The Effect of *Tools of the Mind* Curriculum on Children's Achievement and Self-Regulation

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Self Regulation and Executive Function

- Self regulation manifested in classroom settings and related to learning has had different names
  - Learning Dispositions (Katz, 2002)
  - Work Related Skills (Cooper & Farran, 1988)
  - Approaches to Learning (ECLS-K)
  - Learning-Related Cognitive Self Regulation (Lipsey & Farran, 2009)
- The currently more common term is Executive Function

Characteristics in Common and Importance for Education

- Executive Function (Hughes, 2011)
  - Inhibitory control
  - Working memory
  - Attentional flexibility
- Importance of EF for Education
  - Evidence that EF predicts school achievement
    - Individual tests of content, notably math
    - Grades achieved, notably math again
    - Found in both early and late elementary, middle school
- A critical question – Can EF be increased?

Early Childhood Curricula

- Curriculum as a possible mechanism for change in EF (see Best, Miller, & Naglieri, 2011; Diamond & Lee, 2011; Hughes, 2011)
- Pre-K classrooms required to have a curriculum and a licensed teacher (in most states)
- Public school prekindergarten classrooms serve children likely to have lower self regulation skills
- More experimental and process research needed to determine if a curriculum can mediate changes in EF in prekindergarten classes.

Tools of the Mind Curriculum

- Development began in the 1990s
- Consists of 40-65 Vygotskian-based activities – central focus is socio-dramatic play
- Organized around helping children develop learning dispositions while they are learning academic skills
  - Self Regulation
  - Attentiveness
  - Behavioral Control
- Dispositions to help children master new material across the school years

Prior Research

- In 2008, What Works Clearinghouse found no evidence of effectiveness for the curriculum---"Based on the one study, the WWC found no discernible effects in oral language, print knowledge, cognition, or math"
  - The one study was implemented in 2002 by Barnett et al. (2008) and involved an older version of the curriculum
  - Diamond et al. (2007) post tested the Barnett et al. children on EF measures and found curriculum effects
- Since then IES and NICHD have funded several longitudinal, large-scale randomized trials

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.

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
Total assigned N	477	351	828
N with pre & post data	455	359	794
N pretest range	474-475	345-350	819-825
N posttest range	464-472	347-349	811-821
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

Classroom Characteristics by Condition

	Tools Condition	Comparison Condition	Overall
Fall Class Size	17.3	17.9	17.6
Spring Class Size	17.3	17.7	17.5
Spring ELL (% of class)	29.5	29.7	29.6
Spring IEP (% of class)	11.3	13.4	12.3

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
  - 3 observations
  - 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?

- All Tools teachers implemented many of the activities at the appropriate times during the year.
- 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 were implementing the curriculum with fidelity to the manual.

