Effects of a Curricular Attempt to Improve Self-Regulation and Achievement in Prekindergarten Children

Dale C. Farran, Sandra J. Wilson, & Mark W. Lipsey

Peabody Research Institute

Vanderbilt University

Presentation to the Society of Research in Child Development

April 19, 2013

Research Team

- Principal Investigators
  - Dale C. Farran
  - Mark W. Lipsey
  - Sandra Jo Wilson
- Curriculum Developers
  - Elena Bodrova & Deborah Leong
- Project Coordinators
  - Deanna Meador
  - Jennifer Norvell
  - Diane Spencer
  - Carolyn Boyles
- Research Associate
  - Kimberly Turner
- Post-Doctoral Fellows
  - Mary Wagner Fuhs
  - Asha Spivak
- Research Assistants
  - Ashley Keene
  - Jessica Ziegler
- Doctoral Fellows
  - Karen Anthony
  - Lydia Bentley
  - Sascha Mowery
  - Cathy Yun
- Multiple part-time assessors in Tennessee and North Carolina.

Funded by the Institute for Education Sciences Grant #R305A09053-10

Self Regulation and Executive Function

- Cognitive 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 (Cool) Executive Function

Characteristics in Common and Importance for Education

- Executive Function (Hughes, 2011)
  - Inhibitory control
  - Working memory
  - Attentional flexibility
- Importance of EF for Education
  - Greatly increased interest in past few years
  - 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 Classrooms

- Public school prekindergarten classrooms serve children likely to have lower academic and self regulation skills
- Pre-K classrooms required to have a curriculum and a licensed teacher
- Recent interest in curriculum as a possible mechanism for facilitating executive function and academic skills (e.g., Diamond & Lee, 2011).
- Full day curricular approaches involve significant paradigm shift for teachers, integrating academic skills with self regulation.

Tools of the Mind Curriculum

- Development began in the 1990s
- Focused on helping children develop learning dispositions while they are learning academic skills
  - Self Regulation
  - Attentiveness
  - Behavioral Control
- Dispositions will help children master new material across the school years
- Widely in use (e.g., Washington D.C. school system, the country of Chili)
- Data presented here are from first large scale randomized control trial of the curriculum

Research Questions

1. Do children in *Tools of the Mind* classrooms improve more in literacy, language, math, learning related self-regulation, and social skills during the preschool year than children in "business as usual" comparison classrooms?
   - Do the pre-k effects sustain in kindergarten?
   - Does a second cohort with more focused implementation efforts show greater curriculum effects?
2. Does the overall level of implementation of *Tools* relate to outcomes?
3. How different are the counterfactual classrooms from those implementing *Tools*

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 classrooms
  - 2nd system in North Carolina (data collection lagged a year)
    - 10 *Tools* classrooms; 10 Comparison classrooms
    - All adopting a new curriculum for first time
    - *Tools* developers had results from cohort 1 to guide them
- School-level randomization; blocked by district.

Characteristics of Children with at Least One Data Point at both T1 and T3 by Condition, Cohort 1

	Tools Condition	Comparison Condition	Overall
Number of children	459	347	806
Age in Months at T1	54.2	54.7	54.4
Age in Months at T3	72.9	73.4	73.1
Gender (% female)	47%	43%	45.8%
Ethnicity			
Black (%)	30%	23%	26.2%
Hispanic (%)	23%	25%	24.3%
White (%)	38%	42%	39.4%
Other (%)	9%	10%	9.6%
IEP (%)	14%	15%	14.2%
ELL (%)	28%	31%	28.7%

Characteristics of Children, Cohort 2

	Tools Condition	Comparison Condition	Overall
Number of children	147	120	267
Age in Months at T1	54.6	55.4	55
Gender (% female)	46.3%	46.7%	46.4%
Ethnicity			
Black (%)	30.6%	20.8%	26.2%
Hispanic (%)	26.5%	20.8%	24%
White (%)	38.1%	51.7%	44.2%
Other (%)	4.8%	6.7%	5.6%
IEP (%)	9.5%	5.8%	7.9%
ELL (%)	40.8%	51.7%	45.7%

Cohort 1 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%

Cohort 2 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	11.9	1-34	17	7-31	**14.5**	1-34
Years Teaching Pre-K	7	1-16	10.7	2-20	**8.8**	1-20
Education Level						
Bachelor's Degree	8	80%	6	60%	**14**	70%
Some Graduate Coursework	1	10%	4	40%	**5**	25%
Master's Degree	1	10%	-	-	**1**	5%
Licensure Area						
Early Childhood (0-Pre-K)	7	70%	7	70%	**14**	70%
Pre-K-3rd	1	10%	1	10%	**2**	10%
Elementary Ed.	1	10%	1	10%	**2**	10%
Early Childhood & Special Ed	1	10%	1	10%	**2**	10%

Instrumentation: Pre-Post Pre-K and Kindergarten

- 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
  - Kindergarten preparedness (K only)

Classroom Observations
Collected in both Treatment and Comparison Classrooms

- 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
- Narrative Record
  - Captures how time is spent in the classroom
    - Activities and content focus

Curricula in Comparison Classrooms

Curricula Reported by Comparison Teachers	
Creative Curriculum	15
Literacy First	4
Houghton Mifflin	2
Scott Foresman	5
CSEFEL (Social-Emotional)	6
Opening Worlds of Learning (OWL)	10
Other	10

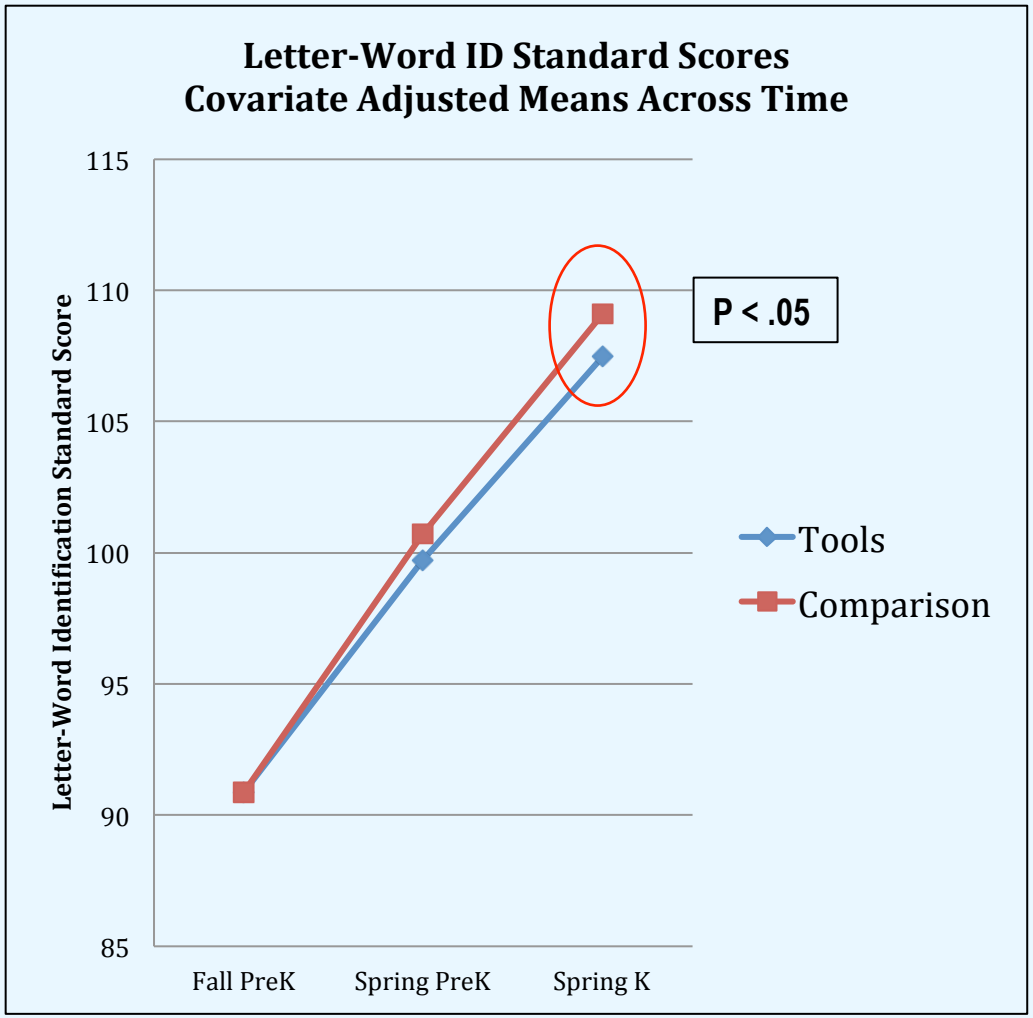
Note: Teachers often listed more than one

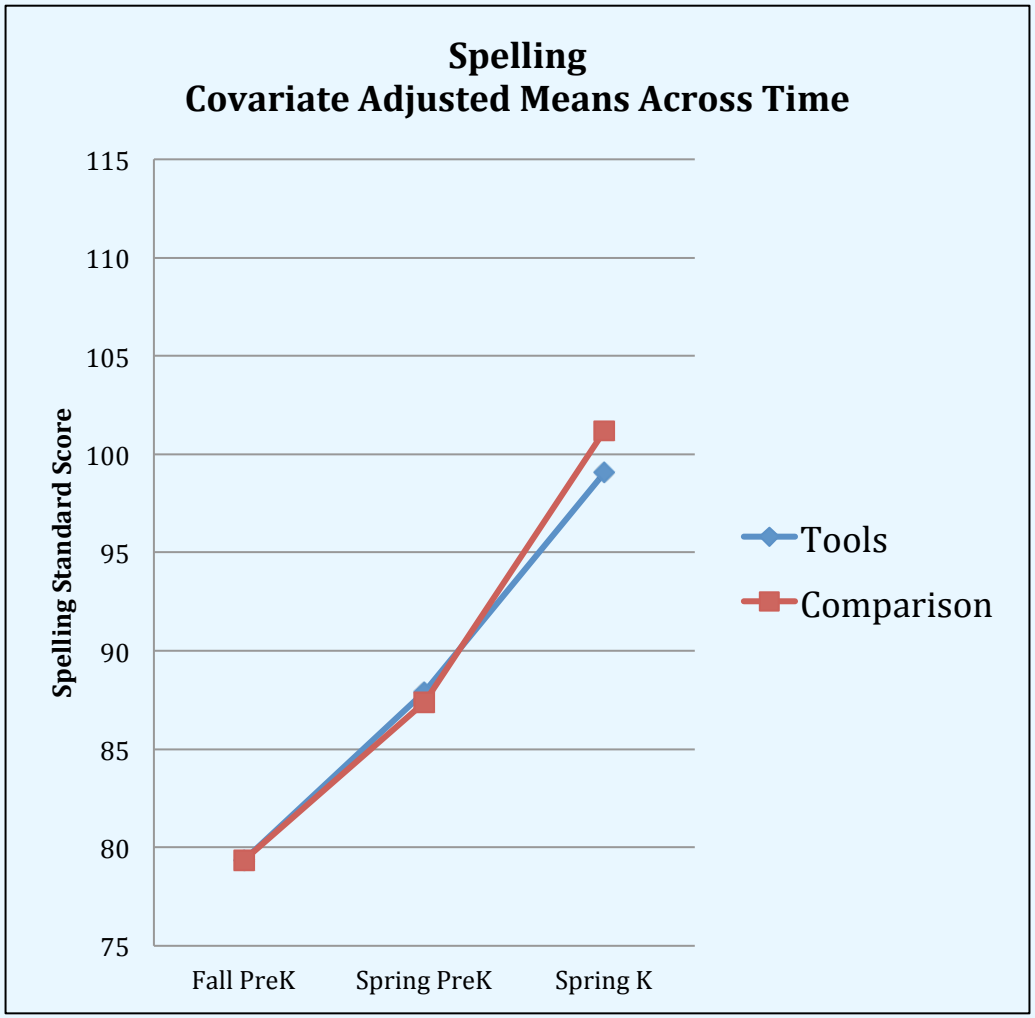
Analysis Plan

- 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 at pre-k and kindergarten, 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 graphs for WJ; percentage correct or raw scores for other assessments and ratings.

