Experimental Evaluation of the Tools of the Mind Curriculum

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Research Team

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- Multiple part-time assessors in Tennessee and North Carolina.
- Funded by the Institute for Education Sciences Grant #R305A09053-10

Overview of the Presentation

- Experimental evaluation of the *Tools of the Mind* curriculum in preschool classrooms in Tennessee and North Carolina.

- Participants, research design, and instrumentation.

- Brief discussion of fidelity of implementation.

- Effects of the curriculum on achievement and self-regulation outcomes at the end of preschool.

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Research Questions

- Do children in *Tools of the Mind* classrooms improve more in literacy, language, math, and social skills during the preschool year than children in "business as usual" comparison classrooms?

- Do children in *Tools of the Mind* classrooms show greater gains in learning-related self-regulation than children in the comparison classrooms?

- Are there differential effects for *Tools of the Mind* associated with characteristics of the children?

Participating School Systems

- Tennessee
  - 4 small rural or suburban school districts
  - 30 classrooms (2010-2011 school year)
    - 17 *Tools* classrooms
    - 13 Comparison classrooms
- North Carolina
  - 1 urban school district
  - 30 classrooms (2010-2011 school year)
    - 15 *Tools* classrooms
    - 15 Comparison classroom
  - 2nd system in North Carolina currently in test year.
- School-level randomization; blocked by district.

Characteristics of the Children by Condition

	Tools Condition	Comparison Condition	Overall
N with pre & post data	455	359	794
Mean age (months)	54.2	54.7	54.4
Gender (% female)	47.6	43.3	45.8
Ethnicity			
Black (%)	29.8	21.7	26.3
Hispanic (%)	23.9	25.6	24.6
White (%)	37.3	41.6	39.1
Other (%)	9.0	11.1	9.9
IEP (%)	13.5	15.1	14.2
ELL (%)	27.5	30.5	28.7

Wilson & Farran, SREE 2012

Teacher Characteristics by Condition

	Tools Condition (n=32)		Comparison Condition (n=28)		Overall (n=60)	
	Mean/n	Range/%	Mean/n	Range/%	Mean/n	Range/%
Years of Experience						
Years Teaching	12.0	2-30	12.1	1-34	12.0	1-34
Years Teaching Pre-K	7.7	2-22	6.6	1-17	7.1	1-22
Education Level						
Bachelor's Degree	12	38%	17	61%	29	48%
Some Graduate Coursework	11	34%	5	18%	16	27%
Master's Degree	9	28%	6	21%	15	25%
Licensure Area						
Early Childhood (0-Pre-K)	19	60%	18	64%	37	62%
Pre-K-3rd	2	6%	1	3%	3	5%
Elementary Ed.	8	25%	8	29%	16	26%
Early Childhood & Special Ed	3	9%	1	4%	4	7%

Instrumentation

- Woodcock-Johnson Tests of Achievement
  - Literacy
    - Letter-Word ID
    - Spelling
  - Language
    - Academic Knowledge
    - Oral Comprehension
    - Picture Vocabulary
  - Mathematics
    - Applied Problems
    - Quantitative Concepts

- Self-Regulation (EF)
  - Attention
    - DCCS
    - Copy Design
  - Inhibitory Control
    - Peg Tapping
    - Head-Toes-Knees-Shoulders
  - Working Memory
    - Corsi Blocks (forward and backward digit span)
- Teacher ratings
  - Interpersonal Skills
  - Work-related Skills
  - Adaptive Language Inventory

Classroom Observations

- Fidelity of Curriculum Implementation Measure
  - Created in partnership with curriculum developers
  - 3 observations by staff familiar with the curriculum
    - Number and timing of *Tools* activities
    - Number of steps enacted for each activity
    - Number of mediators used throughout the day
    - Weighted score incorporating the difficulty level of the activity
- Ratings of teacher curriculum delivery from trainers, coaches, and observers

Did Teachers Implement Tools?

- Most *Tools* teachers implemented the activities prescribed in the manual at the appropriate times during the year.

- There were clear observable differences between *Tools* and comparison classrooms.

- Number of activities, steps, and quality ratings varied across teachers.

- Ratings from trainers, coaches, and observers were significantly correlated with the fidelity instrument scores.