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

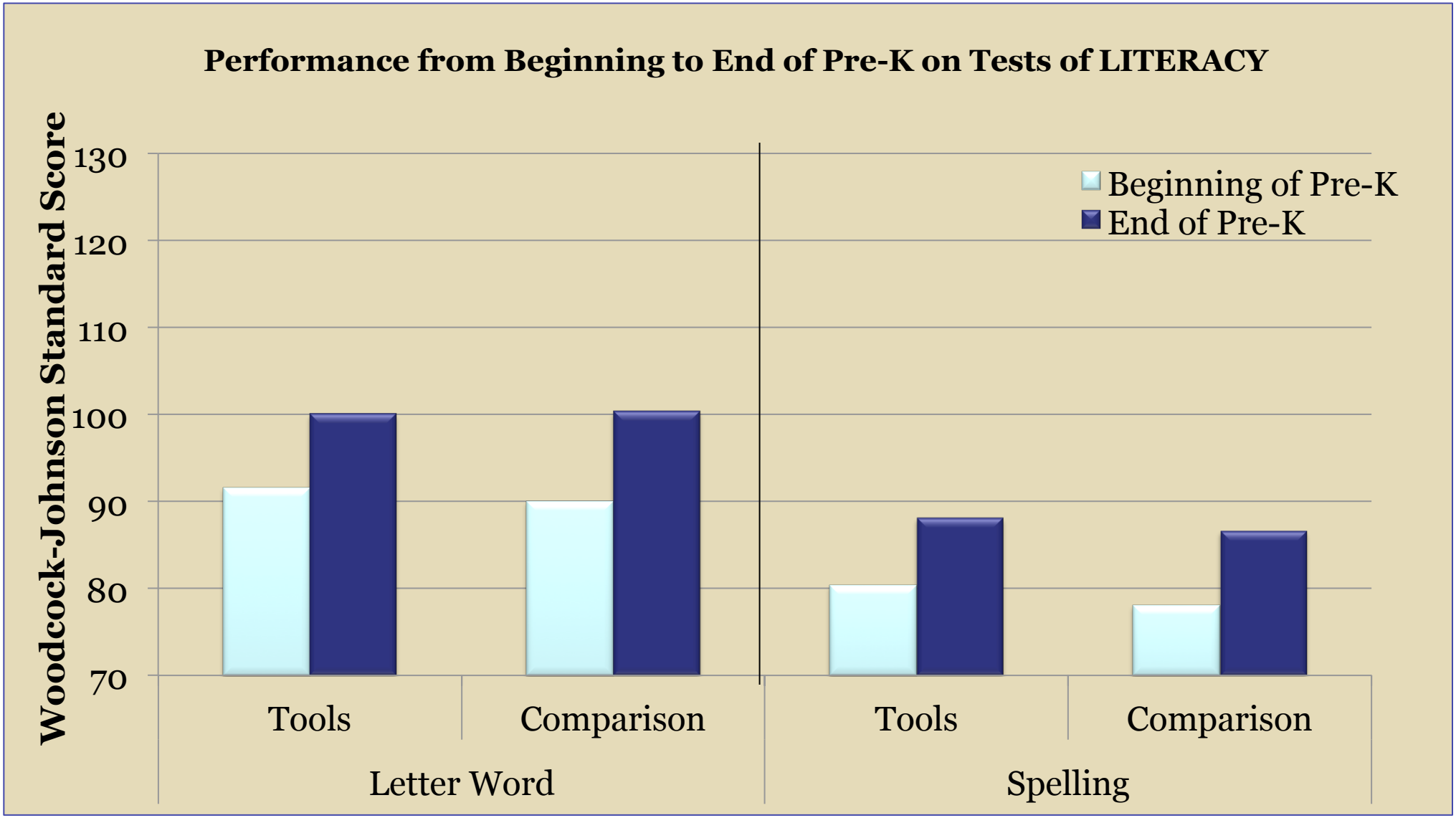
Analysis Plan

- 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.