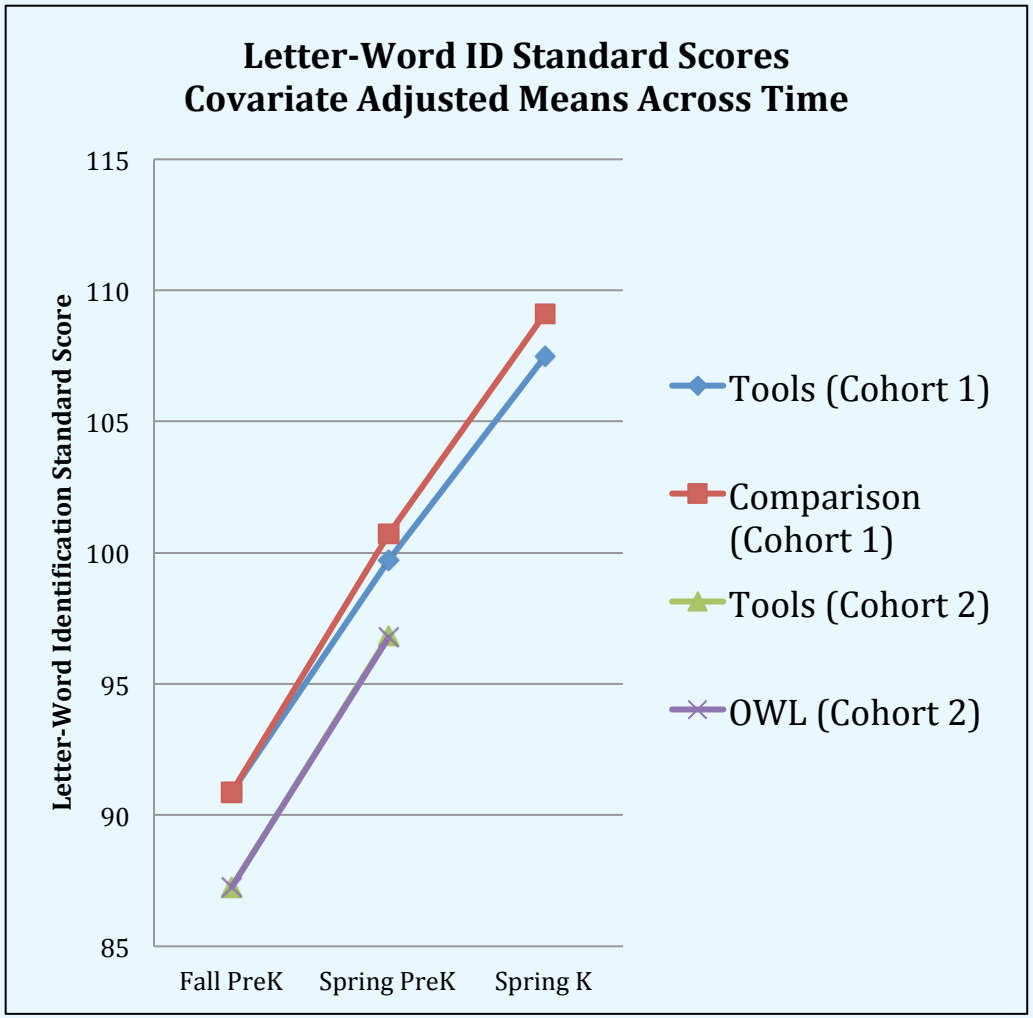
ACHIEVEMENT RESULTS THROUGH KINDERGARTEN FOR COHORT 1 AND THROUGH PRE-K FOR COHORT 2

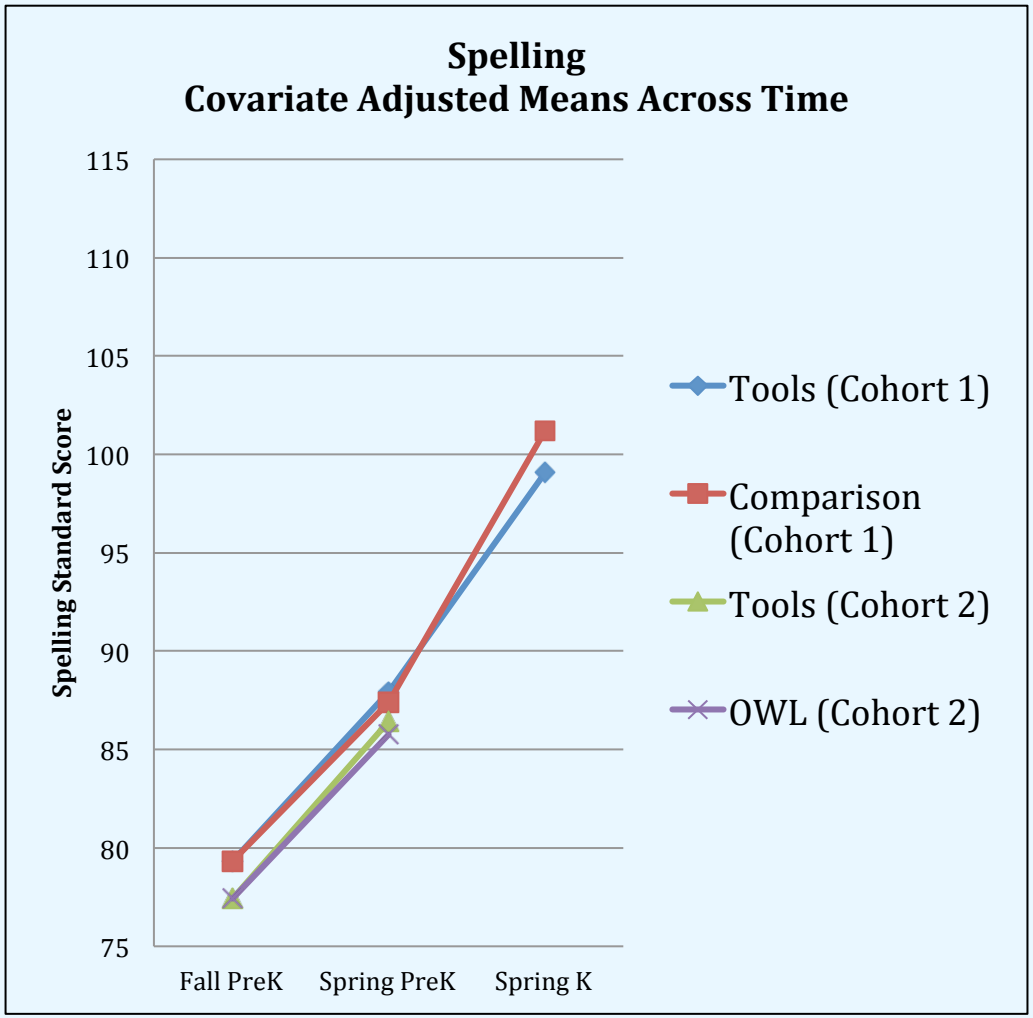
Effects of *Tools* on Literacy



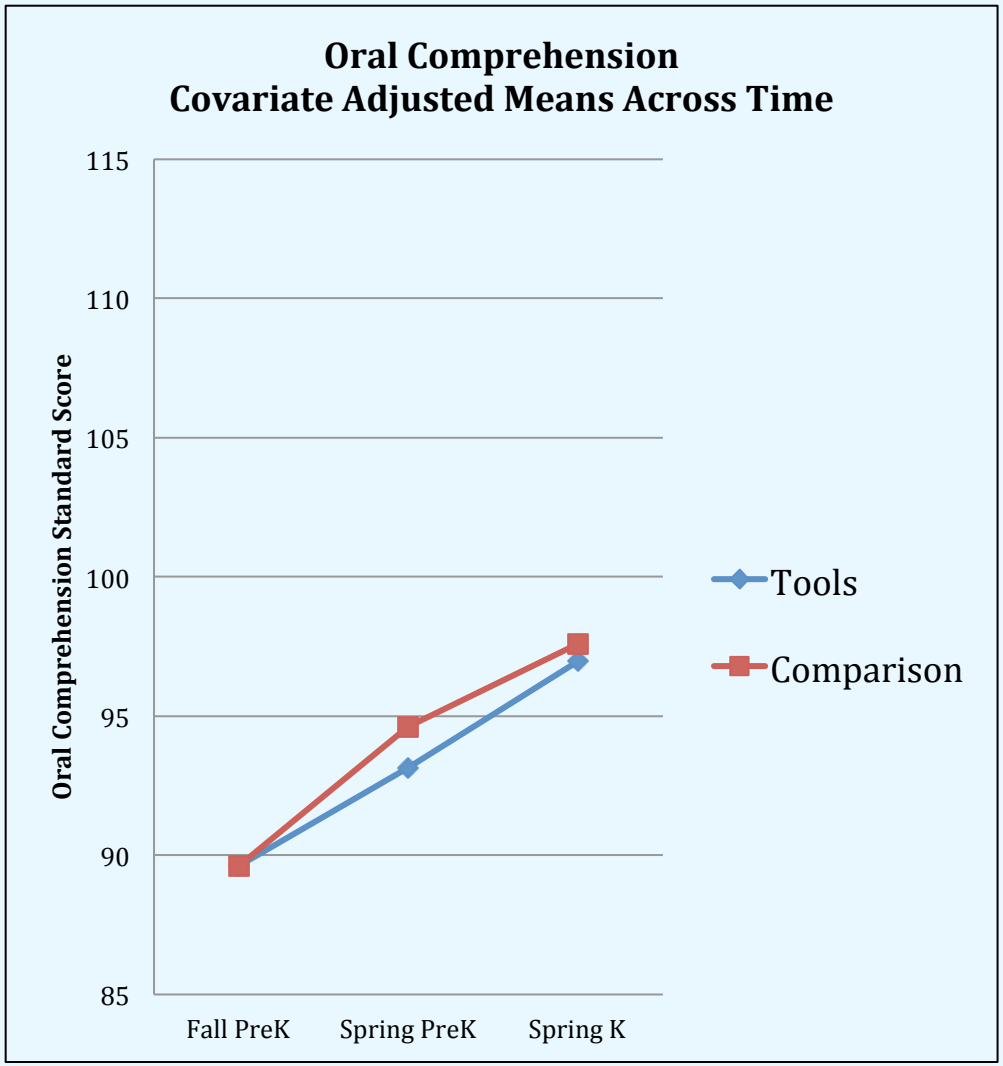


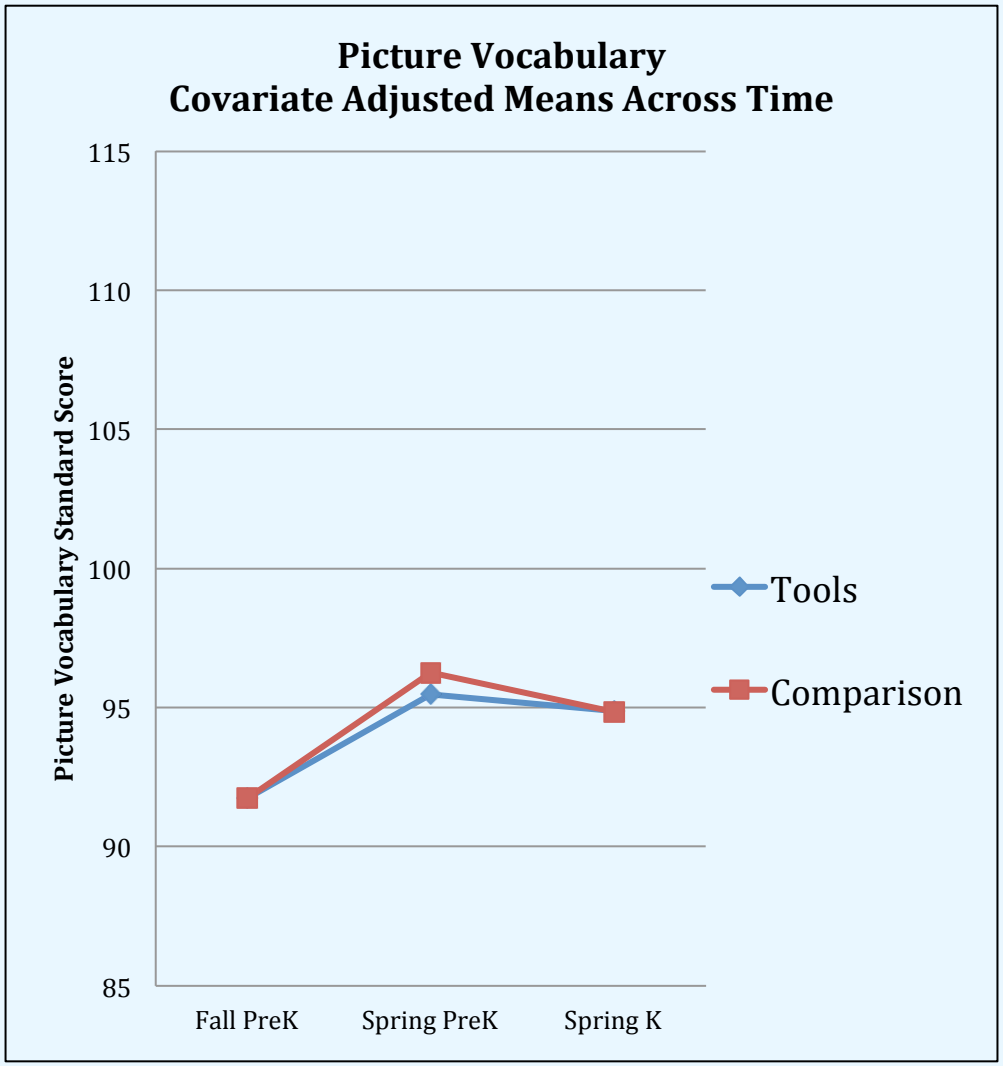
Effects of *Tools* on Literacy Cohorts 1 & 2