- Though we do not know definitively how much of the curriculum is enough, our observations suggest that teachers implemented the curriculum according to the *Tools* manuals.
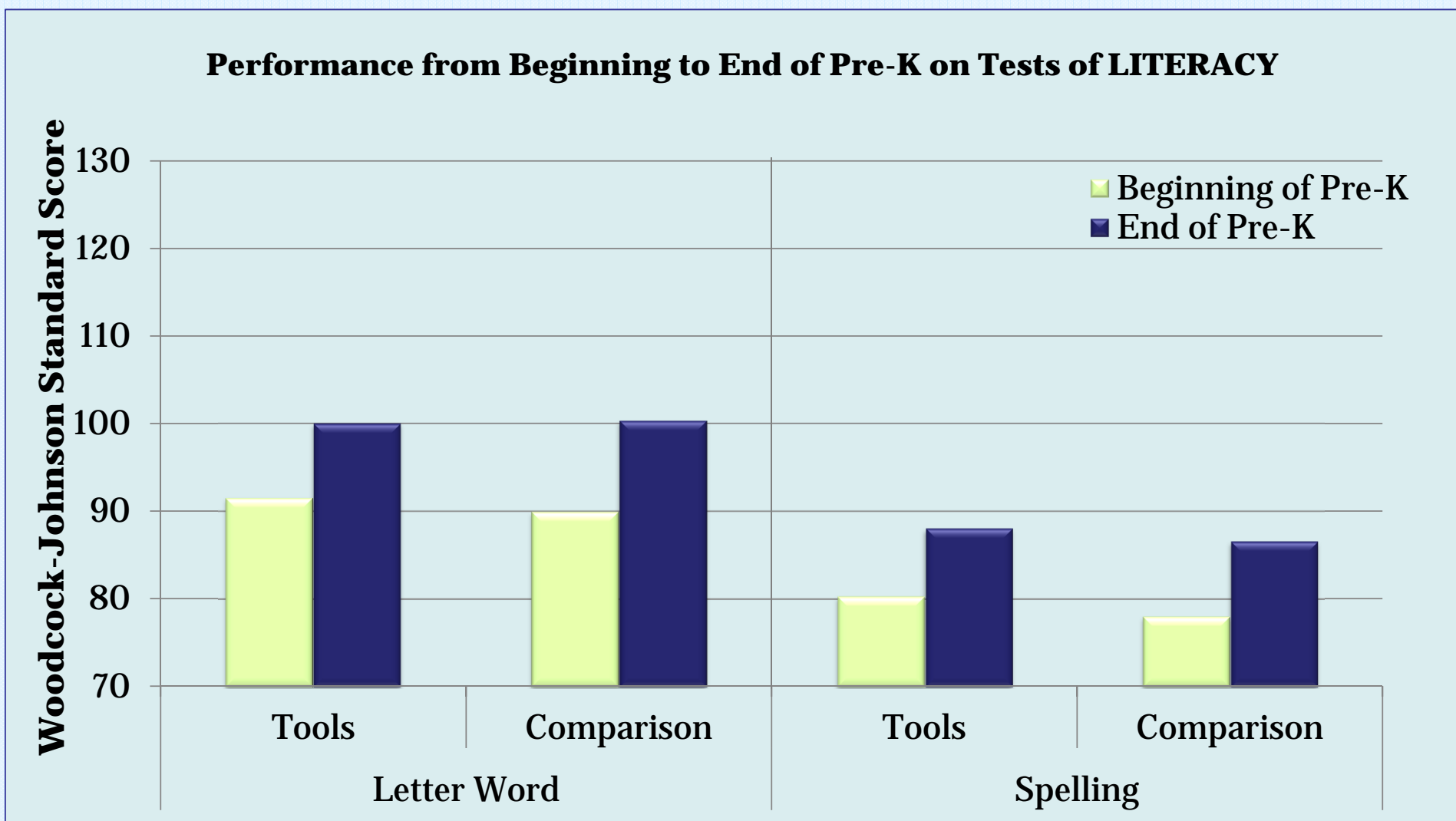
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Curricula in Comparison Classrooms

Curricula Reported by Comparison Teachers	
Creative Curriculum	15
Literacy First	4
Houghton Mifflin	2
Scott Foresman	5
CSEFEL	6
Other	10

Note: Teachers could write down more than one curriculum.

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Analysis Plan

- Randomization check found no significant differences between conditions on any baseline measure.

- To test the effects of *Tools*, multi-level models were fit to posttest scores for each outcome, with students nested within classrooms, schools, and district blocks.

- Covariates included gender, ELL status, ethnicity, pretest, age, and pre-post interval.

- Condition x demographics and condition x pretest interactions were also tested.

- All analyses used Woodcock-Johnson W scores and raw scores on self-regulation assessments and teacher reports.

- Standard scores reported in bar charts for WJ; percentage correct or raw scores for other assessments and ratings.

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Effects of *Tools* on Literacy

Performance from Beginning to End of Pre-K on Tests of LITERACY

Mixed Model Results for Literacy

	Letter-Word ID			Spelling		
	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**0.01**	**.907**	**-.11**	**1.98**	**.160**	**.05**
Gender=male	13.83	.000		27.21	.000	
Language status=ELL	0.55	.461		0.52	.472	
Ethnicity=Black	5.33	.021		6.00	.015	
Ethnicity=White	4.56	.034		1.81	.179	
Ethnicity=Hispanic	2.58	.109		0.62	.433	
Pretest	392.57	.000		232.88	.000	
Age at pretest	0.04	.841		3.95	.047	
Pre-post interval	1.19	.288		0.31	.581	
Interactions	-	-		-	-	
Condition x Pretest	0.68	.412		1.52	.219	
Condition x Gender	3.18	.075		1.18	.278	
Condition x ELL	0.03	.864		1.72	.191	
Condition x Black Ethnicity	0.07	.789		0.96	.328	
Condition x White Ethnicity	0.01	.940		0.24	.622	