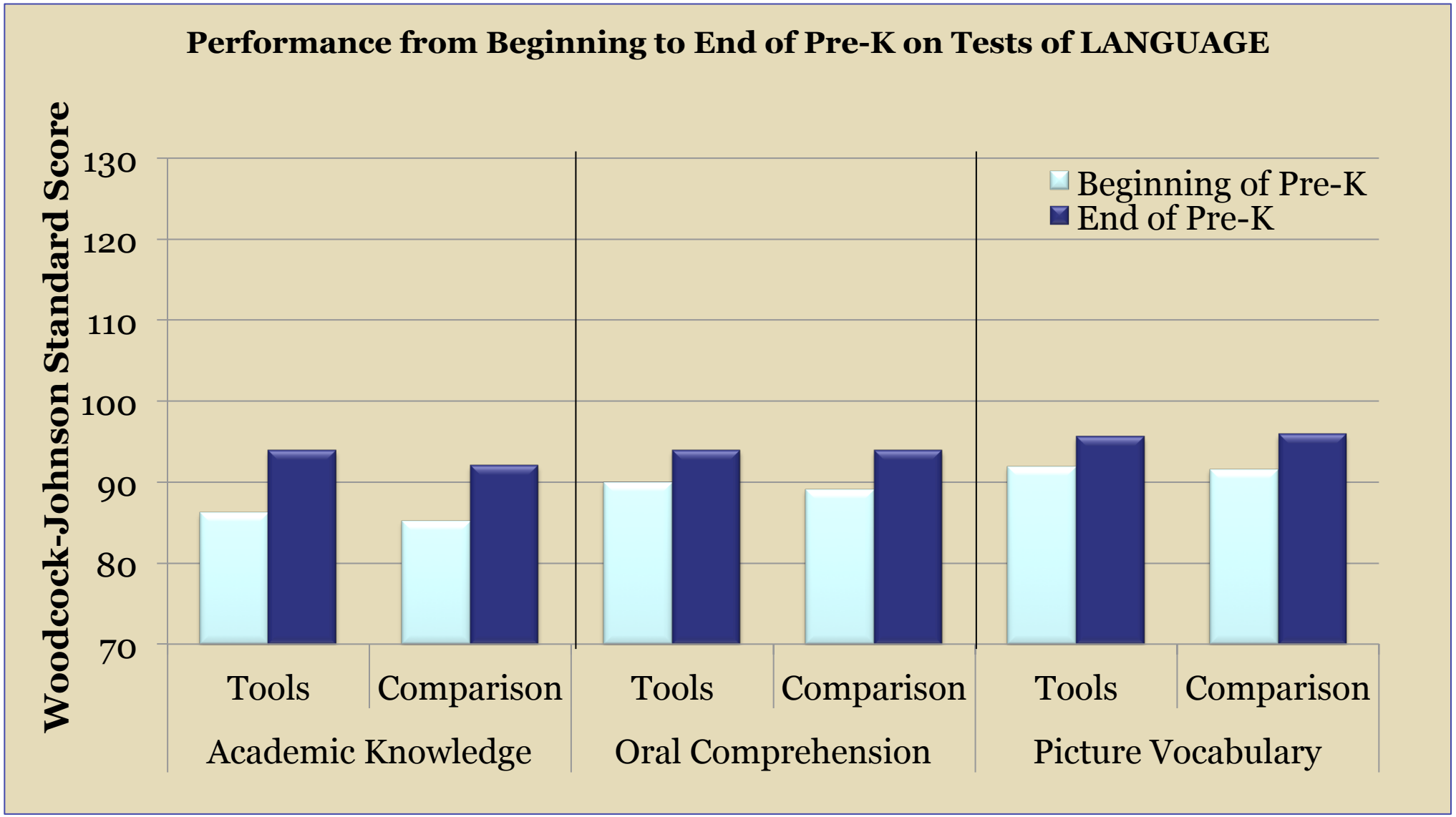
ACHIEVEMENT TEST RESULTS

THE CURRICULUM WAS PREDICTED TO IMPROVE CHILDREN'S LANGUAGE, LITERACY, AND MATHEMATICS SKILLS AND GENERAL KNOWLEDGE.