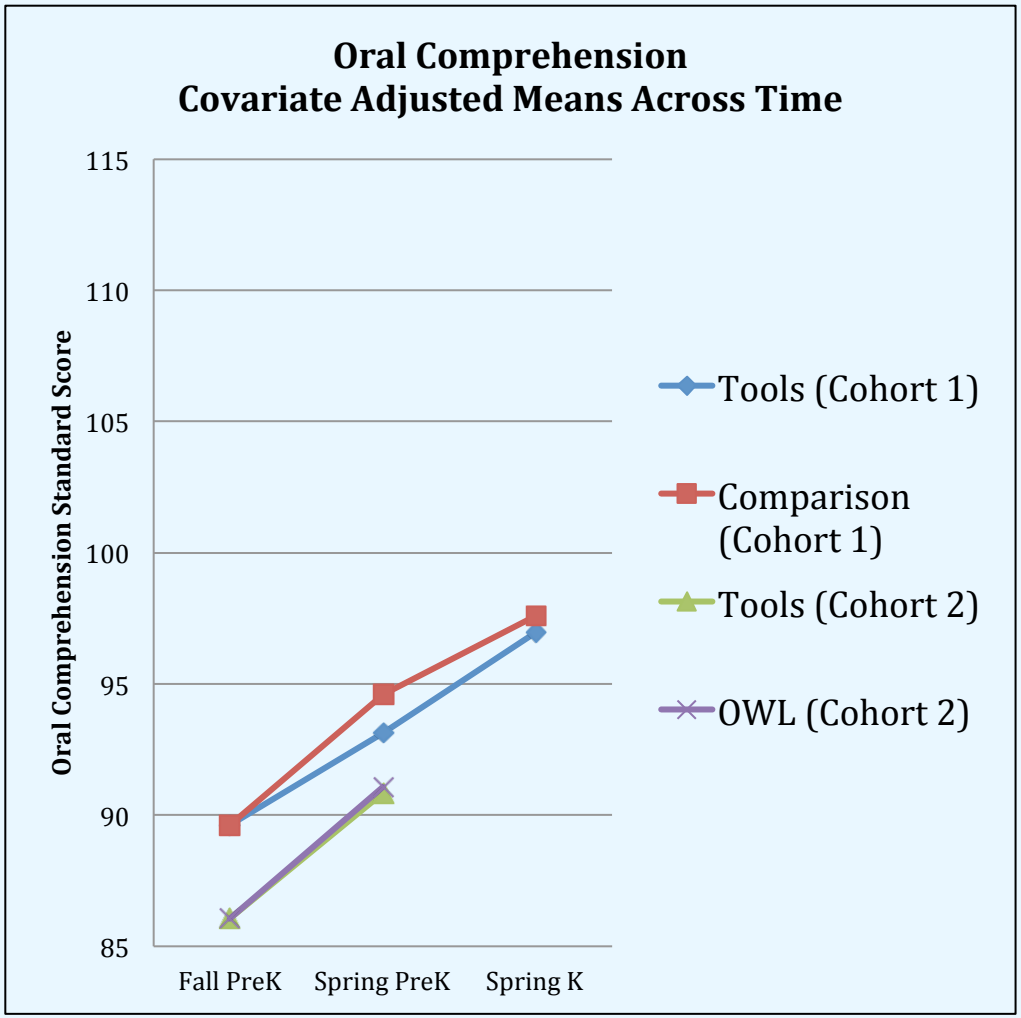


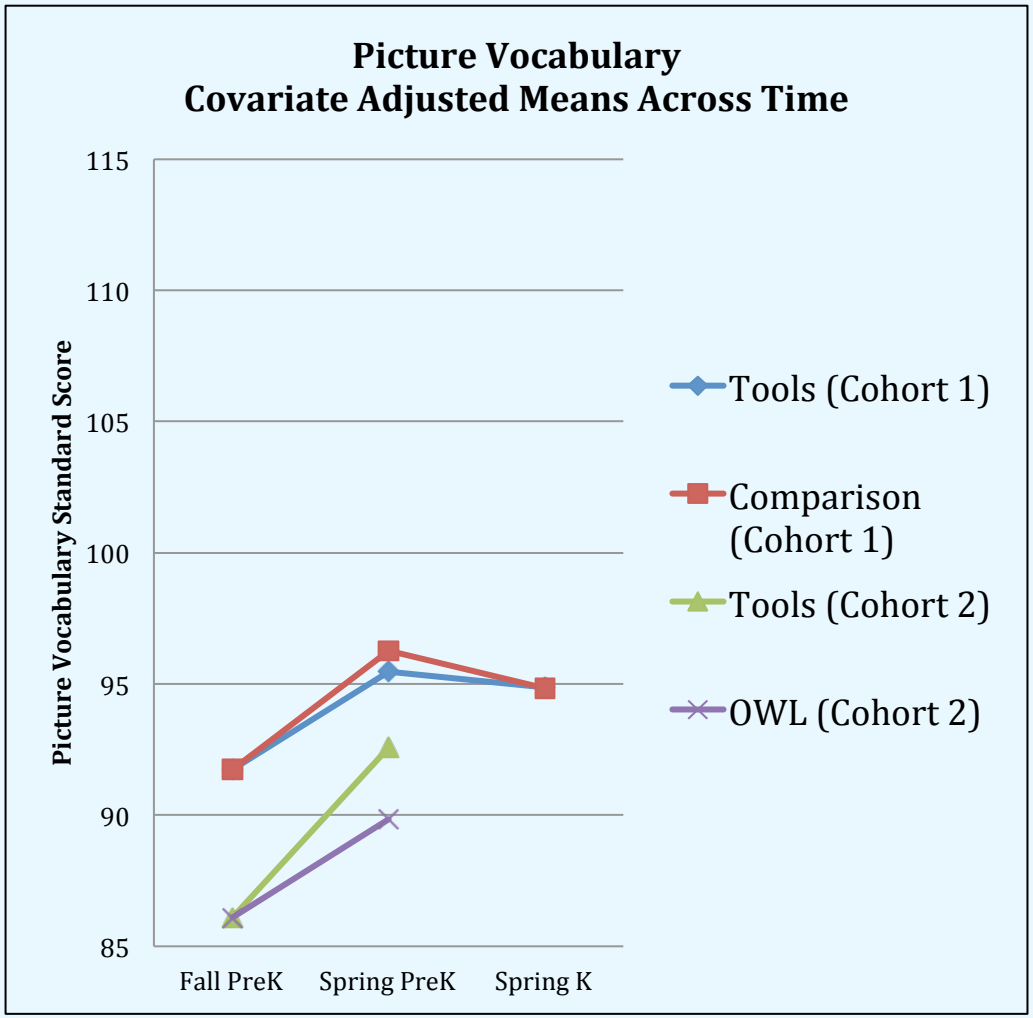
Effects of *Tools* on Language



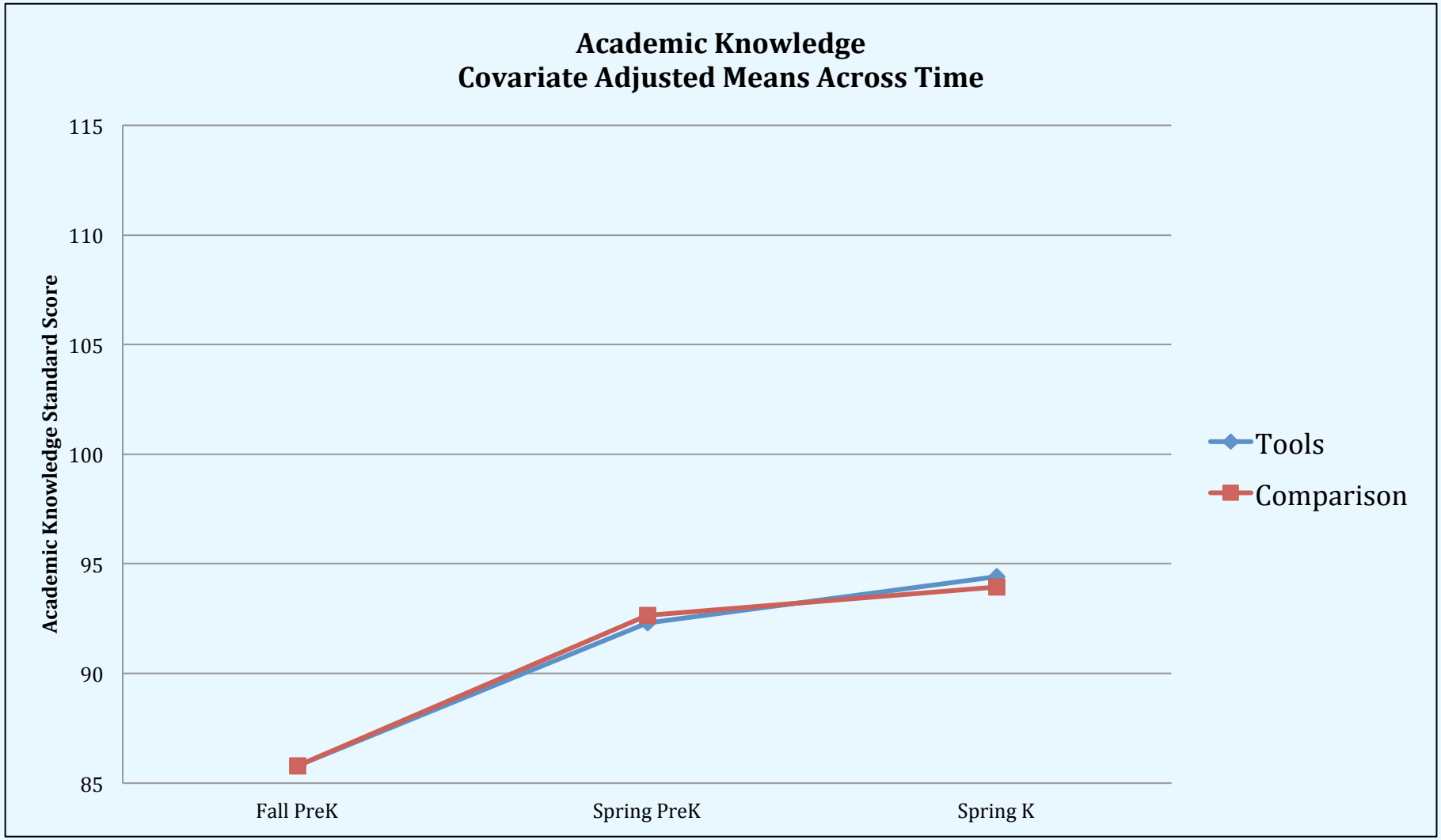


Effects of *Tools* on Language Cohorts 1 & 2

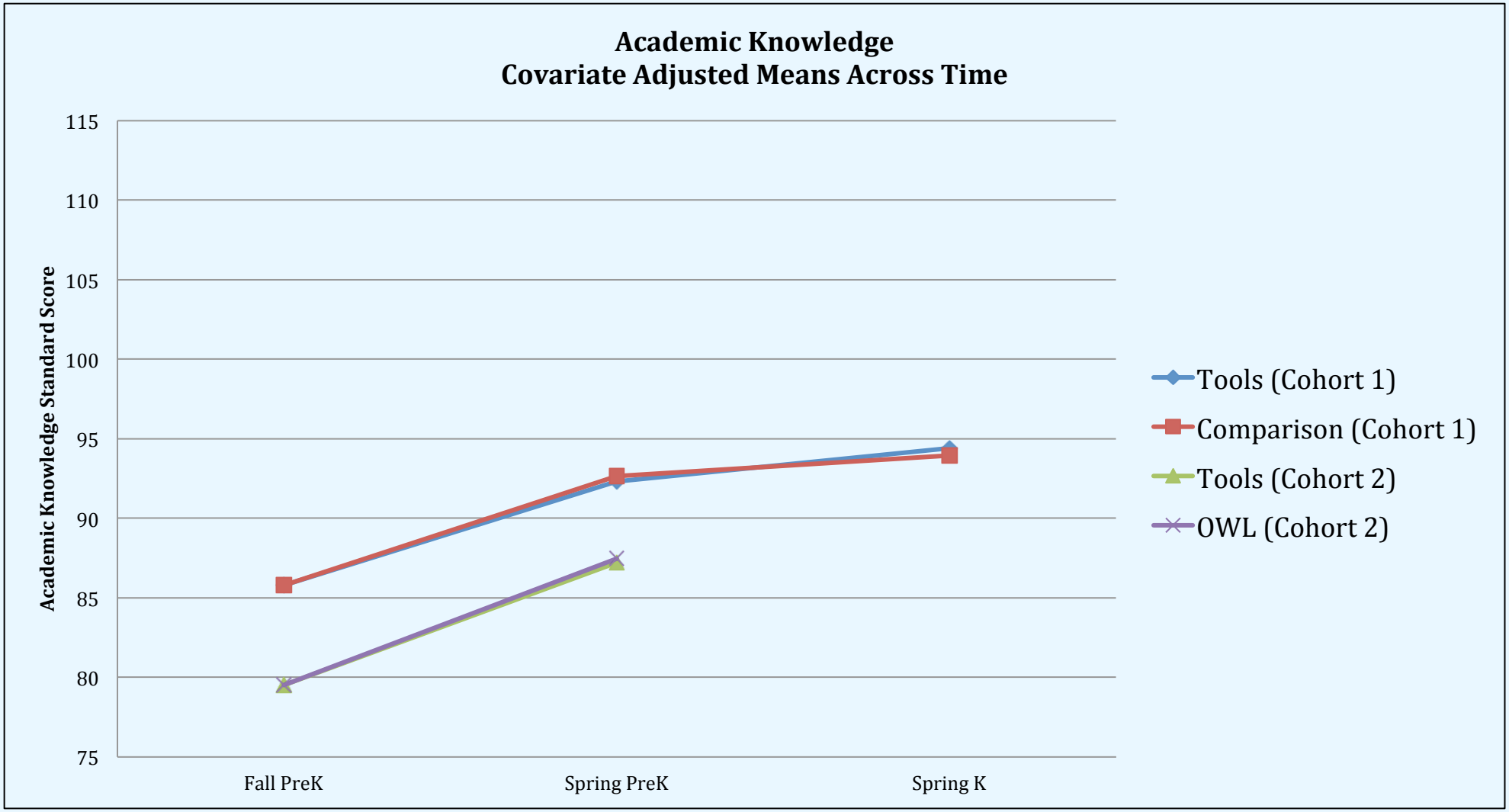




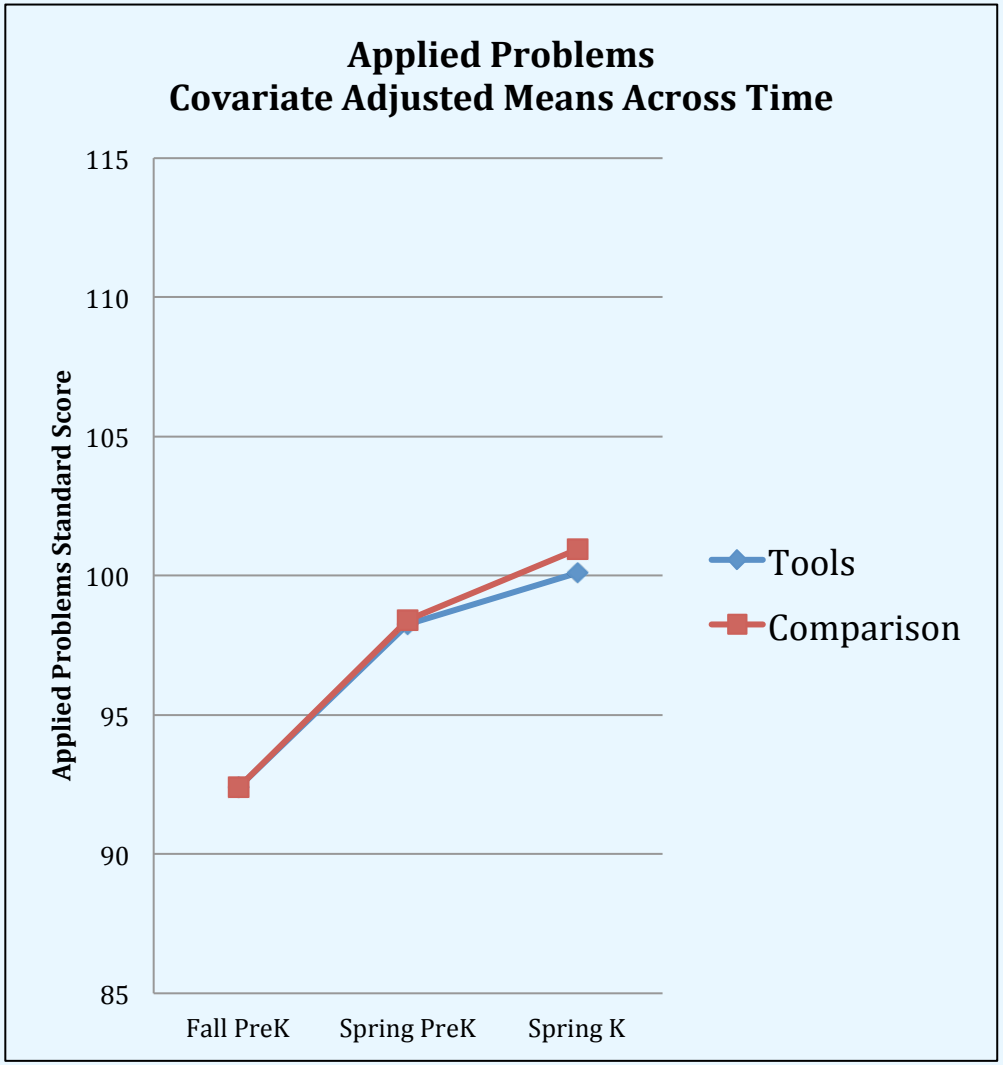
Language, Cont.