Effects of *Tools* on Language

Performance from Beginning to End of Pre-K on Tests of LANGUAGE
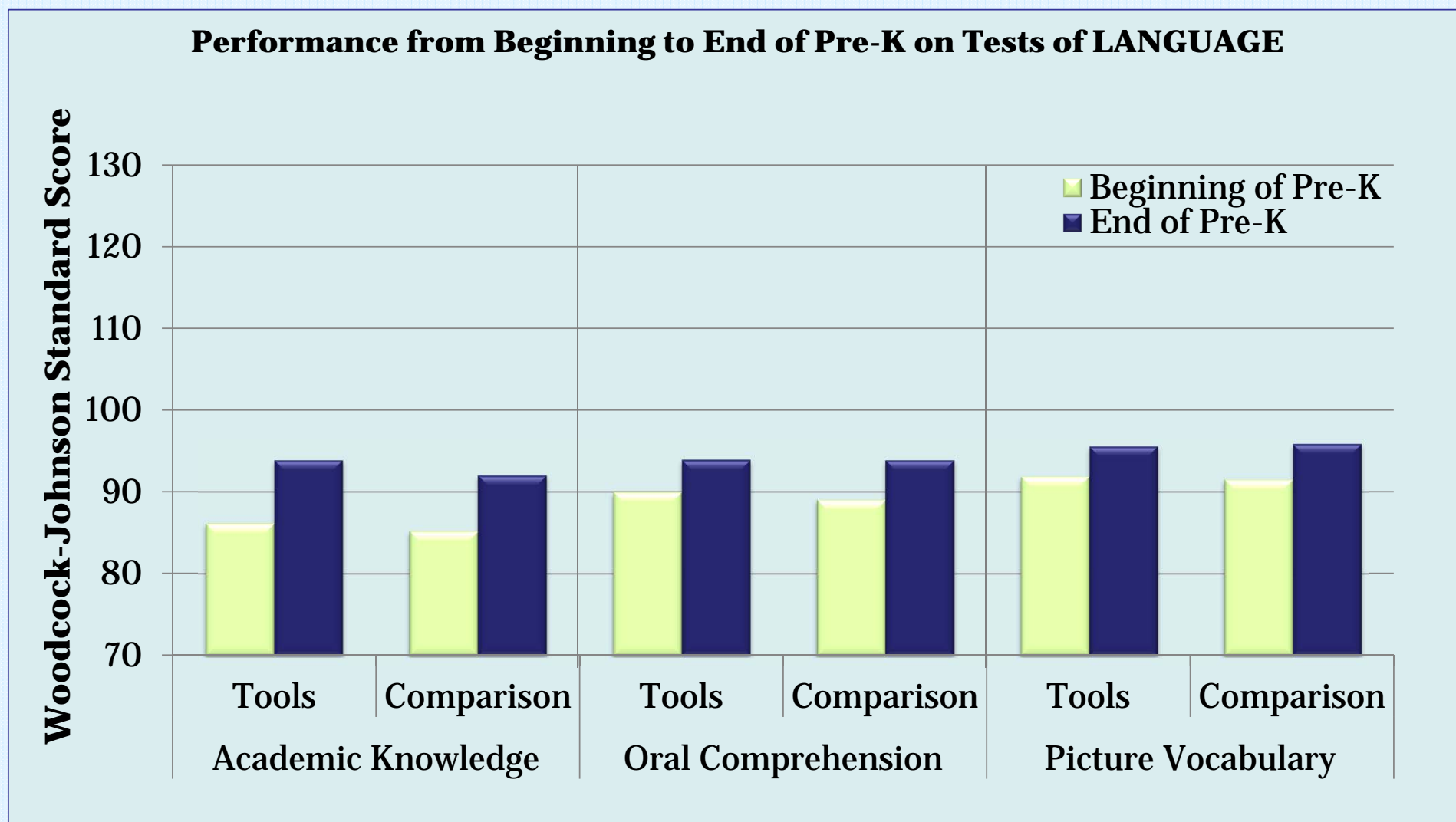
Mixed Model Results for Language

	Academic Knowledge			Oral Comprehension			Picture Vocabulary		
	F	p	ES	F	P	ES	F	p	ES
Tools Condition (vs. Comparison)	**0.56**	**.457**	**.03**	**0.71**	**.399**	**-.07**	**0.41**	**.522**	**-.05**
Gender=male	14.48	.000		0.06	.811		0.04	.846	
Language status=ELL	0.19	.662		6.55	.011		3.97	.047	
Ethnicity=Black	0.75	.388		0.26	.611		1.46	.227	
Ethnicity=White	0.06	.802		1.32	.251		0.30	.581	
Ethnicity=Hispanic	1.92	.166		0.36	.549		3.25	.072	
Pretest	935.98	.000		533.85	.000		637.94	.000	
Age at pretest	0.01	.916		0.97	.325		0.44	.509	
Pre-post interval	0.87	.352		0.08	.774		2.06	.154	
Interactions	-	-		-	-		-	-	
Condition x Pretest	3.87	.049		1.16	.281		3.79	.052	
Condition x Gender	0.68	.411		0.02	.889		1.73	.189	
Condition x ELL	0.65	.419		0.34	.563		0.01	.927	
Condition x Black Ethnicity	0.67	.414		0.08	.775		0.90	.343	
Condition x White Ethnicity	5.59	.018		0.02	.890		0.70	.404	

