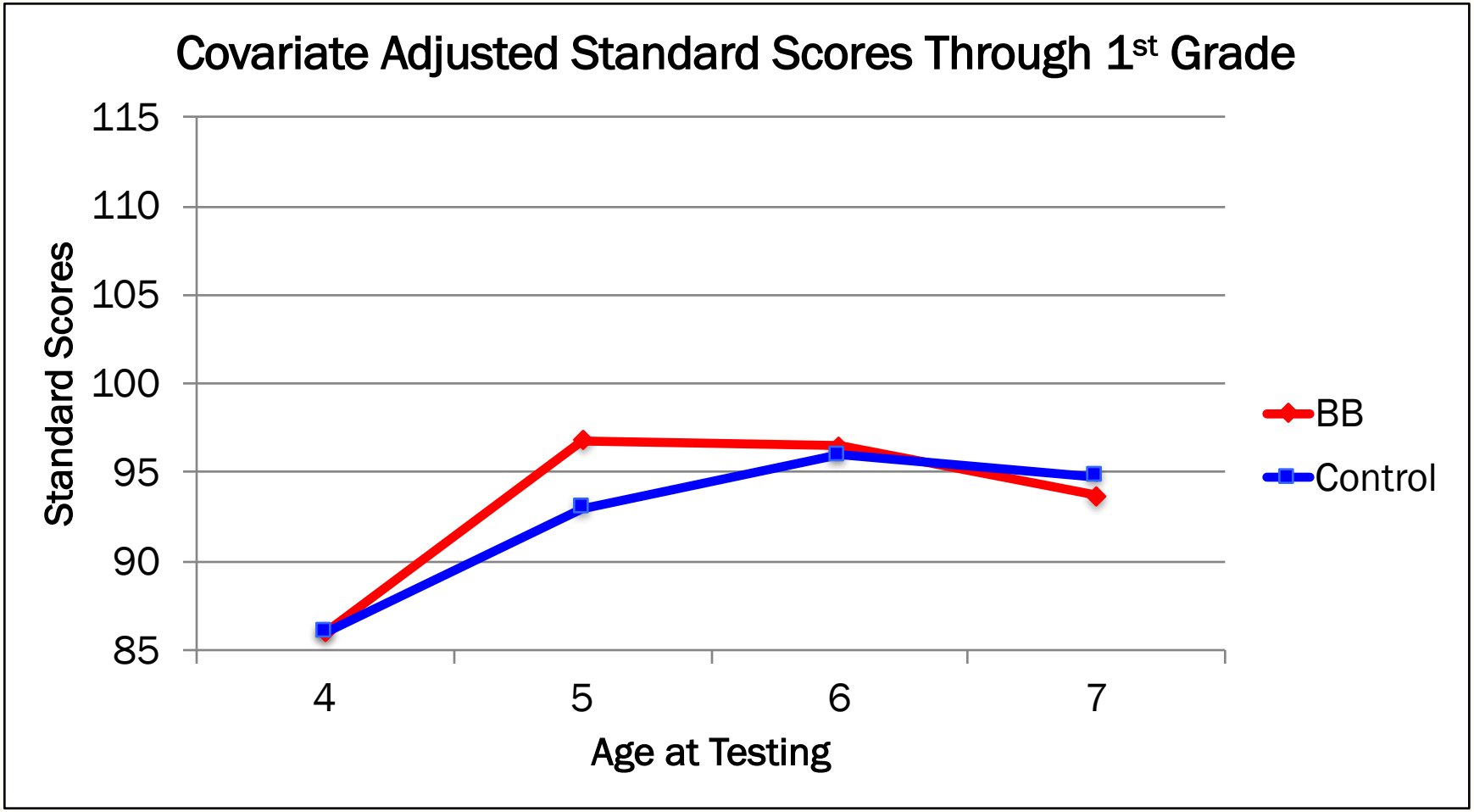
- 20 schools randomly assigned to conditions
  - 16 Metropolitan Public schools
  - 4 Head Start centers
- 57 classrooms
  - 31 treatment classrooms (16 public, 15 Head Start)
  - 26 control classrooms (17 public, 9 Head Start)
- Approximately 680 children with PK pre- and post-data
  - Sample was predominantly Black, all from low-income households
- Children followed through end of 1st grade