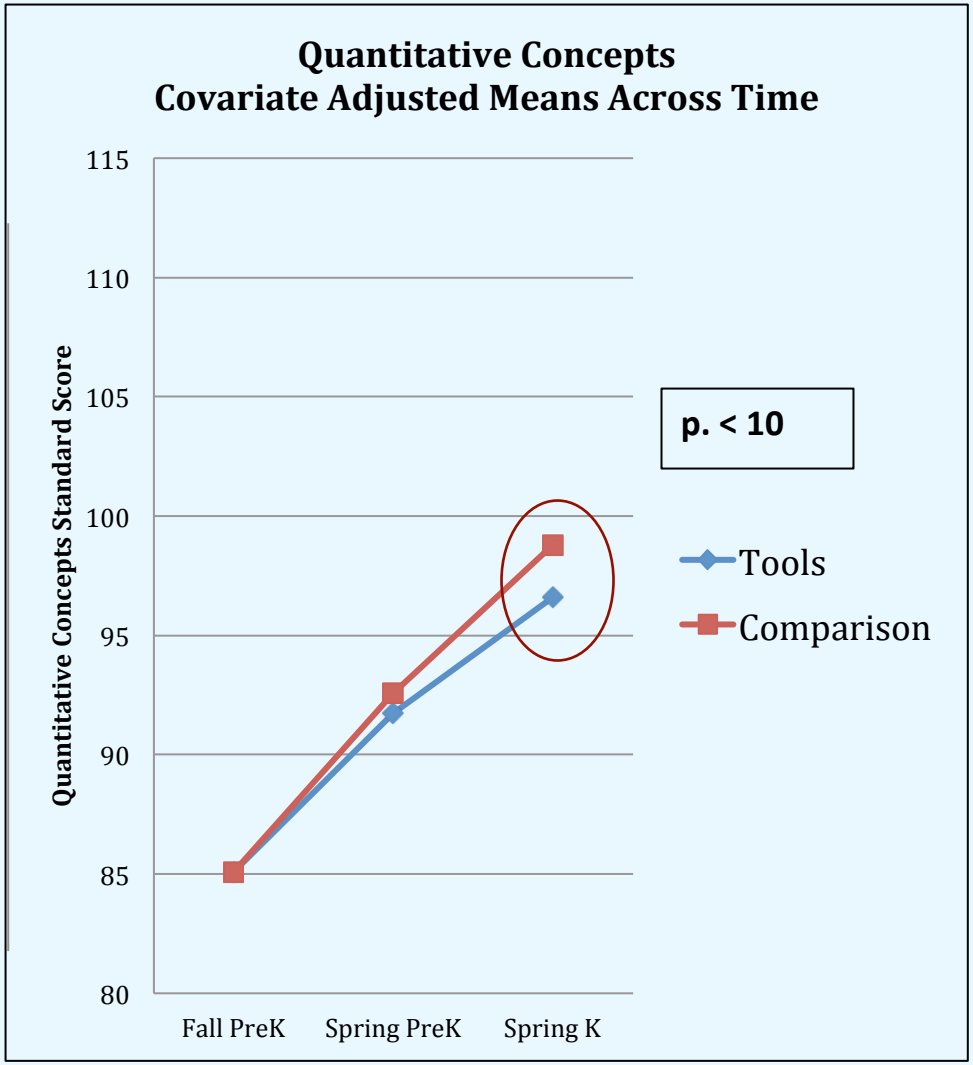


Language, Cont. including Cohorts 1 & 2

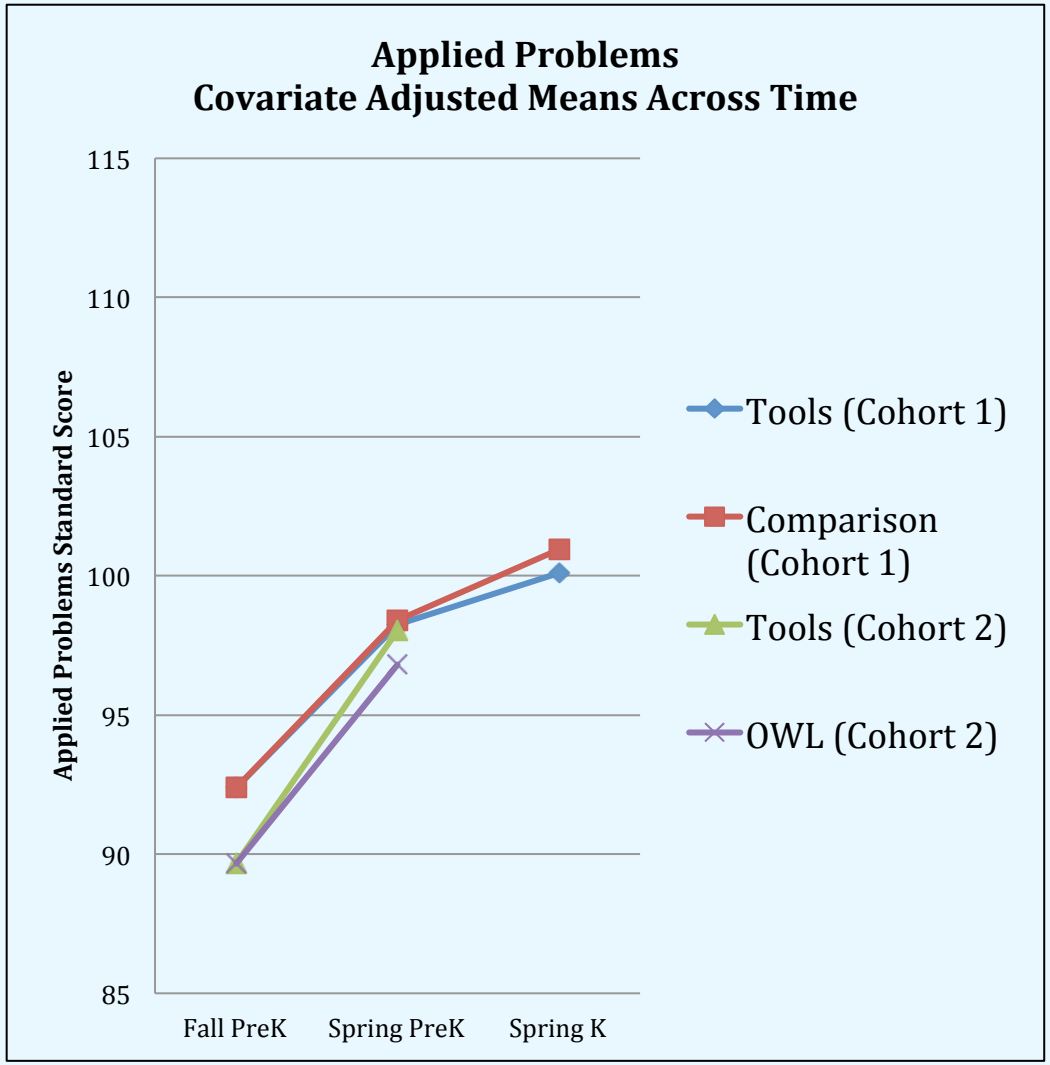


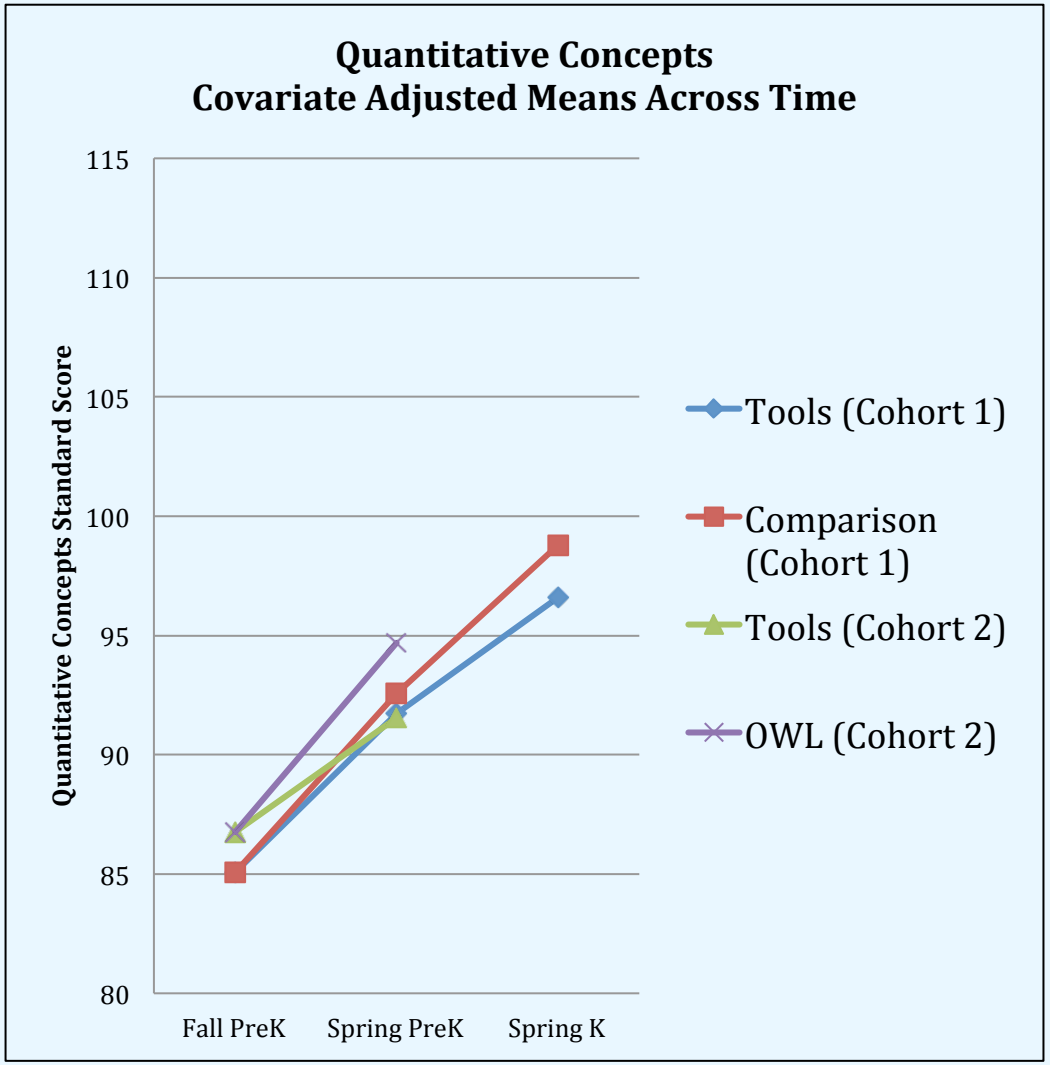
Effects of *Tools* on Mathematics