Effects of *Tools* on Mathematics

Performance from Beginning to End of Pre-K on Tests of Mathematics
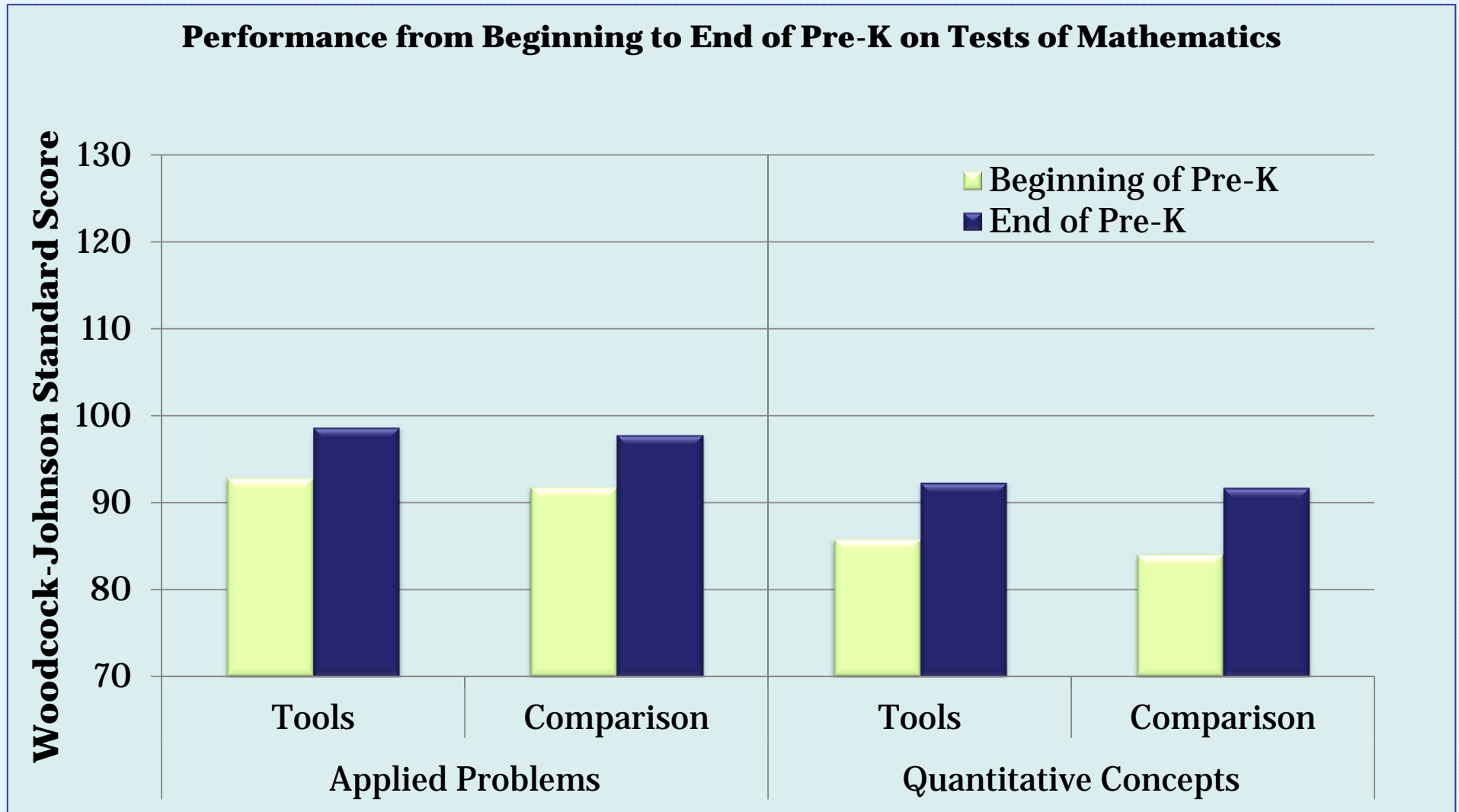
Mixed Model Results for Mathematics

	Applied Problems			Quantitative Concepts		
	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**2.26**	**.133**	**.03**	**0.02**	**.883**	**-.07**
Gender=male	0.00	.977		0.02	.891	
Language status=ELL	0.00	.952		1.46	.227	
Ethnicity=Black	14.25	.000		3.24	.072	
Ethnicity=White	2.04	.154		1.49	.223	
Ethnicity=Hispanic	2.64	.105		0.02	.901	
Pretest	529.07	.000		509.45	.000	
Age at pretest	0.18	.670		2.80	.095	
Pre-post interval	1.93	.176		3.68	.065	
Interactions						
Condition x Pretest	0.25	.617		0.22	.637	
Condition x Gender	0.32	.570		1.11	.292	
Condition x ELL	1.53	.216		0.50	.478	
Condition x Black Ethnicity	1.00	.317		0.11	.735	
Condition x White Ethnicity	1.40	.238		0.05	.824	

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Effects of *Tools* on Attention

Performance from Beginning to End of Pre-K on ATTENTION
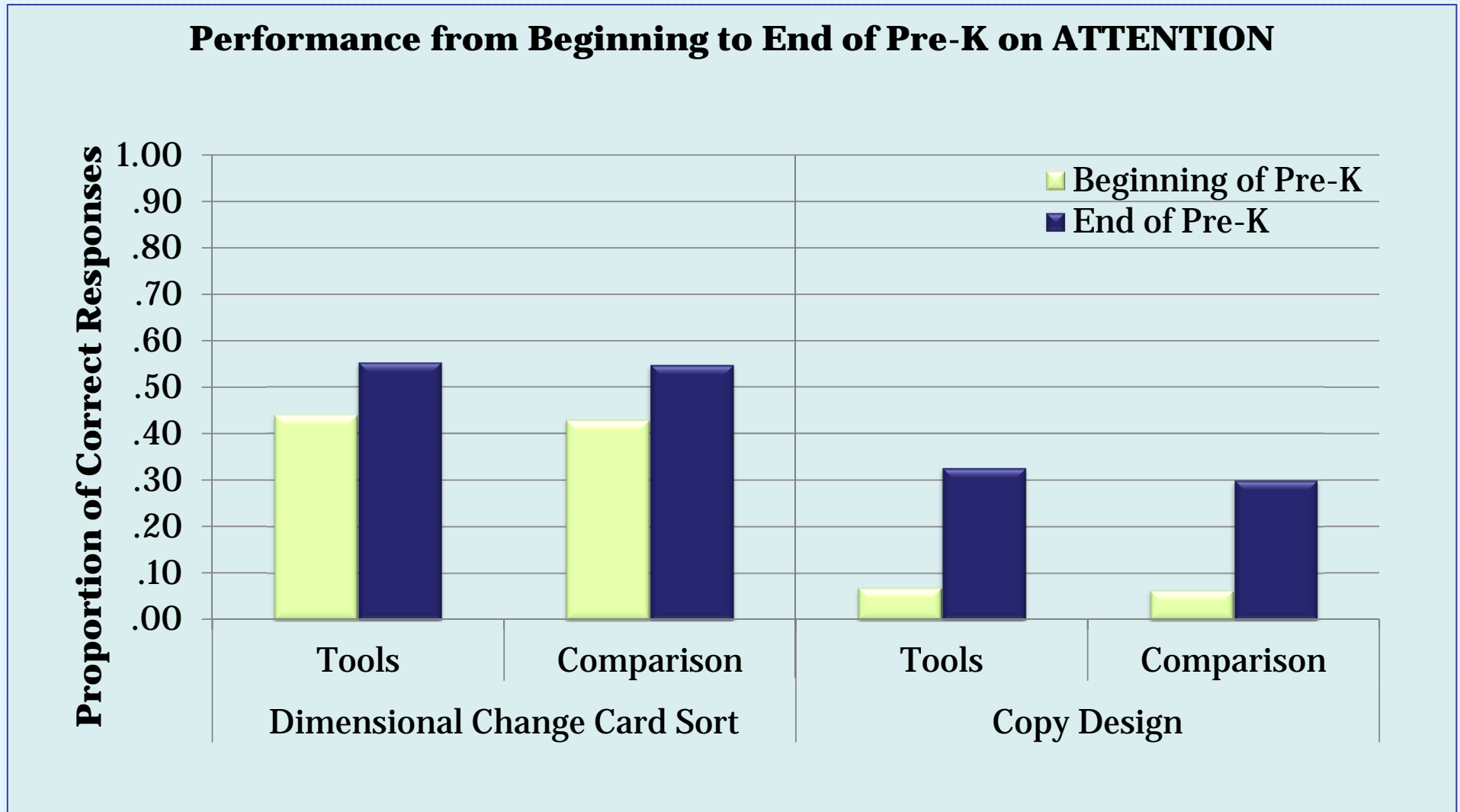
Mixed Model Results for Attention