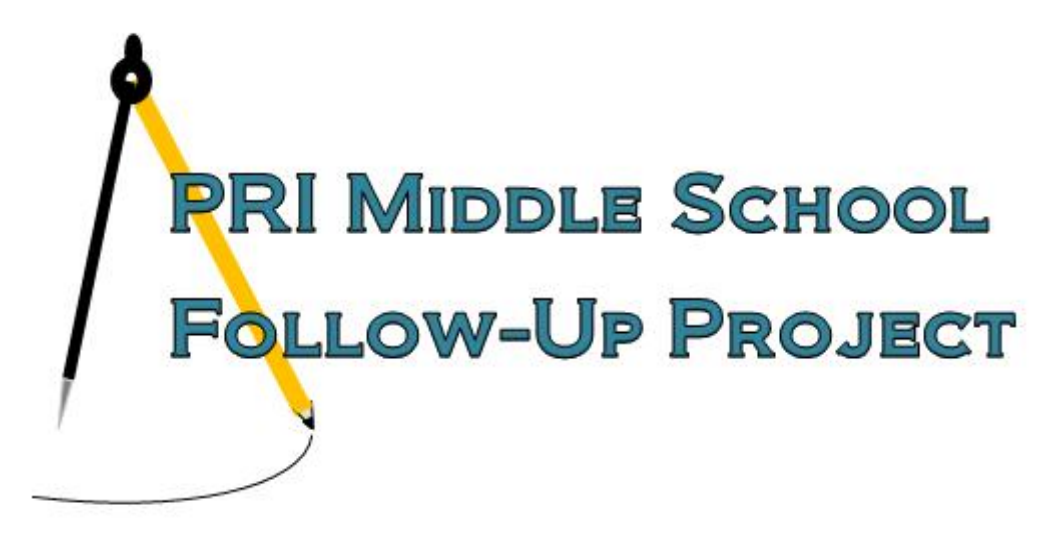
REMA – Rasch-scaled T-scores



*Covariate Adjusted Scores

WJIII Quantitative Concepts





Funded by the Heising Simons Foundation (2013),
Institute of Education Sciences (R305A140126, 2014)
Dale Farran, Bethany Rittle-Johnson, Gavin Price Co-PI's

Follow Up Sample

- 771 consented students originally
  - 16 withdrew in 1st grade
  - 29 no longer in Tennessee
  - 45 students not located in state data base
  - 53 in Tennessee but not in Nashville
  - **34 students' Nashville parents declined**
  - 72 students located but never responded (backpacks!)

90 Students unrecoverable

- 523 students re-consented – all from Metro Nashville Public Schools (MNPS) (77% retained; 5% declined)
  - 521 assessed in first year
    - 317 BB treatment children (70% of original group)
    - 205 Control children (64% of original group)

Poverty Status When Re-Consented

Poverty Status	Overall	
	Freq	Pct
FRPL Eligibility (from last year)		
Reduced Price Lunch	21	4%
Free Lunch	454	87%
Non-subsidized Lunch	39	8%
Missing	7	1%

Demographics 7th Grade Follow Up

	Overall	
	Freq	Pct
Ethnicity		
Black	396	78.7
White	44	8.7
Hispanic	41	8.2
Other	21	4.2
Gender		
Male	219	43.5
Female	284	56.5
Number of Current Schools	59	-

Follow Up Measures

KeyMath 3 Diagnostic

1. *Numeration*
2. *Algebra*
3. *Geometry*

Woodcock Johnson III

1. *Quantitative Concepts (longitudinal)*
2. *Letter Word Identification (beginning 7th grade)*