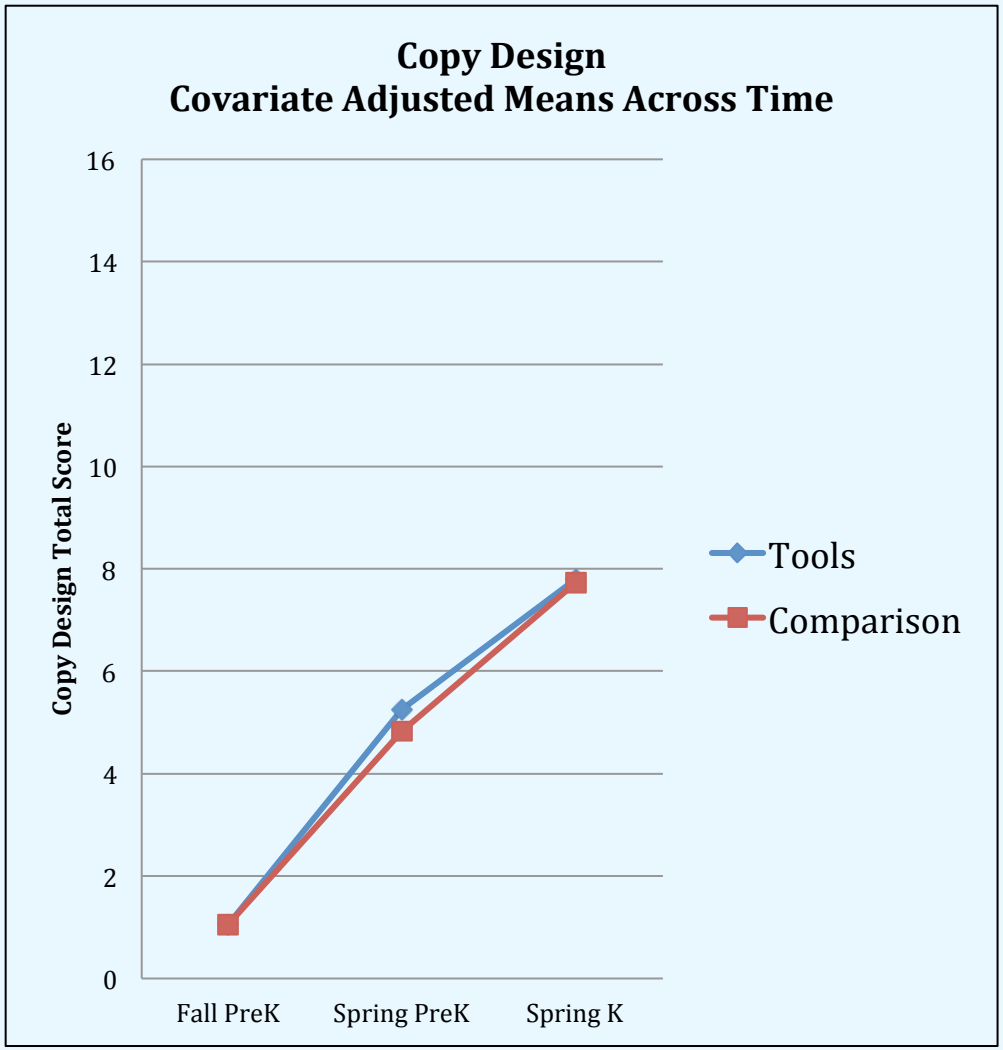
Effects of *Tools* on Mathematics including Cohorts 1 & 2

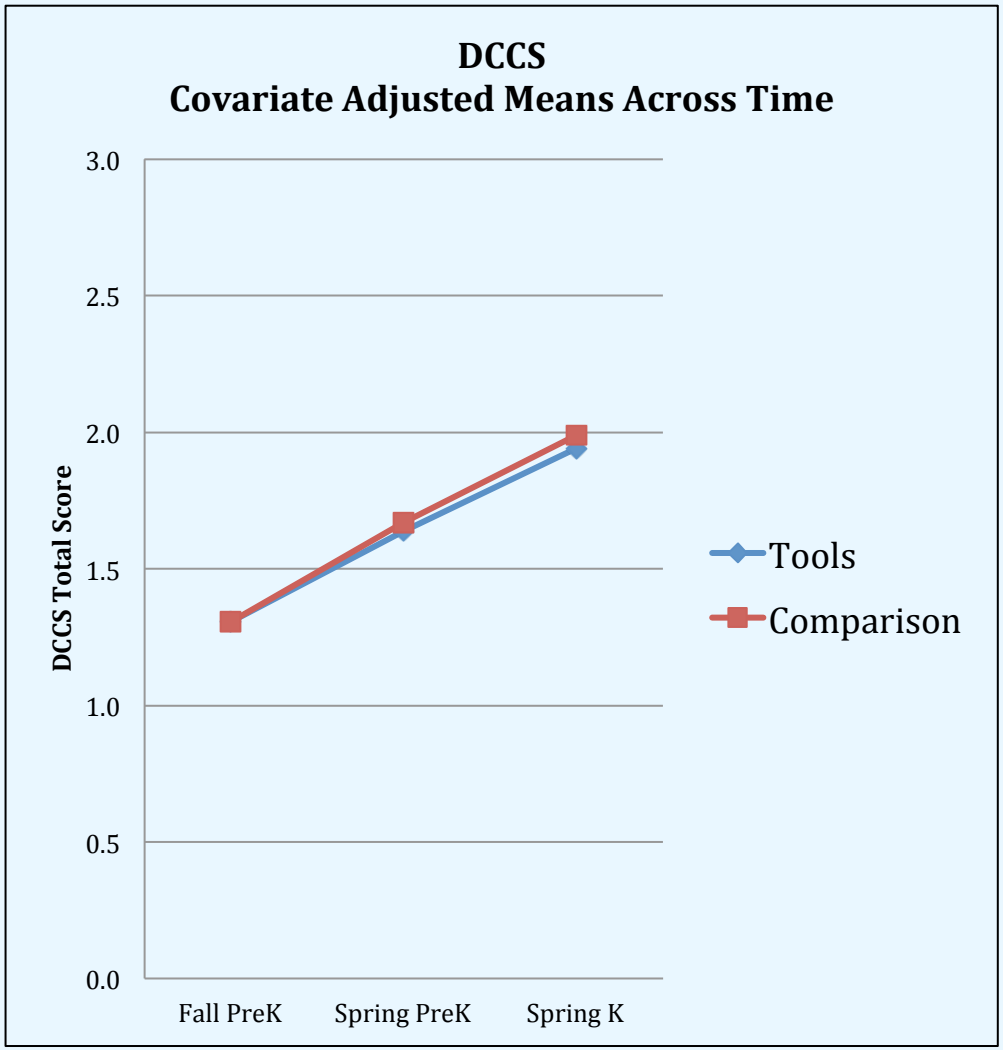




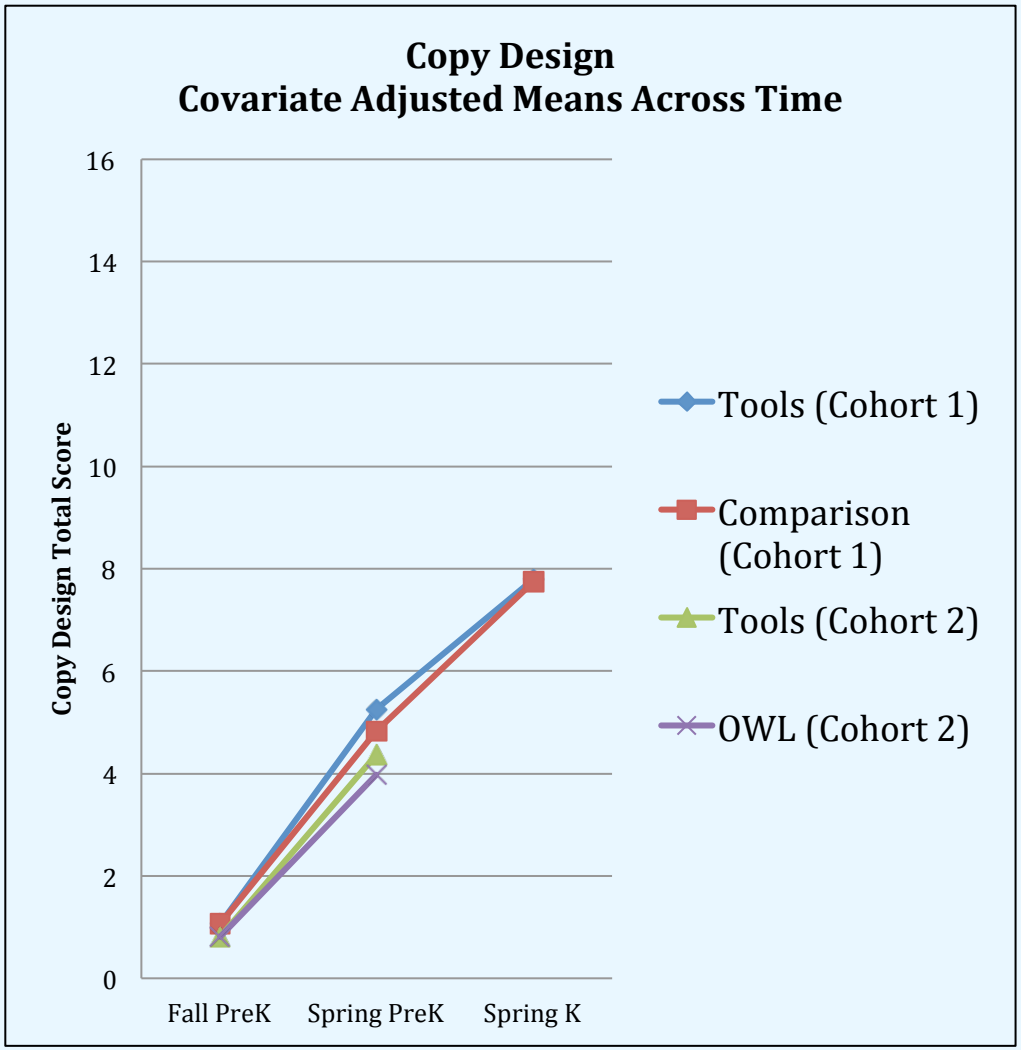
WHAT ABOUT EFFECTS ON SELF REGULATION?