	DCCS			Copy Design		
	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**0.01**	**.935**	**.01**	**0.14**	**.707**	**.15**
Gender=male	11.93	.001		2.46	.117	
Language status=ELL	0.83	.364		2.41	.121	
Ethnicity=Black	1.08	.299		6.33	.012	
Ethnicity=White	2.37	.125		3.03	.082	
Ethnicity=Hispanic	0.64	.426		0.11	.738	
Pretest	76.78	.000		172.76	.000	
Age at pretest	0.71	.399		14.55	.000	
Pre-post interval	0.02	.903		0.16	.688	
Interactions						
Condition x Pretest	0.96	.327		1.84	.175	
Condition x Gender	3.81	.051		0.15	.696	
Condition x ELL	0.02	.891		0.35	.554	
Condition x Black Ethnicity	0.01	.932		0.10	.754	
Condition x White Ethnicity	0.25	.616		0.10	.757	

Effects of *Tools* on Inhibitory Control

Performance from Beginning to End of Pre-K on INHIBITORY CONTROL
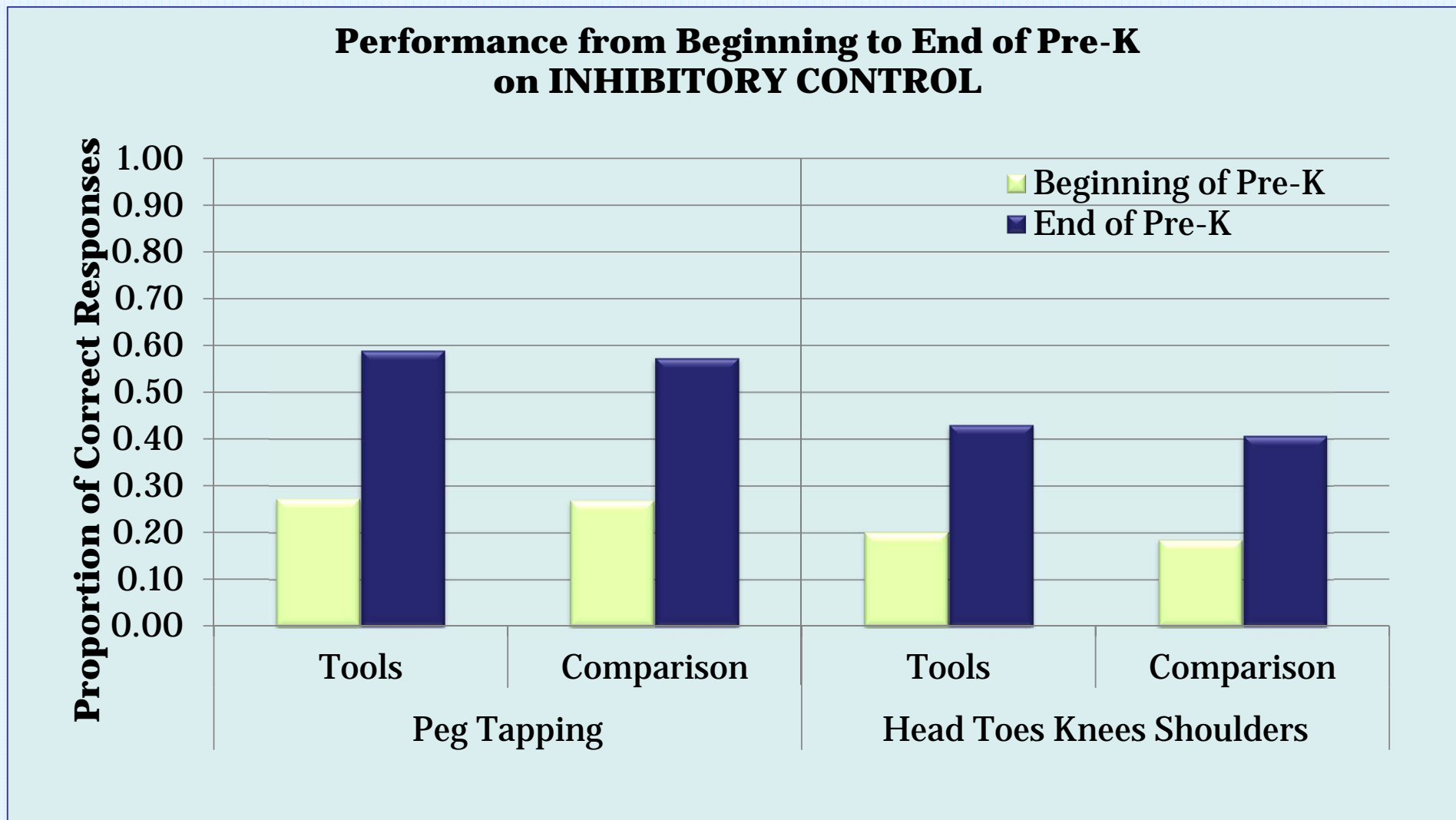
Mixed Model Results for Inhibitory Control