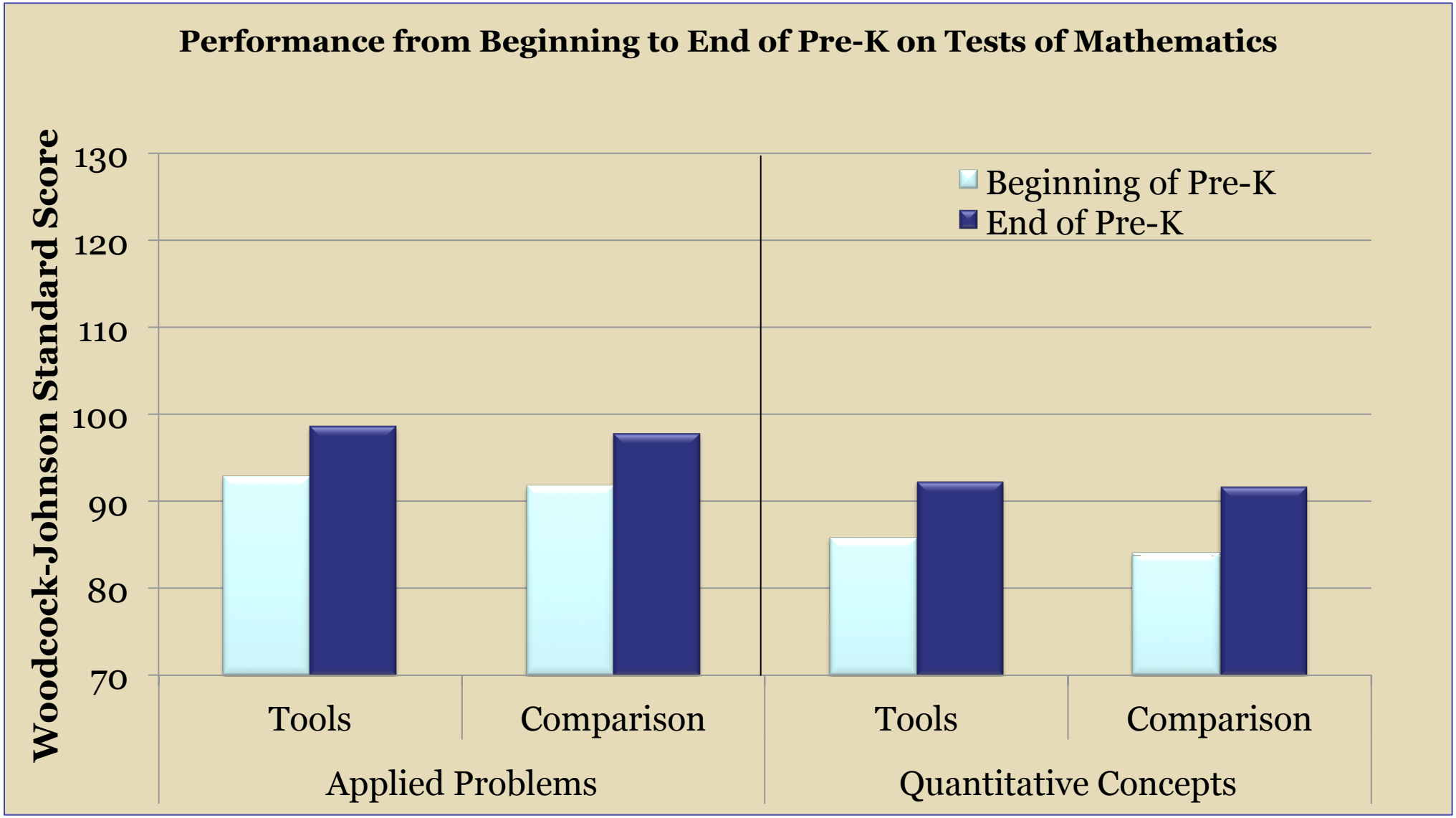
Effects of *Tools* on Literacy



Effects of *Tools* on Language



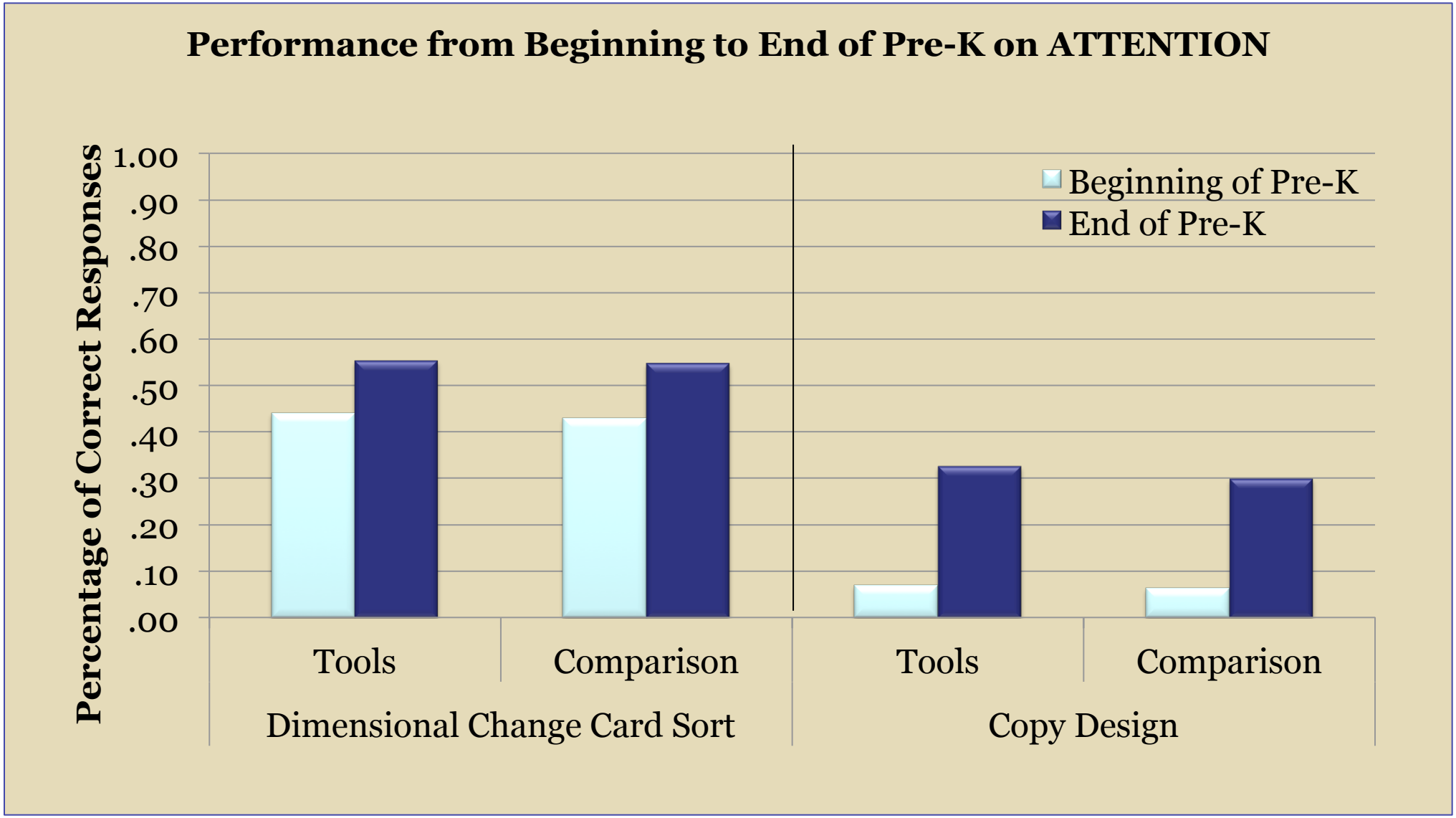
Effects of *Tools* on Mathematics



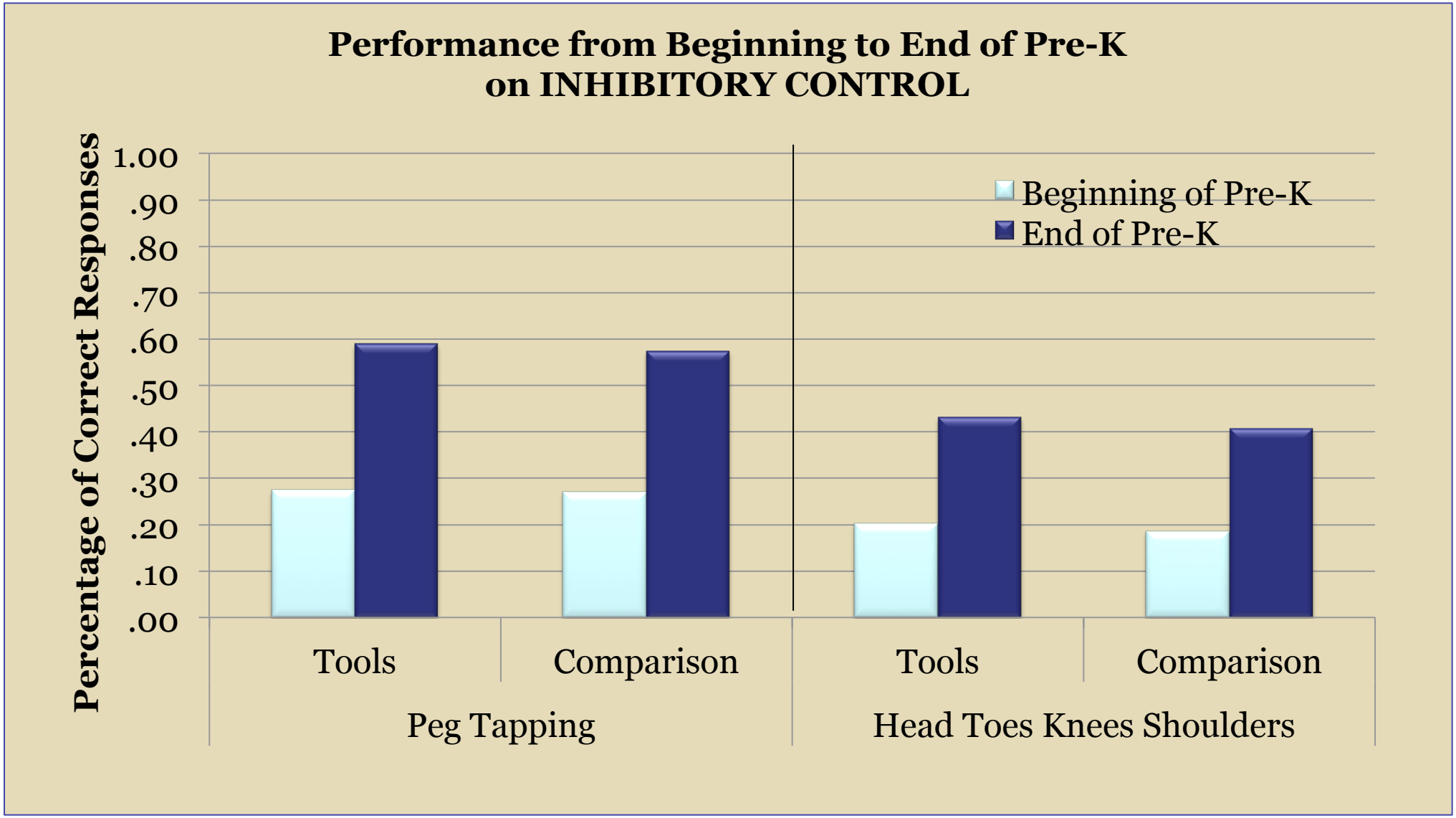
SELF REGULATION RESULTS

GAINS IN ACHIEVEMENT WERE PROPOSED TO BE MEDIATED BY GAINS IN SELF REGULATION OR EF SKILLS. EVEN WITH NO DIFFERENTIAL EFFECTS ON ACHIEVEMENT, EF SKILLS COULD STILL BE AFFECTED.