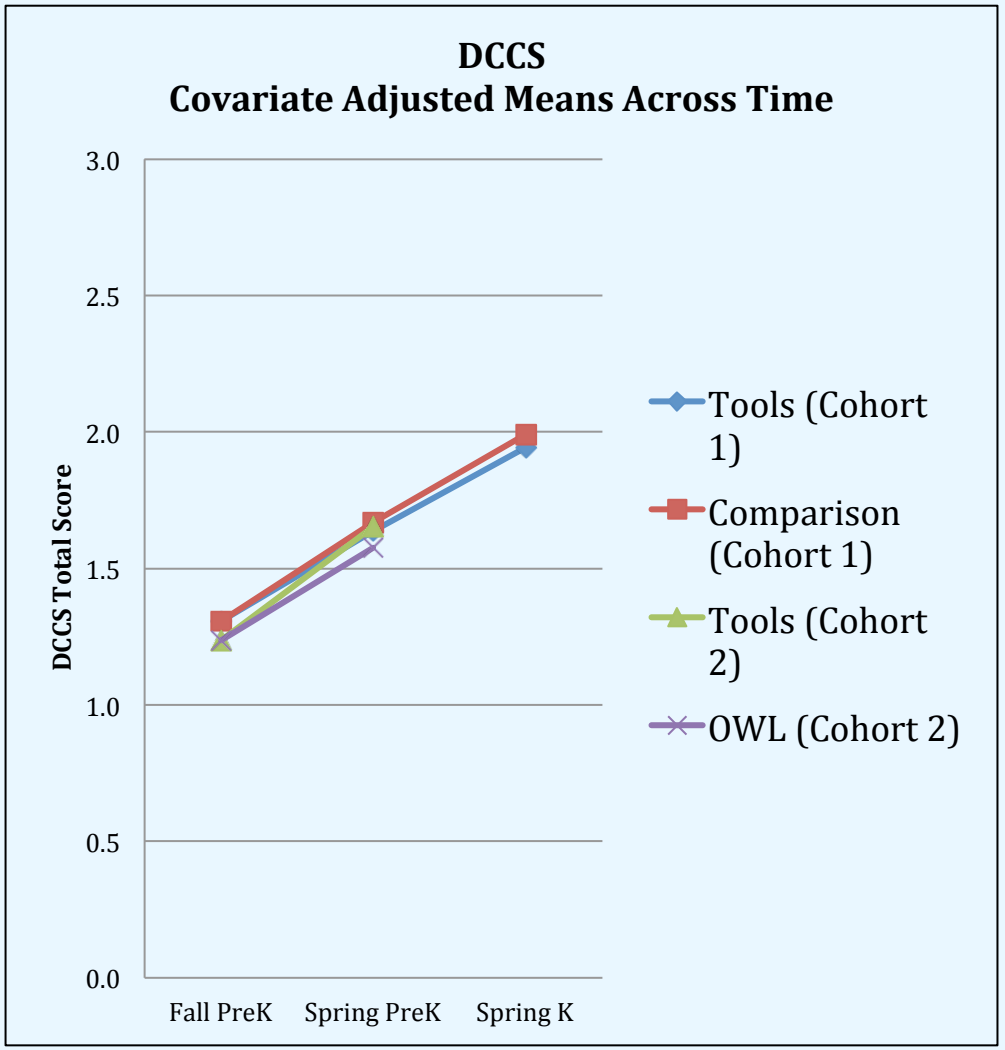
Effects of *Tools* on Attention



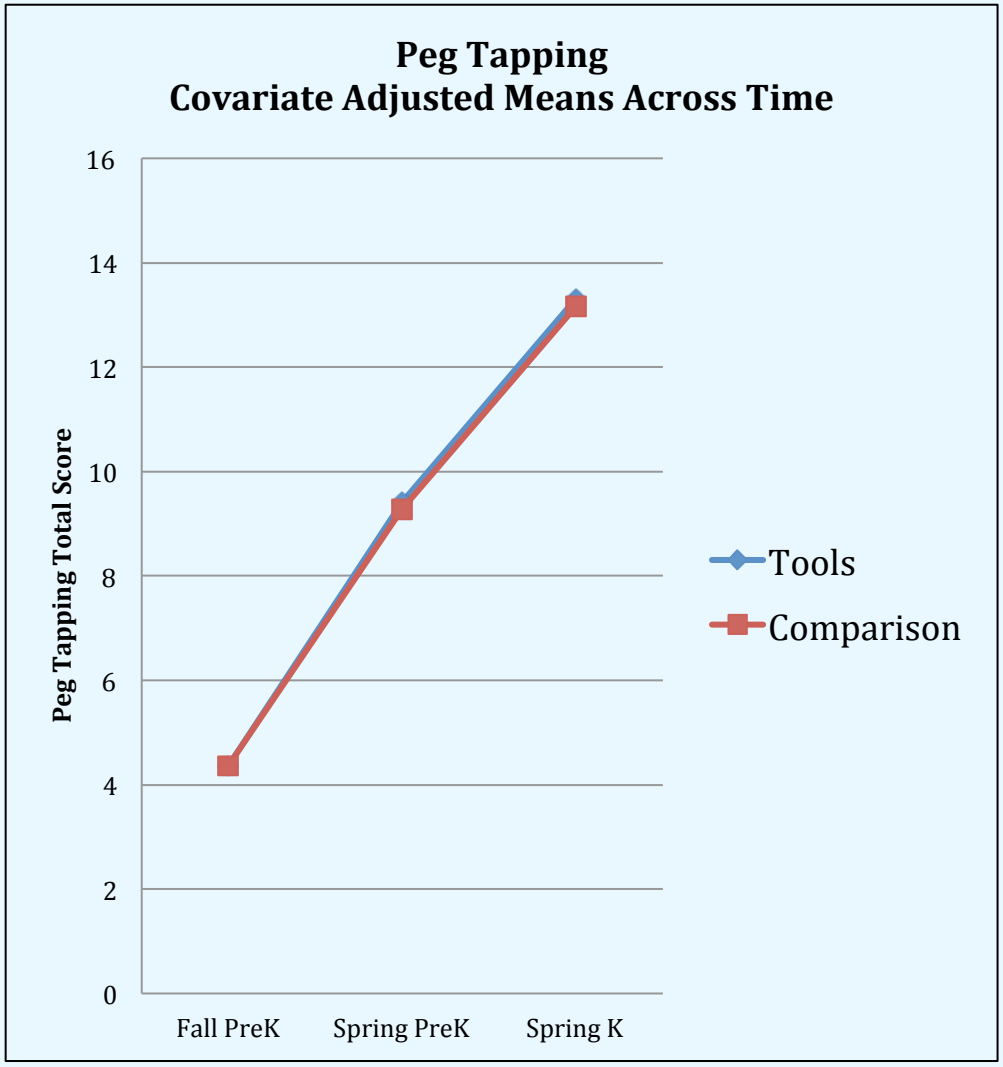


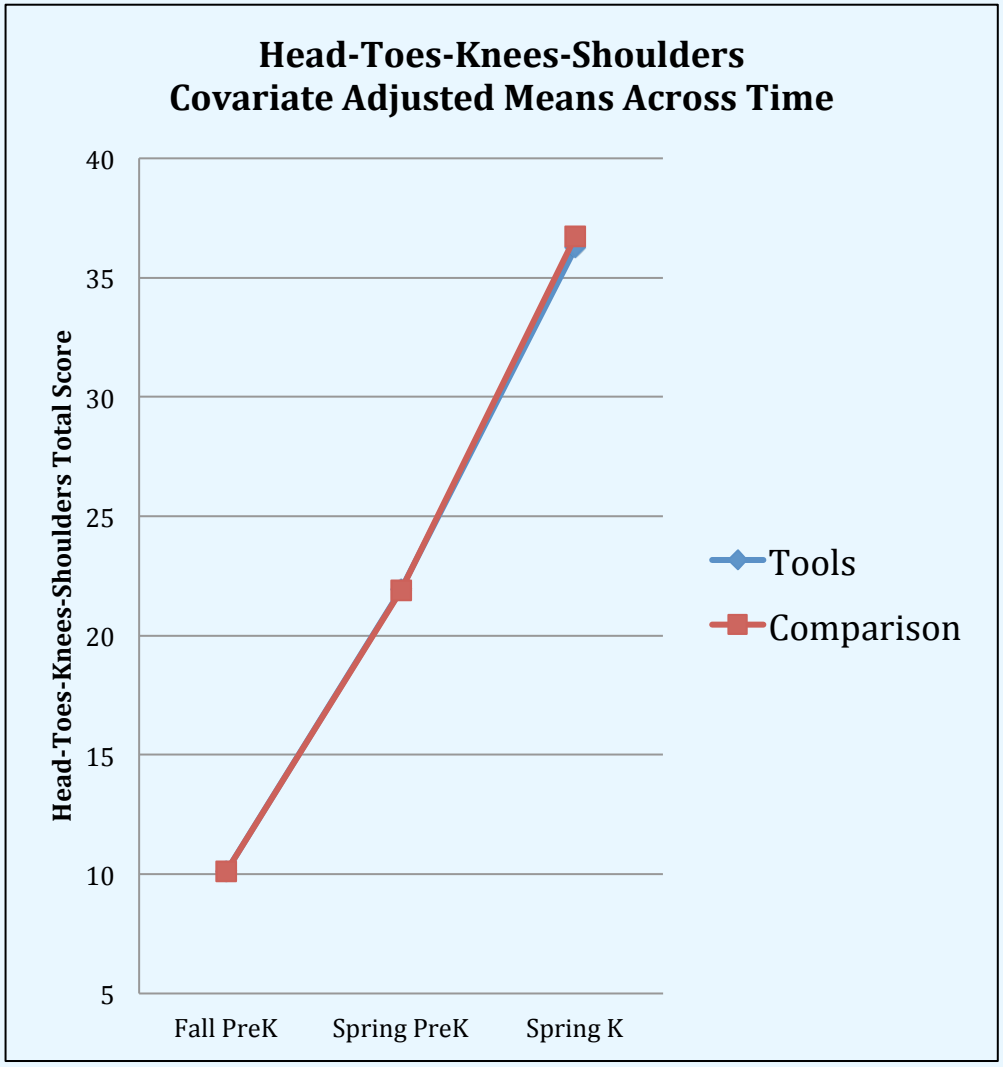
Effects of *Tools* on Attention including Cohorts 1 & 2



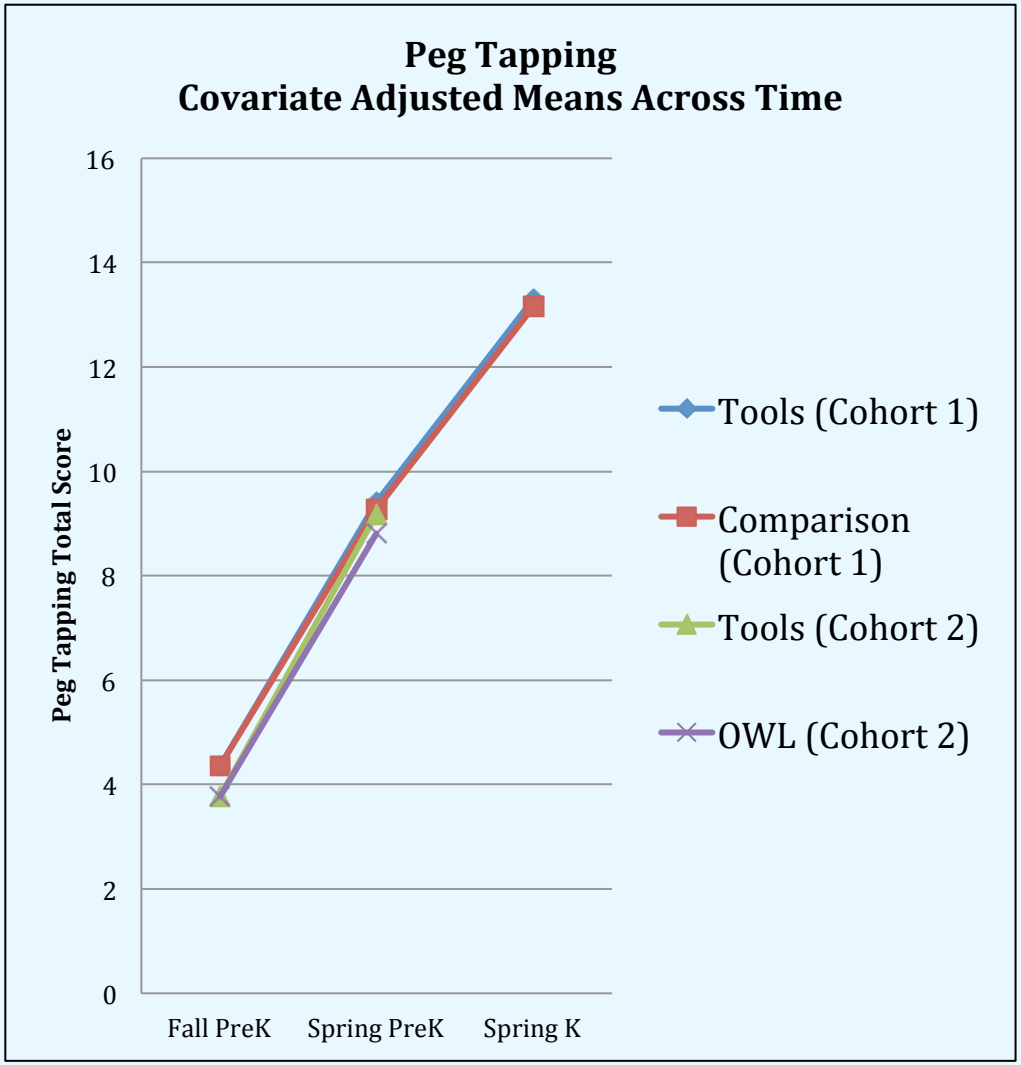


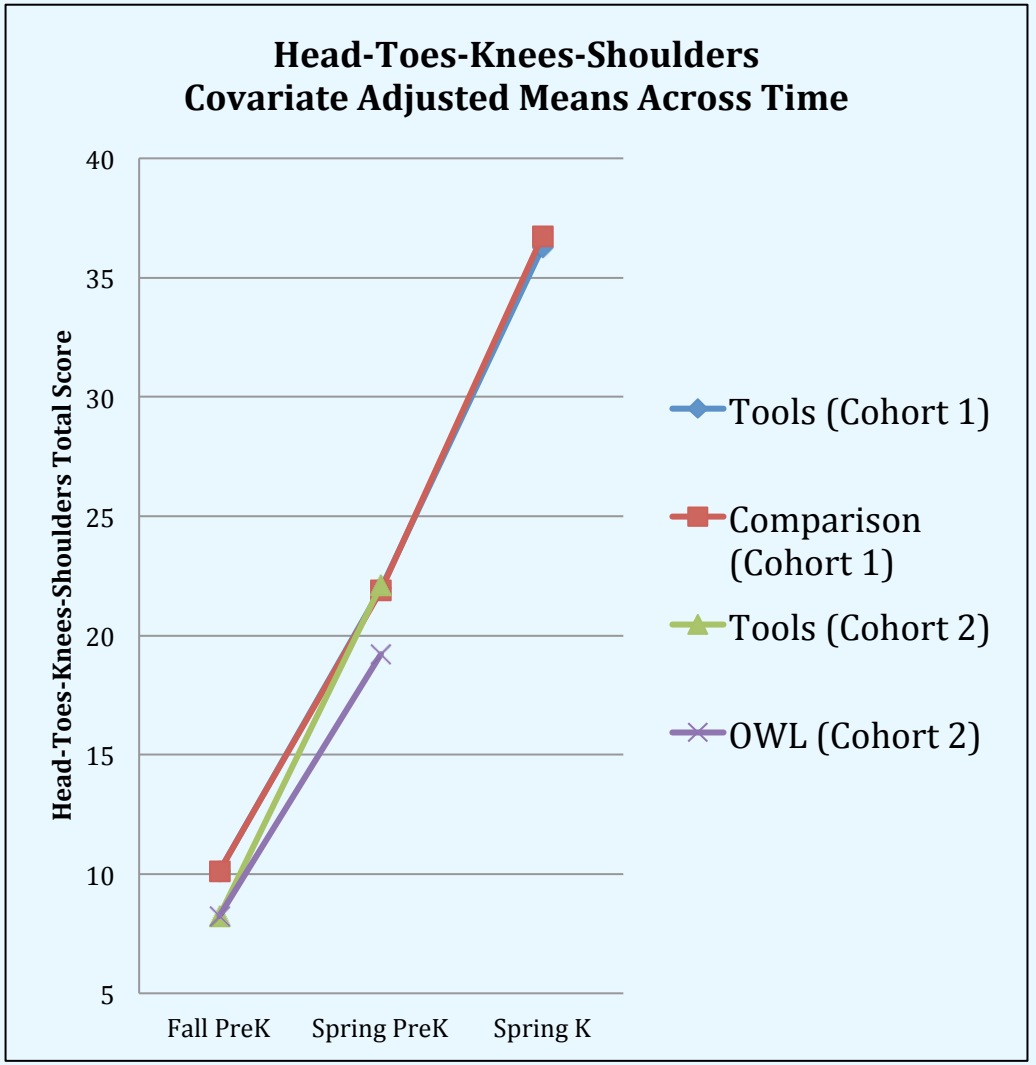
Effects of *Tools* on Inhibitory Control