	Peg Tapping			HTKS		
	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**0.17**	**.685**	**.16**	**0.04**	**.837**	**.03**
Gender=male	6.78	.009		8.75	.003	
Language status=ELL	0.44	.506		0.68	.409	
Ethnicity=Black	4.87	.028		1.20	.273	
Ethnicity=White	0.05	.819		2.03	.154	
Ethnicity=Hispanic	1.22	.271		0.22	.641	
Pretest	308.76	.000		199.22	.000	
Age at pretest	5.16	.023		14.64	.000	
Pre-post interval	0.07	.792		8.68	.004	
Interactions						
Condition x Pretest	0.61	.436		0.95	.331	
Condition x Gender	0.09	.767		0.54	.464	
Condition x ELL	0.00	.950		0.51	.477	
Condition x Black Ethnicity	4.08	.044		0.24	.622	
Condition x White Ethnicity	1.01	.316		0.33	.565	

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Effects of *Tools* on Working Memory

Performance from Beginning to End of Pre-K on WORKING MEMORY
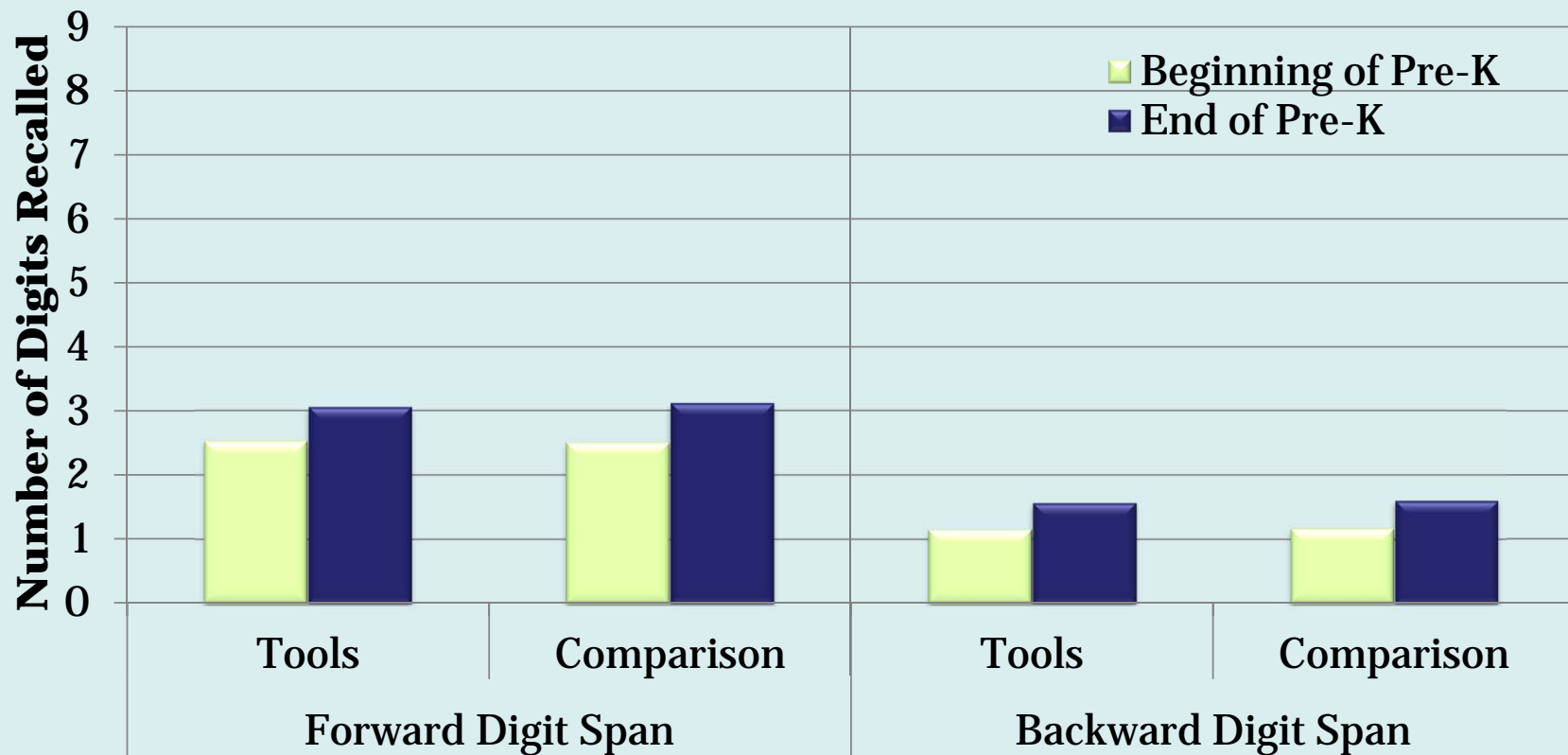
Mixed Model Results for Working Memory

	Forward Span			Backward Span		
	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**0.31**	**.576**	**-.04**	**0.00**	**.998**	**-.02**
Gender=male	0.11	.738		5.29	.022	
Language status=ELL	0.25	.620		2.23	.136	
Ethnicity=Black	4.67	.031		2.60	.107	
Ethnicity=White	0.30	.584		0.01	.925	
Ethnicity=Hispanic	0.69	.405		0.00	.997	
Pretest	140.22	.000		27.90	.000	
Age at pretest	4.89	.027		17.43	.000	
Pre-post interval	0.35	.559		7.58	.007	
Interactions						
Condition x Pretest	0.05	.829		0.00	.973	
Condition x Gender	0.00	.947		6.47	.011	
Condition x ELL	0.98	.322		0.33	.563	
Condition x Black Ethnicity	1.61	.205		1.76	.186	
Condition x White Ethnicity	0.49	.485		0.01	.926	