Student Attitudes toward Math

Teacher Survey

KeyMath 7th Grade Results

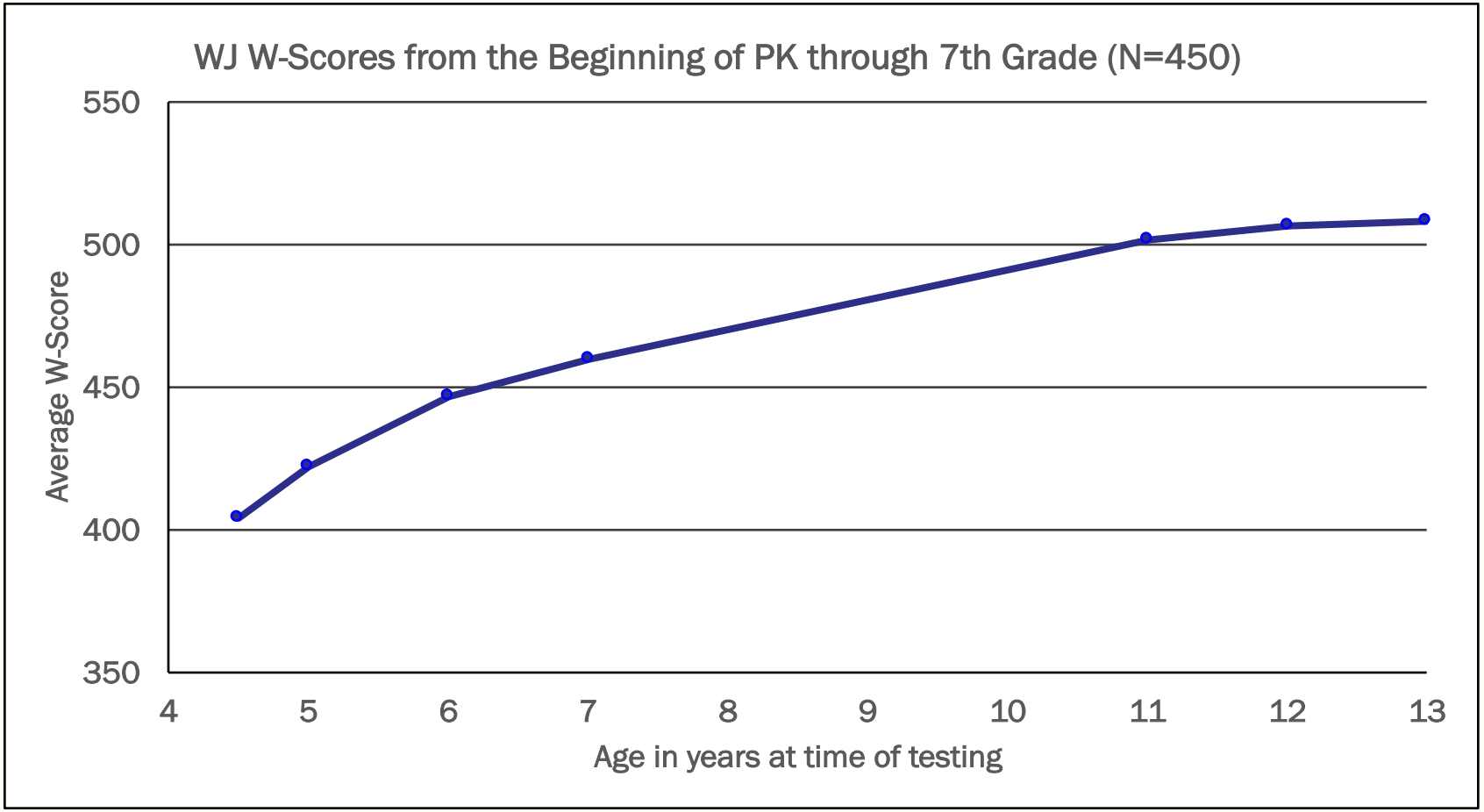
(Student Age = 12.4 Grade Level = 7.84)

	N	Min	Max	Mean	SD
KeyMath: Numeration					
Age Equivalent	503	5.0	16.0	10.82	2.62
Grade Equivalent	503	0.2	10.0	5.38	2.55
Key Math: Algebra					
Age Equivalent	503	5.0	16.0	11.00	2.76
Grade Equivalent	503	0.0	10.0	5.70	2.65
Key Math: Geometry					
Age Equivalent	503	5.0	16.0	10.17	2.32
Grade Equivalent	503	0.0	10.0	5.13	2.31