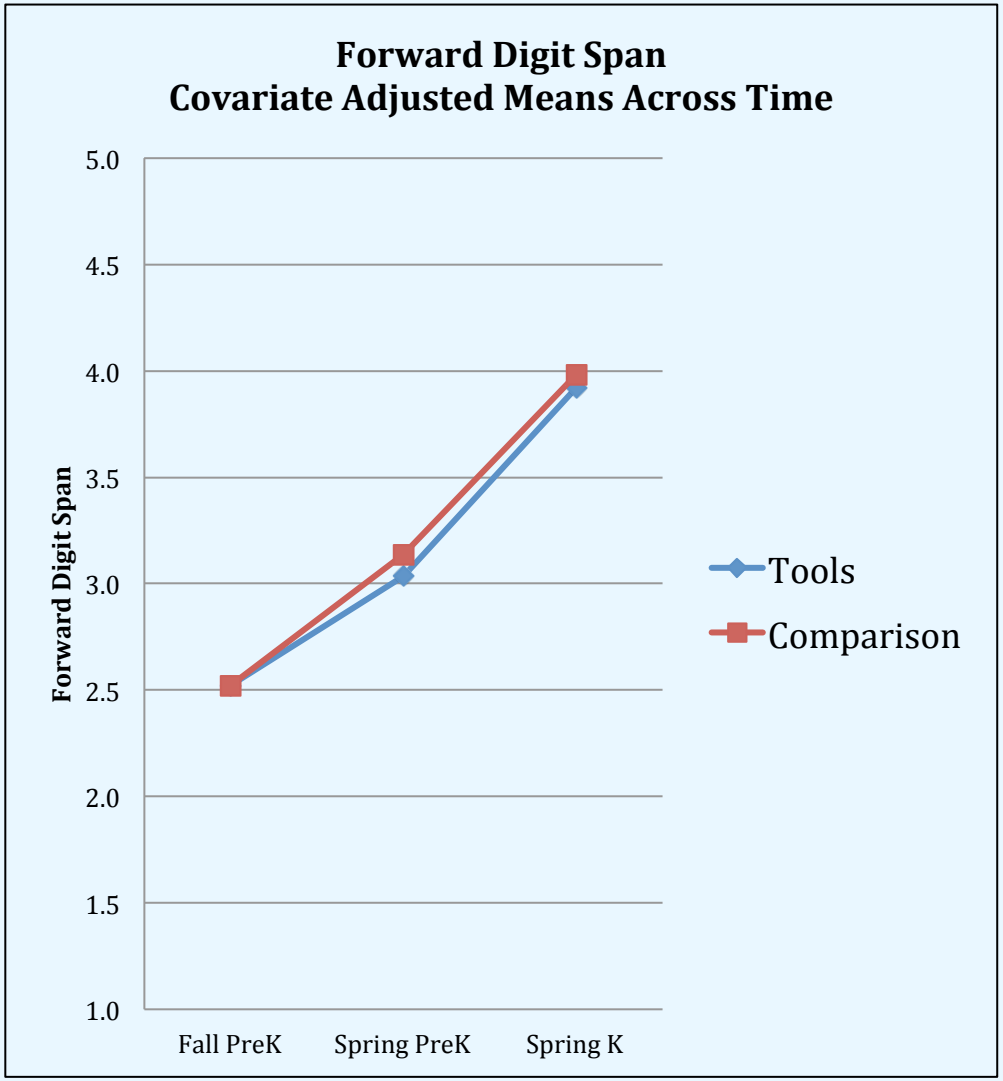


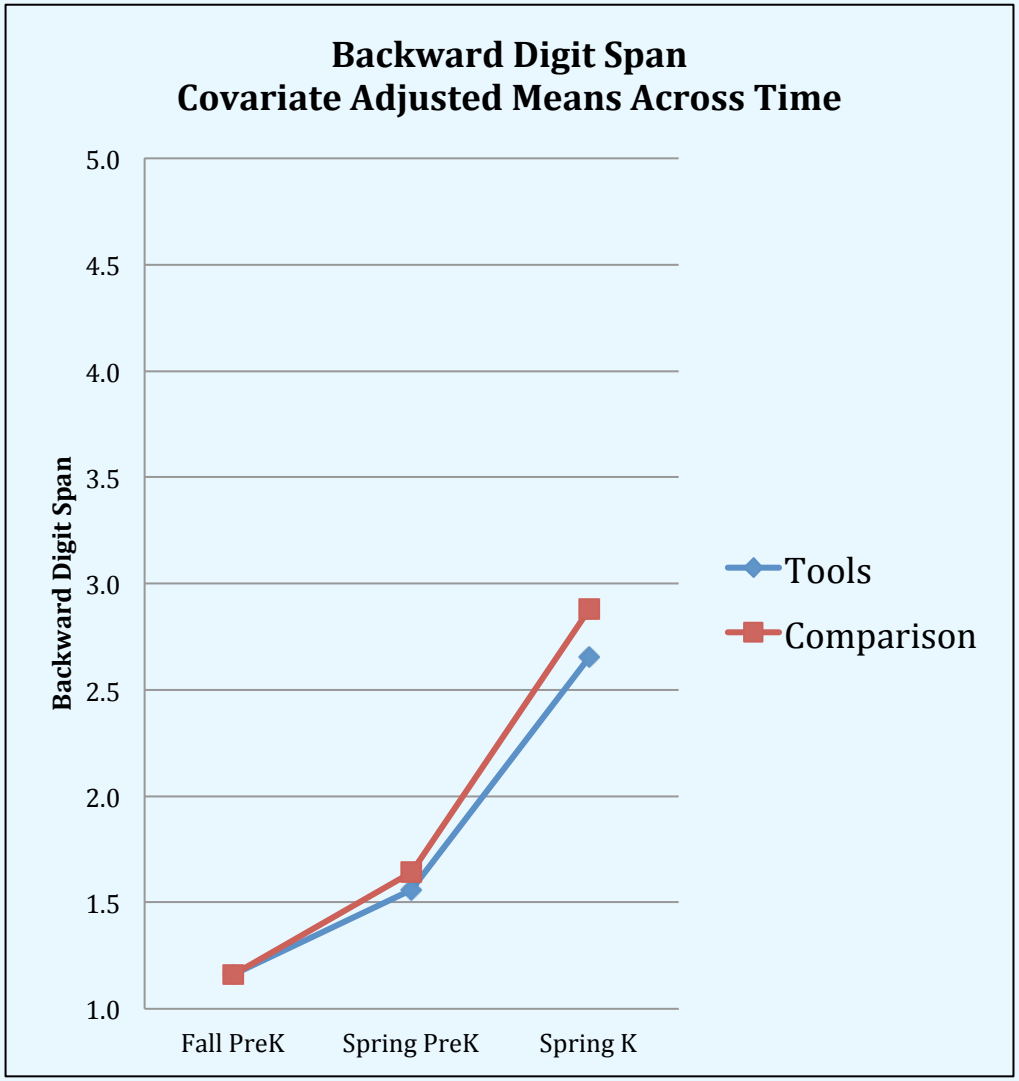
Effects of *Tools* on Inhibitory Control including Cohorts 1 & 2