Effects of *Tools* on Teacher Ratings of Social and Behavioral Skills

Performance from Beginning to End of Pre-K on SOCIAL AND BEHAVIORAL SKILLS
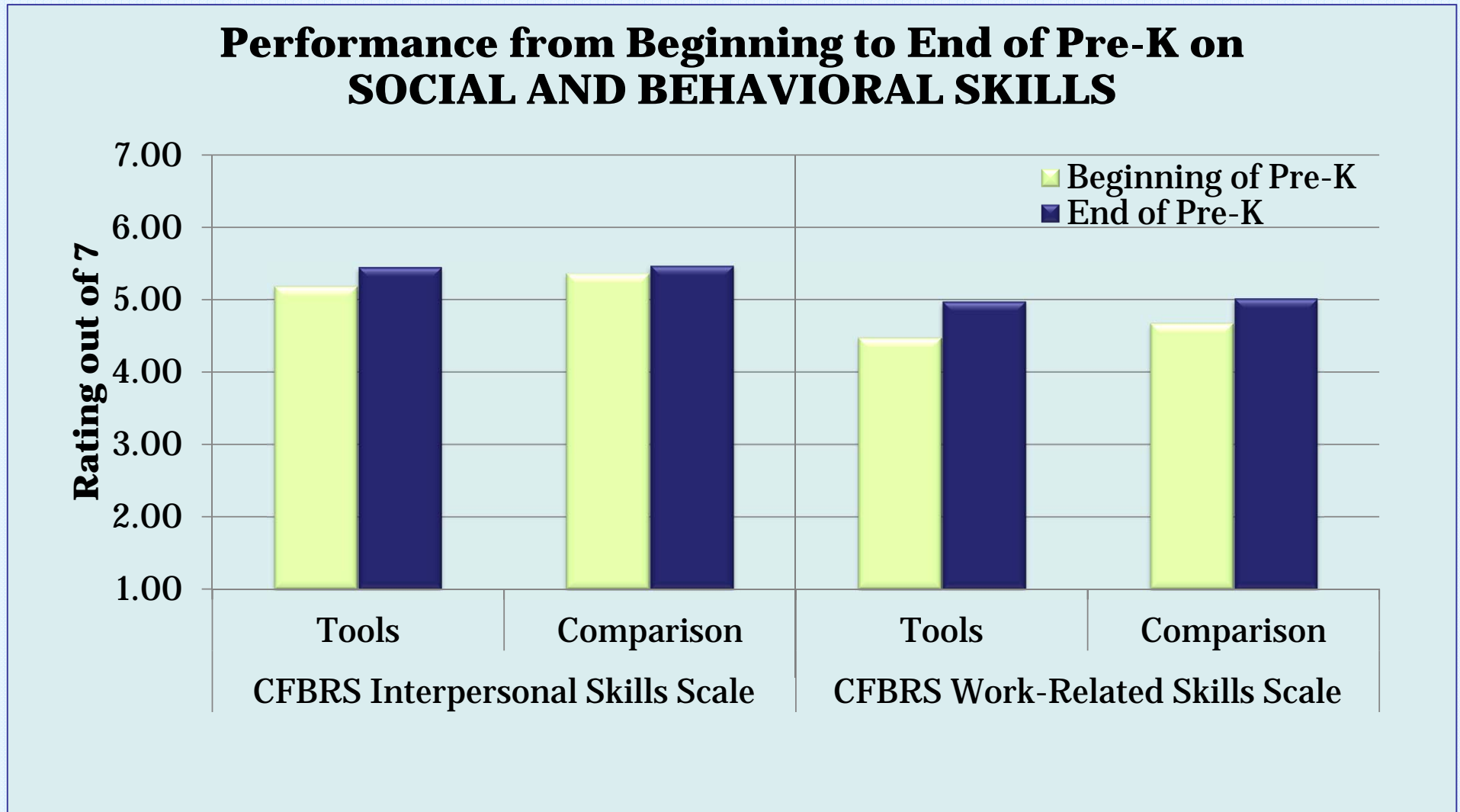
Effects of *Tools* on Teacher Ratings of Adaptive Language