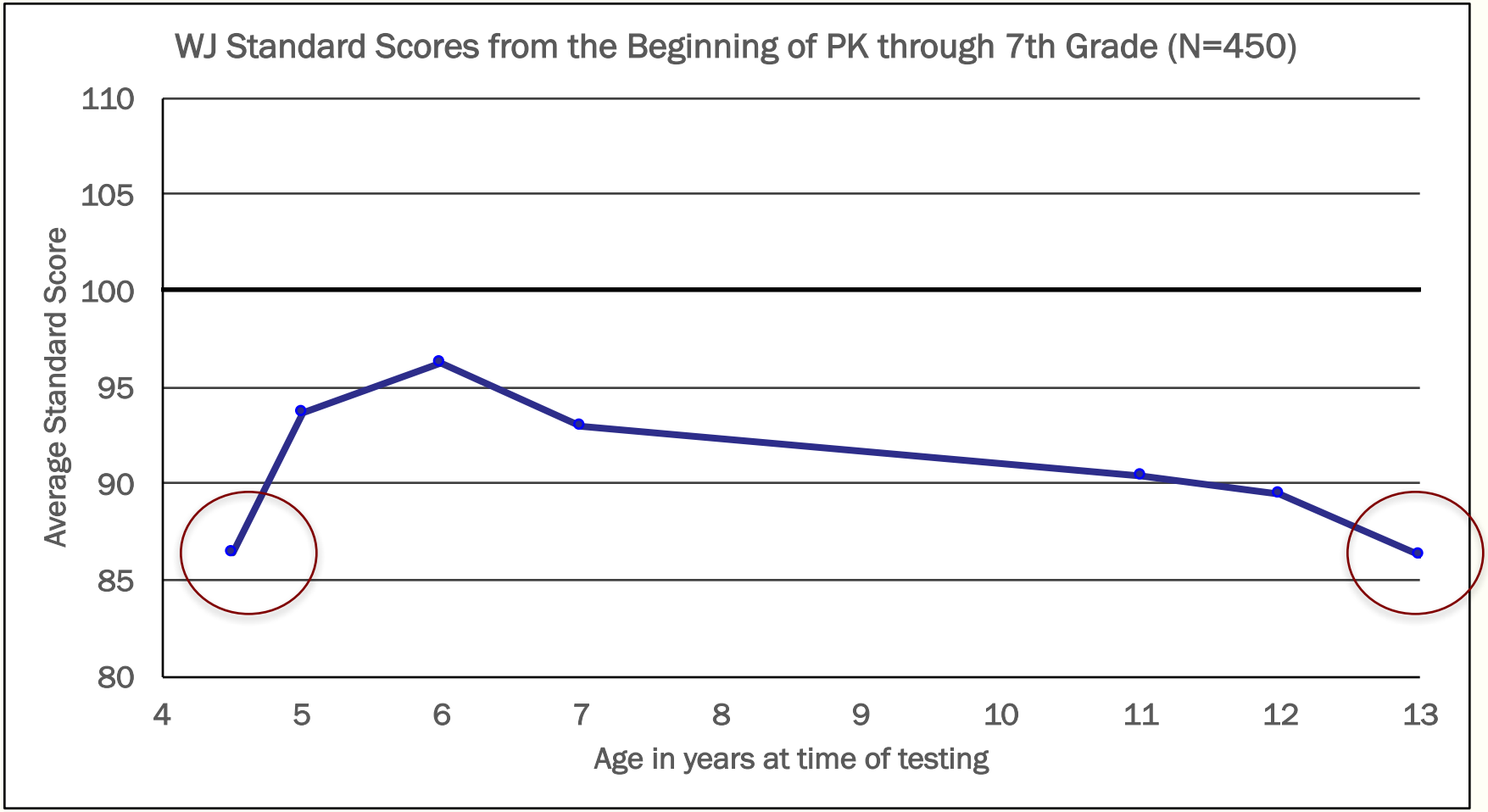
KeyMath Grade Equivalences Across the Years

Year	Mean Grade	Test	N	M	SD
Year 1	5.83	Number	517	4.20	1.98
		Algebra	517	4.31	1.84
		Geometry	517	3.90	1.97
Year 2	6.84	Number	513	4.98	2.15
		Algebra	513	5.20	2.25
		Geometry	513	4.80	2.06
Year 3	7.84	Number	503	5.38	2.55
		Algebra	503	5.70	2.65
		Geometry	503	5.13	2.31