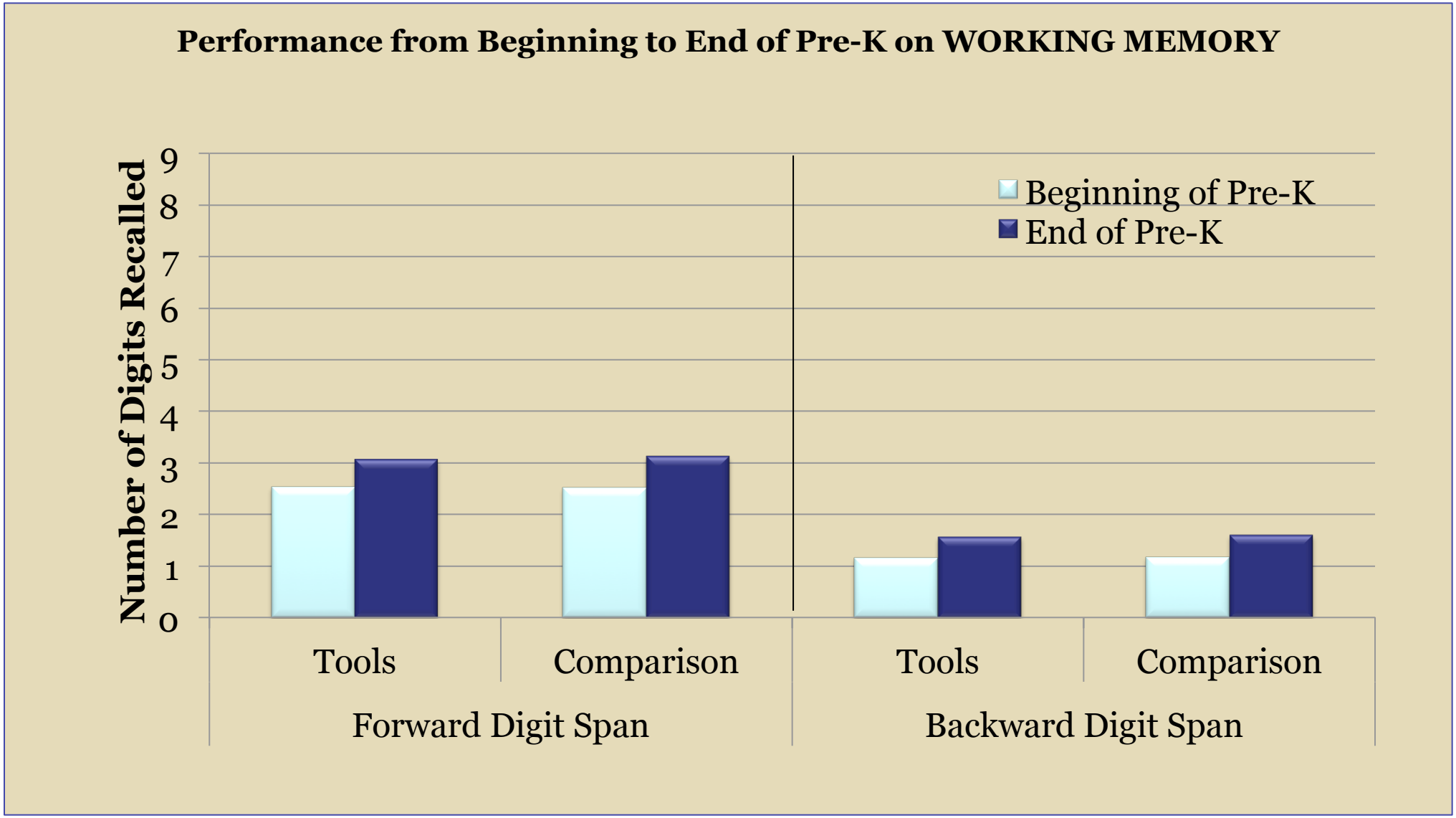
Effects of *Tools* on Attention



Effects of *Tools* on Inhibitory Control



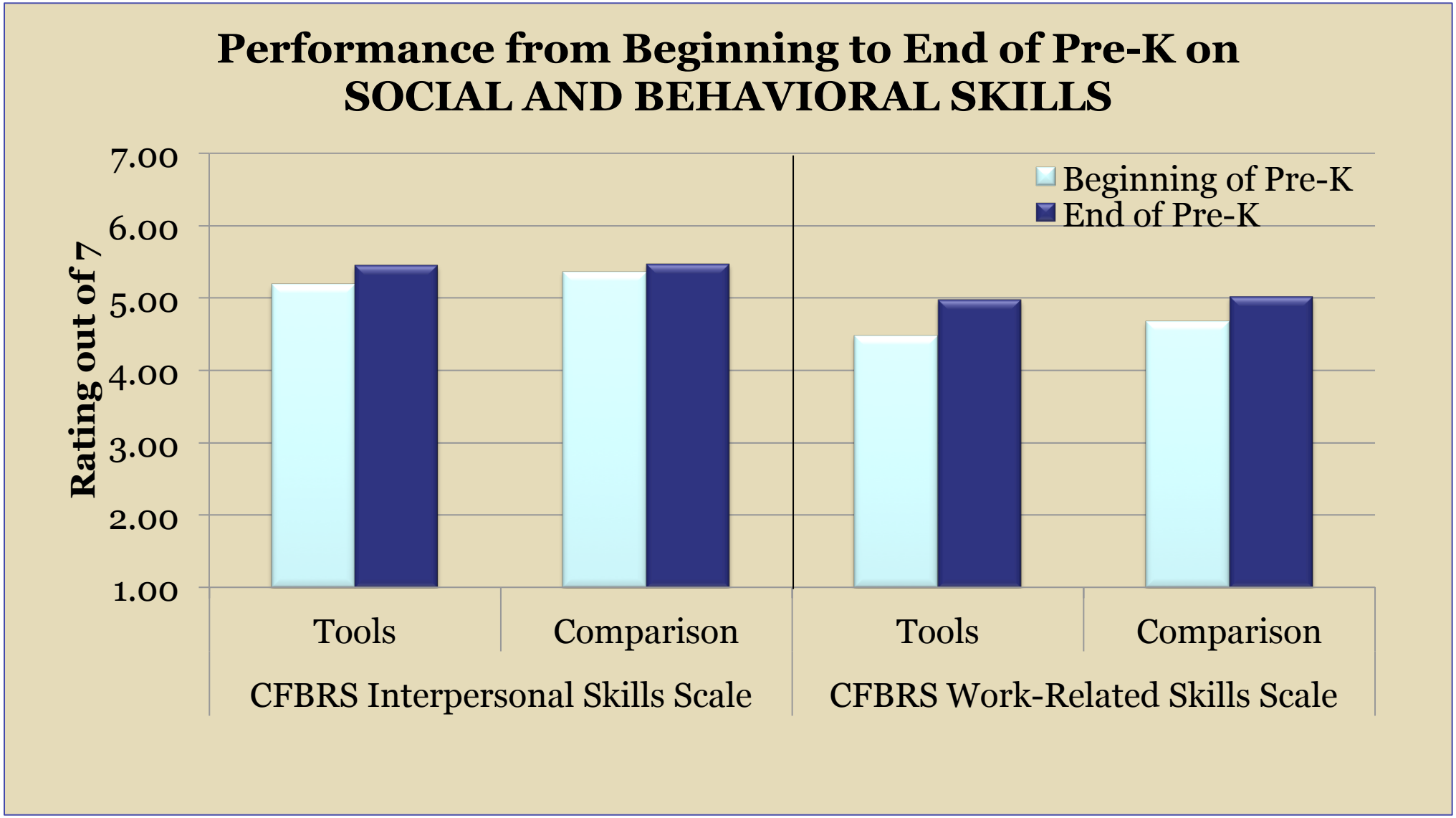
Effects of *Tools* on Working Memory



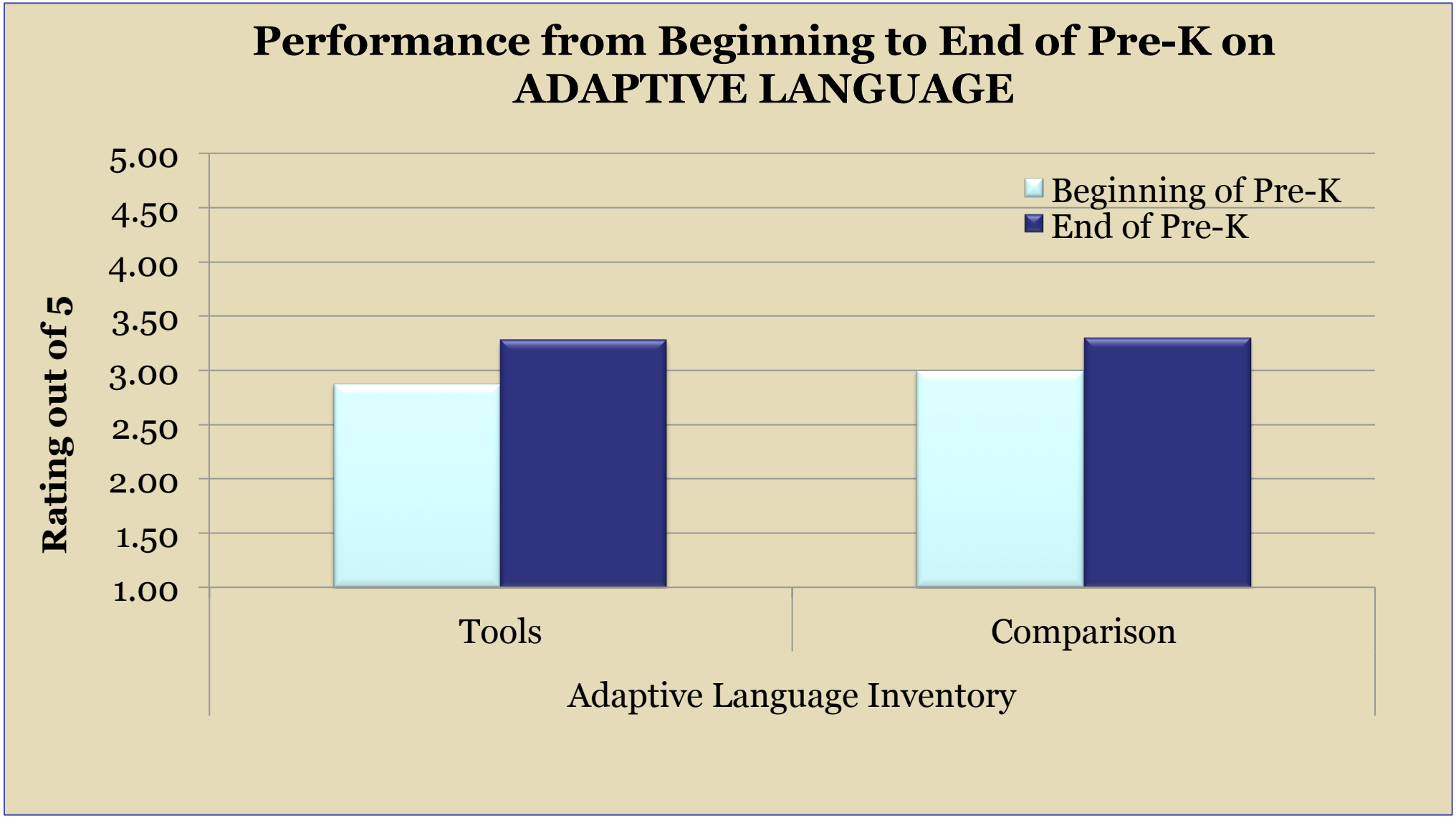
TEACHER RATINGS RESULTS

TEACHERS MAY HAVE OBSERVED BEHAVIORAL DIFFERENCES IN CLASSROOM INTERACTIONS THAT WE DID NOT PICK UP WITH OUR ASSESSMENTS

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



Effects of *Tools* on Teacher Ratings of Adaptive Language



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.
- *Tools of the Mind* was no more or less effective in any of the 5 school systems

Discussion

- No evidence that *Tools* was more effective than business as usual in prekindergarten classrooms staffed with licensed early childhood teachers.
- No indication that *Tools* was harmful either.
- We were as surprised as the developers by these results – we consider them to be our partners in this rigorous evaluation, and we both expected the curriculum to be a success.
- Kindergarten and 1st grade follow-ups are planned; and 2nd cohort of preschoolers in NC is finishing their full implementation year now.
- Stay tuned!

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