Performance from Beginning to End of Pre-K on ADAPTIVE LANGUAGE
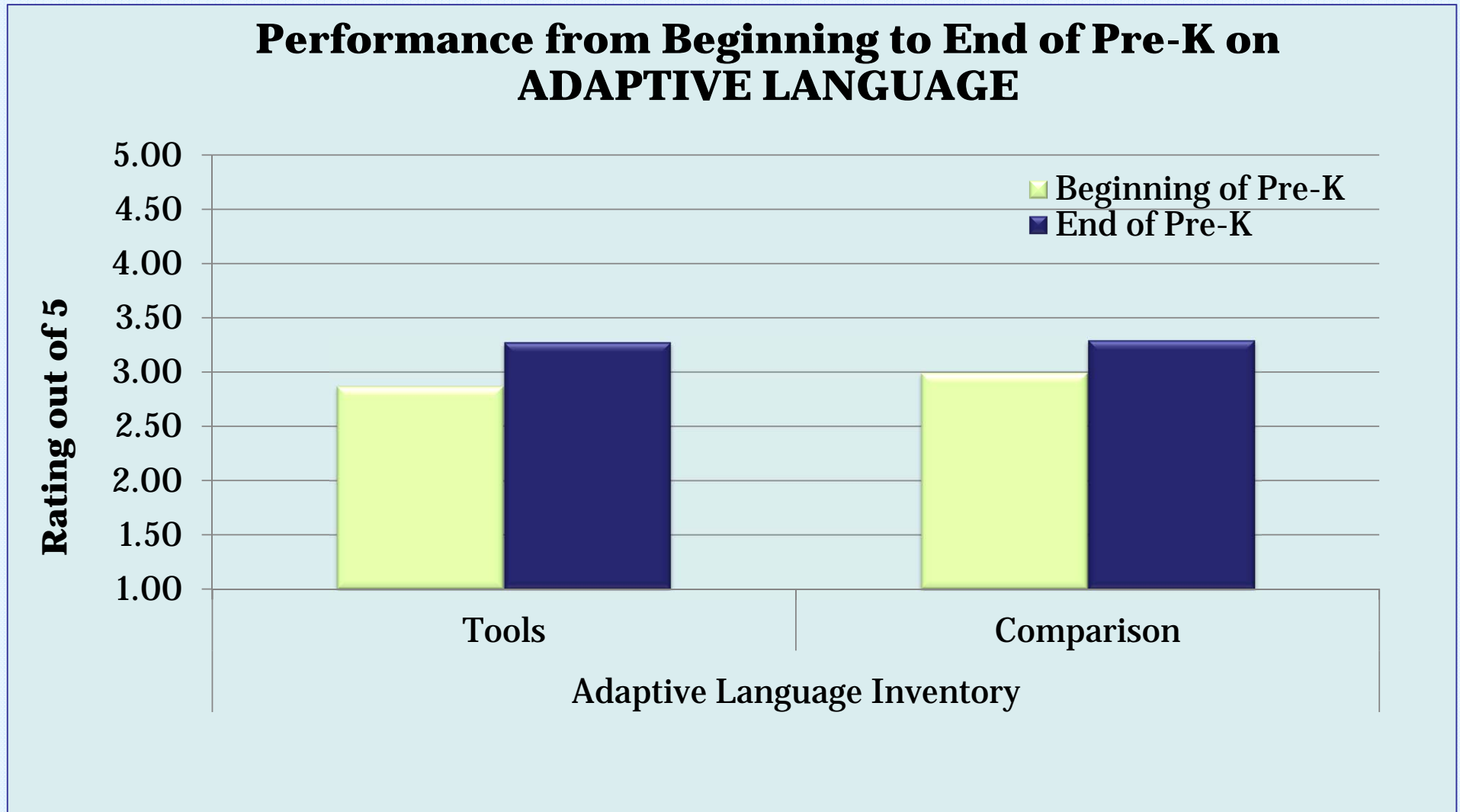
Mixed Model Results for Teacher Ratings

	Interpersonal Skills			Work-related Skills			Adapt. Language		
	F	P	ES	F	p	ES	F	p	ES
Tools Condition (vs. Comparison)	**1.81**	**.180**	**.11**	**0.24**	**.624**	**.10**	**1.64**	**.202**	**.01**
Gender=male	0.05	.820		3.09	.079		2.45	.118	
Language status=ELL	0.63	.428		3.71	.054		0.33	.568	
Ethnicity=Black	8.71	.003		19.49	.000		10.22	.001	
Ethnicity=White	3.79	.052		6.68	.010		4.09	.043	
Ethnicity=Hispanic	1.44	.230		9.78	.002		3.91	.048	
Pretest	1268.90	.000		932.07	.000		867.40	.000	
Age at pretest	1.17	.281		2.59	.108		4.55	.033	
Pre-post interval	0.15	.702		0.69	.407		2.35	.128	
Interactions									
Condition x Pretest	7.74	.006		2.00	.157		2.24	.135	
Condition x Gender	0.66	.417		0.10	.751		0.81	.370	
Condition x ELL	0.43	.513		0.03	.860		1.21	.271	
Condition x Black Ethnicity	0.00	.986		0.81	.369		0.18	.674	
Condition x White Ethnicity	0.34	.559		0.20	.654		0.66	.417	

Interpreting the Interactions

Outcome	Interaction	Interpretation
Letter-Word ID	Condition x Gender	Comparison favored for boys.
DCCS	Condition x Gender	Post hoc tests not significant; interaction due to gender differences within conditions.
Backward Span	Condition x Gender	Comparison favored for girls.
Academic Knowledge	Condition x White	Tools favored for White students.
Peg Tapping	Condition x Black	Tools favored for Black students.
Academic Knowledge	Condition x Pretest	Tools slightly favored for low pretesters.
Picture Vocabulary	Condition x Pretest	Comparison favored overall; more so for low pretesters.
Interpersonal Skills	Condition x Pretest	Tools favored for low pretesters.

Summary of Results

- No significant effects for *Tools of the Mind* on literacy, language, or mathematics gains when compared to comparison classrooms.

- No significant effects for *Tools* on self-regulation gains.

- No significant effects on teacher ratings.

- *Tools of the Mind* was not found to be consistently more or less effective for demographic subgroups or low scorers at baseline.

What about Fidelity of Implementation?

- There was variation among the teachers in implementation of the curriculum.

- Observations were consistent with ratings of high implementation provided by trainers/coaches.

- Variations in fidelity of implementation measures across the full group of 32 *Tools* teachers were not associated with greater gains in achievement or self-regulation.

- Comparisons between the 8 classrooms with the highest fidelity and the remaining 24 *Tools* classrooms revealed positive effects on some achievement and self-regulation outcomes, as well as teacher ratings.

Discussion

- Our objective from the outset was to conduct a rigorous evaluation of a very intriguing curriculum.

- No evidence that Tools was more effective than typical preschool classrooms; no evidence that it was harmful either.
  - Particularly surprising were the findings on self-regulation.

- Kindergarten and 1st grade follow-ups are planned; and 2nd cohort of preschoolers in NC is in preschool now.

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