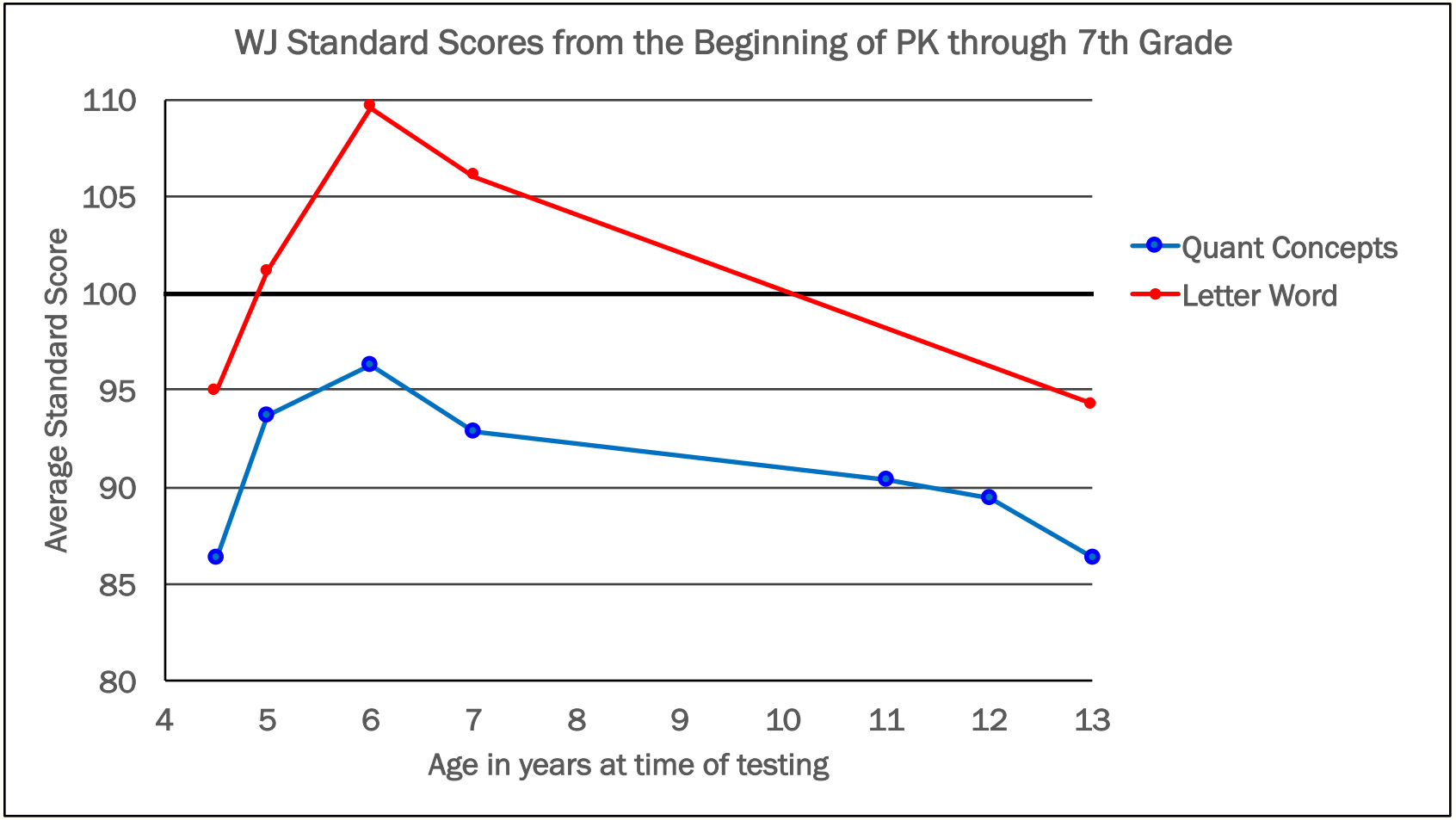
Quantitative Concept W Scores Pre-K to 7th Grade



Quantitative Concepts Standard Scores Over Time



Letter Word and Quantitative Concepts Over Time



Student Ratings of Math Competence (TIMMS)

DESCRIPTIVES FOR SUBSCALES BY YEAR (1-4 rating)				
	Year 2		Year 3	
	MEAN	SD	MEAN	SD
Students' Confidence in Mathematics	3.22	0.58	3.07	0.62
Students Value Mathematics	3.55	0.40	3.52	0.42
Students Like Learning Mathematics	3.37	0.53	3.21	0.60

6th Grade Teacher Ratings of Math Skills

		Numeration			Algebra			Geometry	
Math skills are:	N	Mean (SD)	F		Mean (SD)	F		Mean(SD)	F
Far below average	33	3.18 (1.52)	55.54***		3.27 (1.25)	63.74***		3.50 (1.72)	33.36***
Below average	121	4.22 (1.56)			4.30 (1.50)			4.19 (1.59)	
Average	154	5.35 (1.75)			5.56 (1.79)			5.04 (1.89)	
Above average	92	6.85 (1.88)			7.22 (2.08)			6.17 (1.81)	
Far above average	17	8.02 (1.31)			8.57 (1.68)			7.86 (1.76)	

***p <.001

Students' Grade Level: 6.84

Summing Up Performance

- Students experience early and persistent poverty
- 500+ attended high poverty schools in urban district through middle school
- Located in 5th (or 4th) grade, they had skills comparable to beginning 4th graders or those finishing 3rd grade.
- Each year in middle school, students fell further behind
- Initial pre-k and K improvements in both math and literacy disappear. Children are back where they started.
- Initial positive benefits from pre-k math curriculum disappeared by the end of 1st grade
- Students unjustifiably confident about math abilities
- Teachers have recalibrated expectations

Next Steps

- Exploring student and teacher views in more depth
  - New Heising Simons funding
  - Conducted focus groups with 450 students fall 2016
    - 30-45 minute discussions in groups of 4-6
    - Using picture prompts (working with Megan Franke), explored current math attitudes, future plans and evaluation of early school experiences with math
  - Individual interviews with teachers to explore in depth their beliefs about student math potential and their skills at working with children so far behind.
- At the pre-k level, developing materials to improve math centers in choice of activities and scaffolding

THANK YOU!
QUESTIONS?