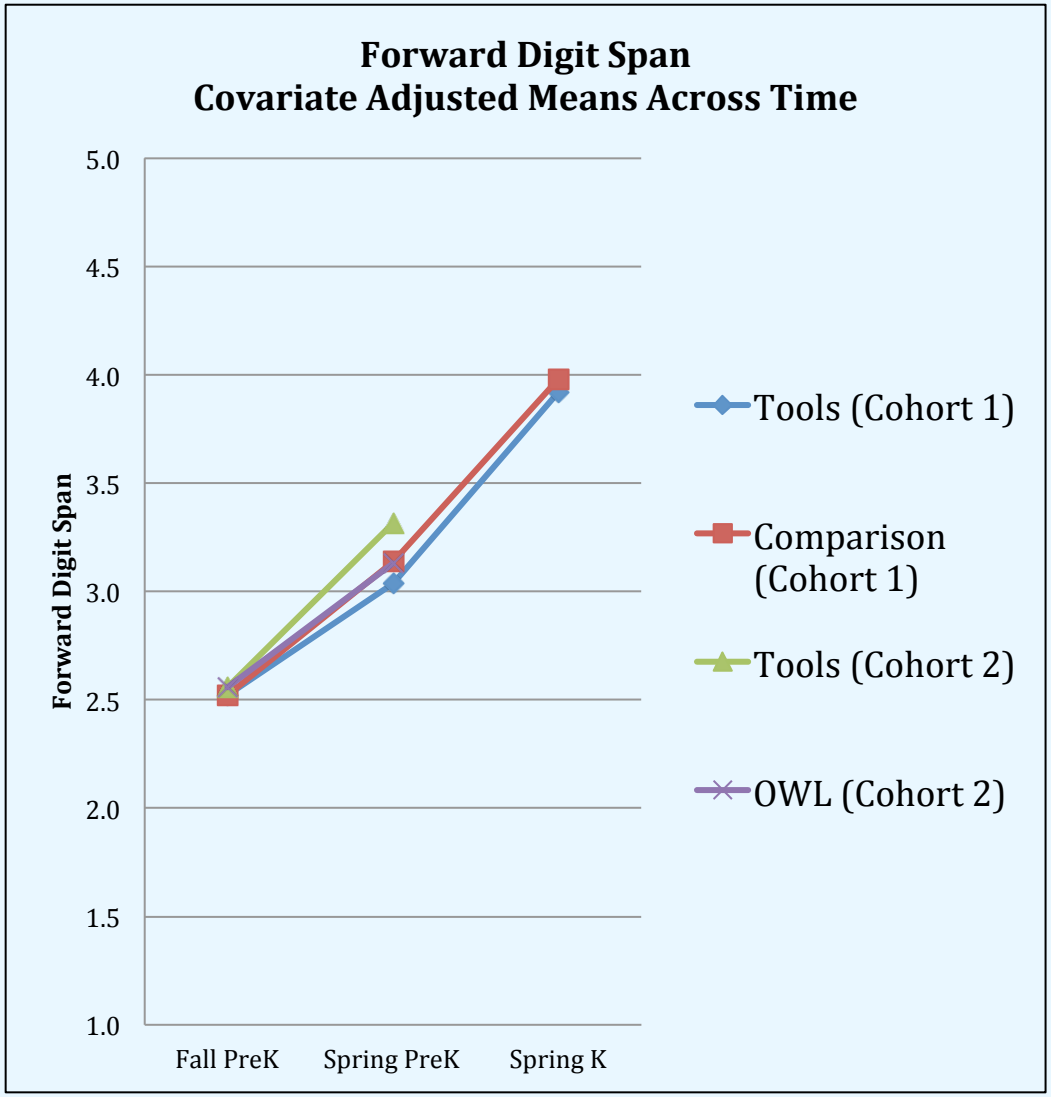


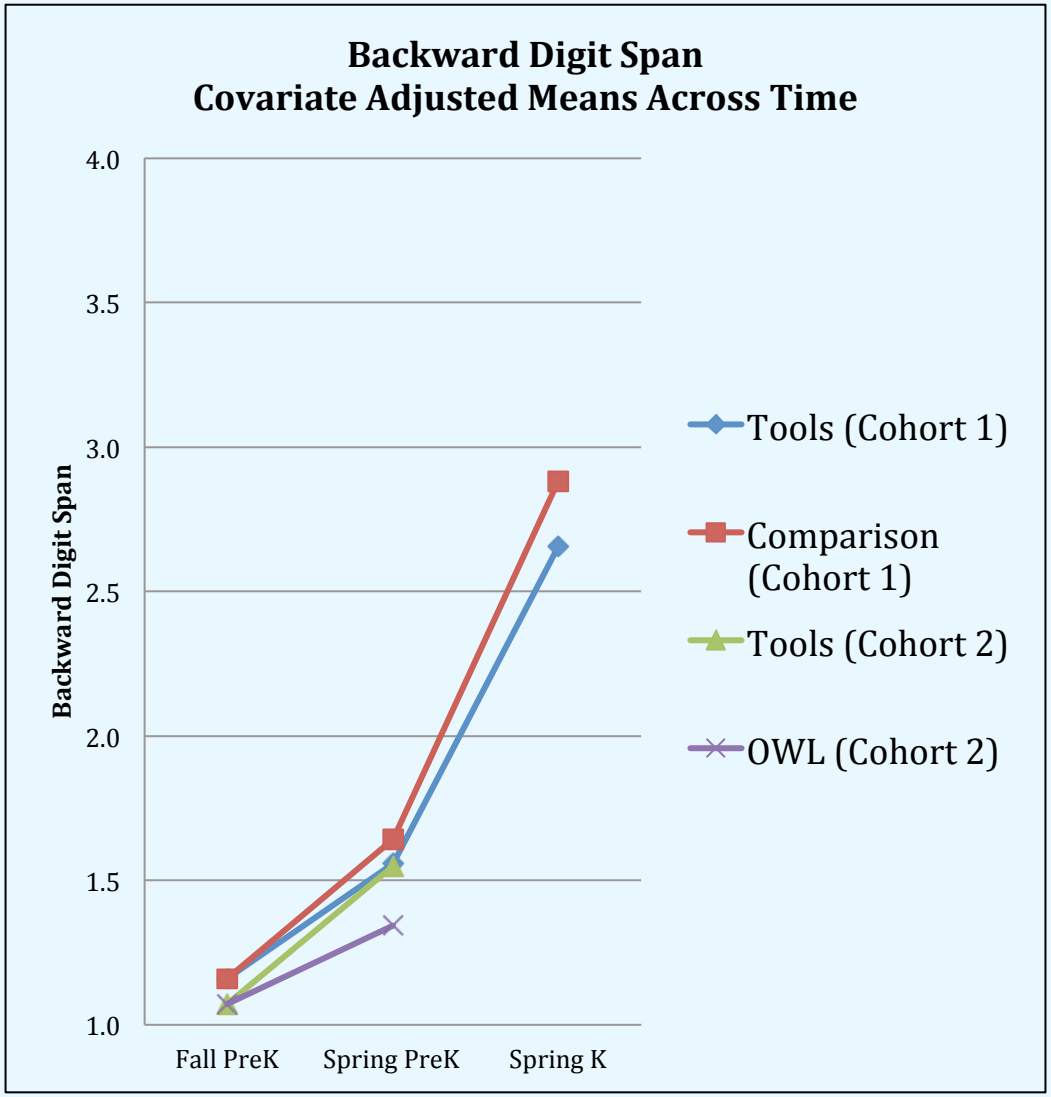
Effects of *Tools* on Working Memory





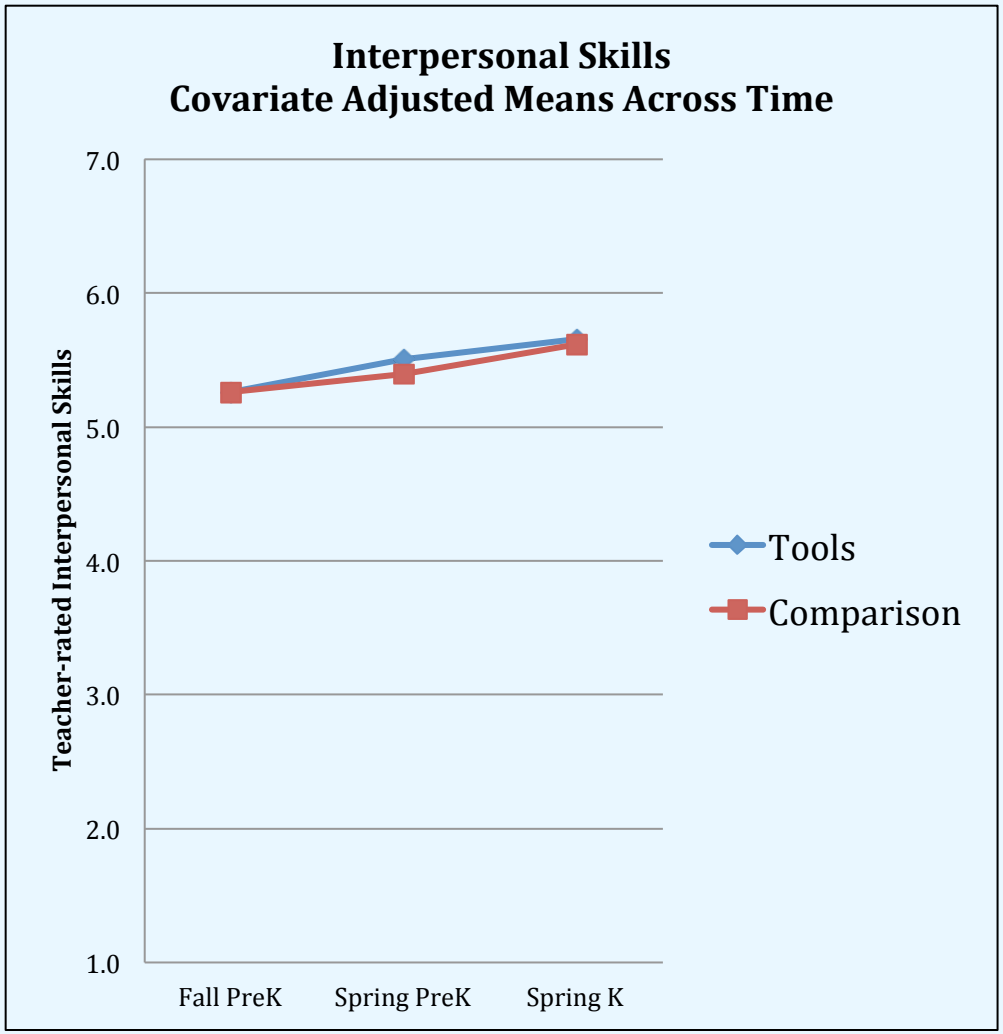
Effects of *Tools* on Working Memory including Cohorts 1 & 2

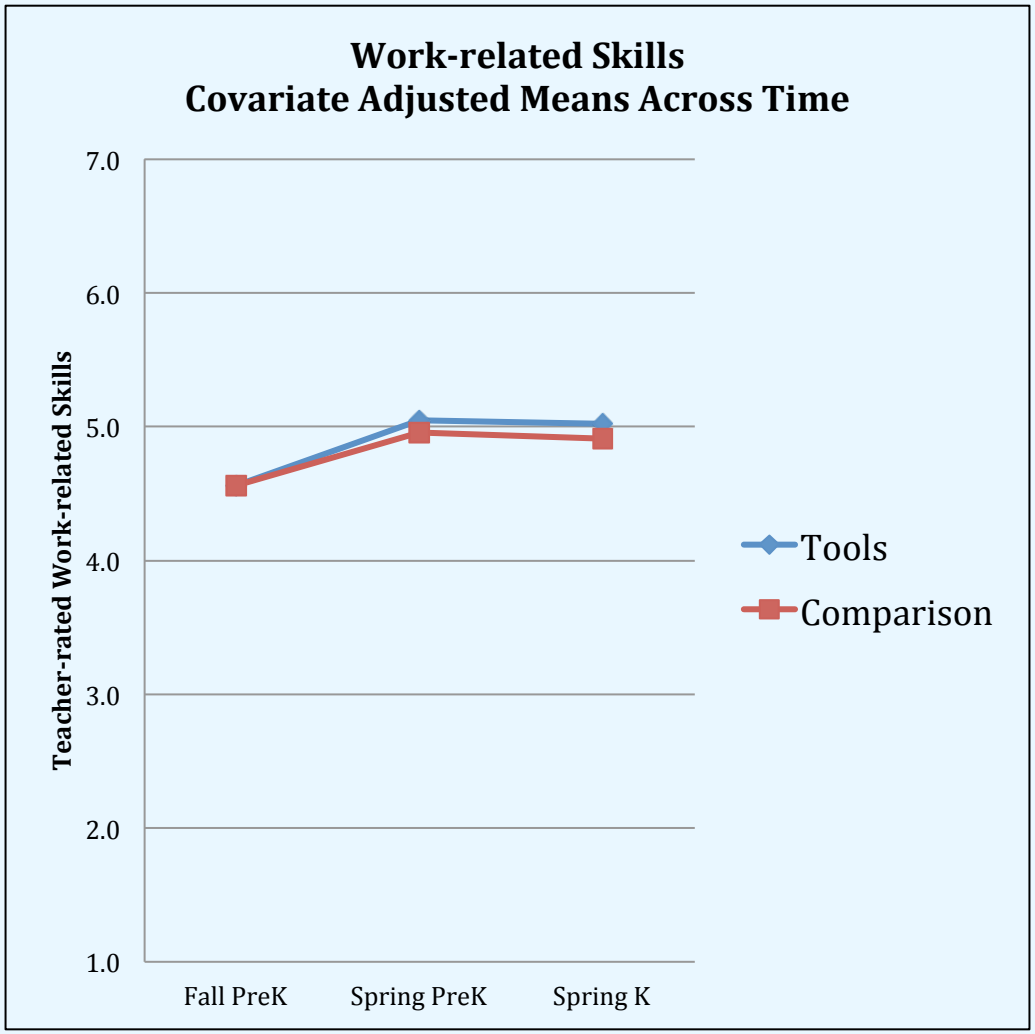




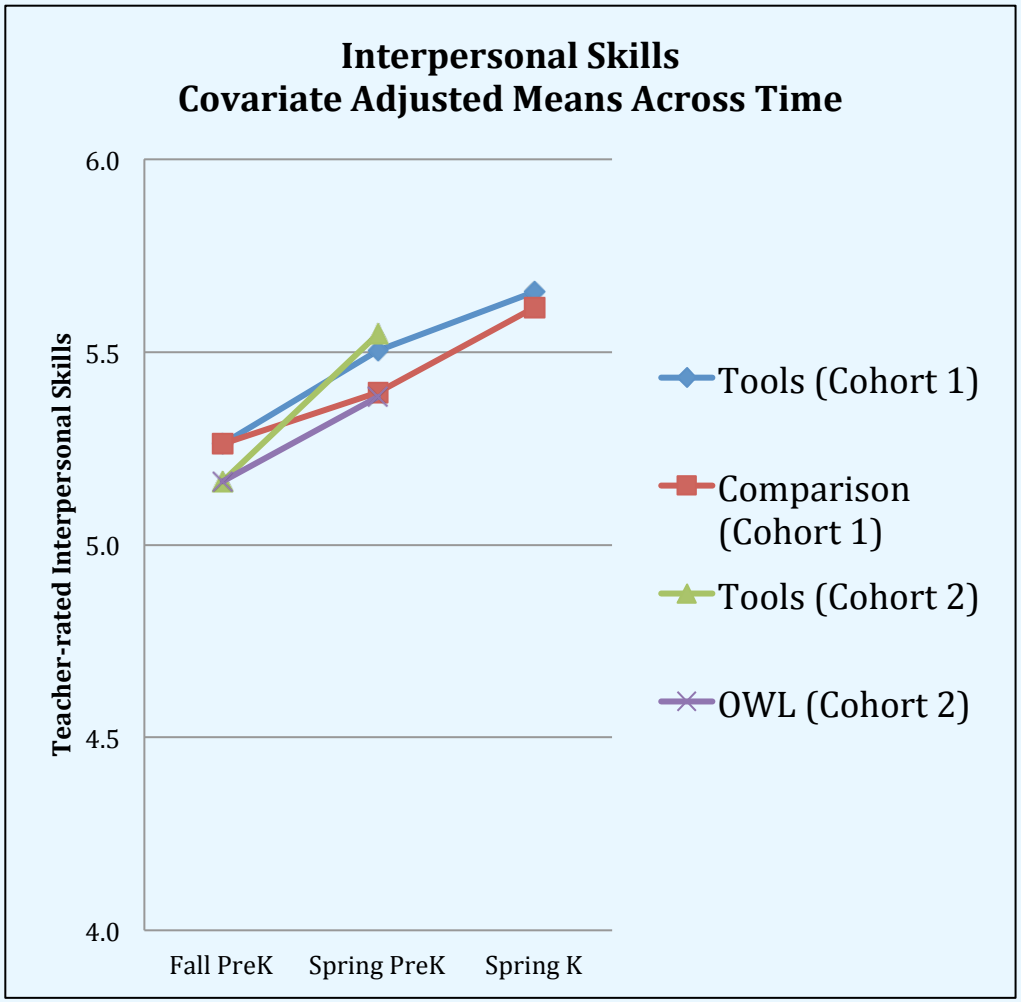
WHAT ABOUT EFFECTS ON TEACHER RATINGS?

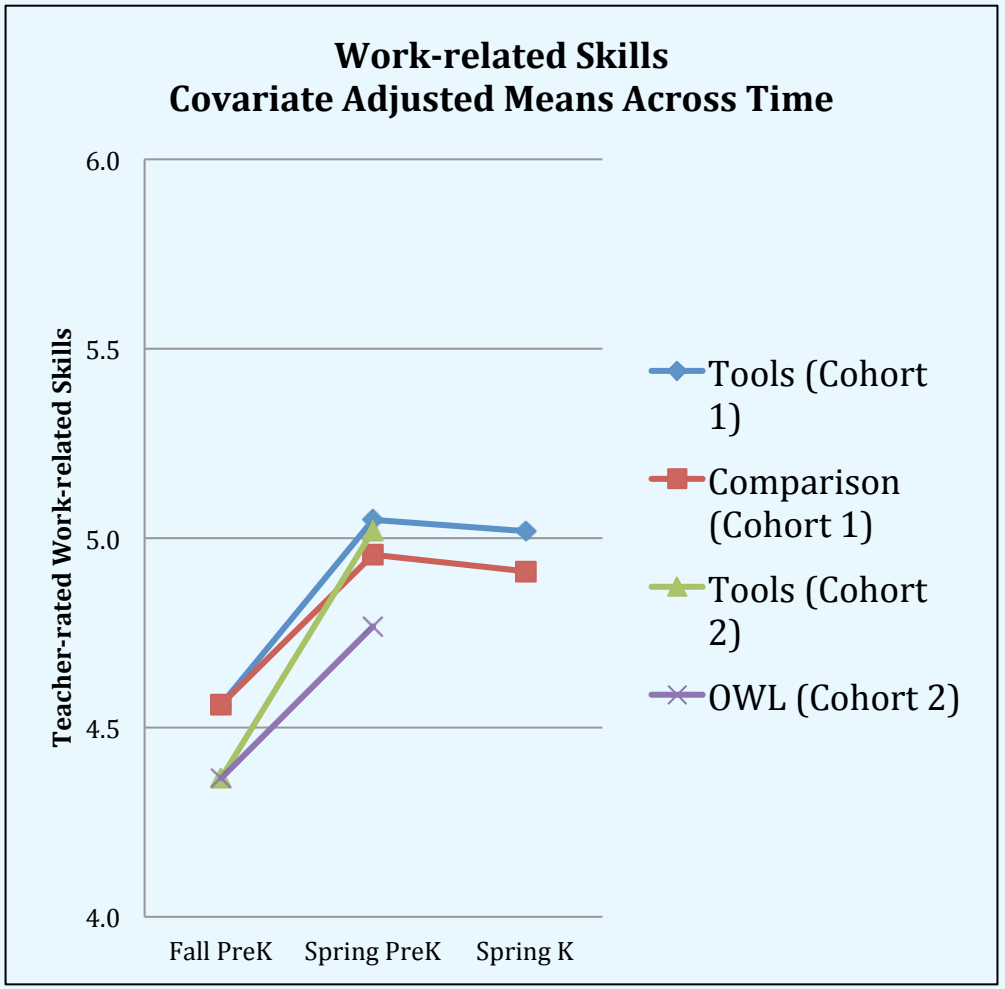
Effects of *Tools* on Teacher Ratings of Social and Behavioral Skills



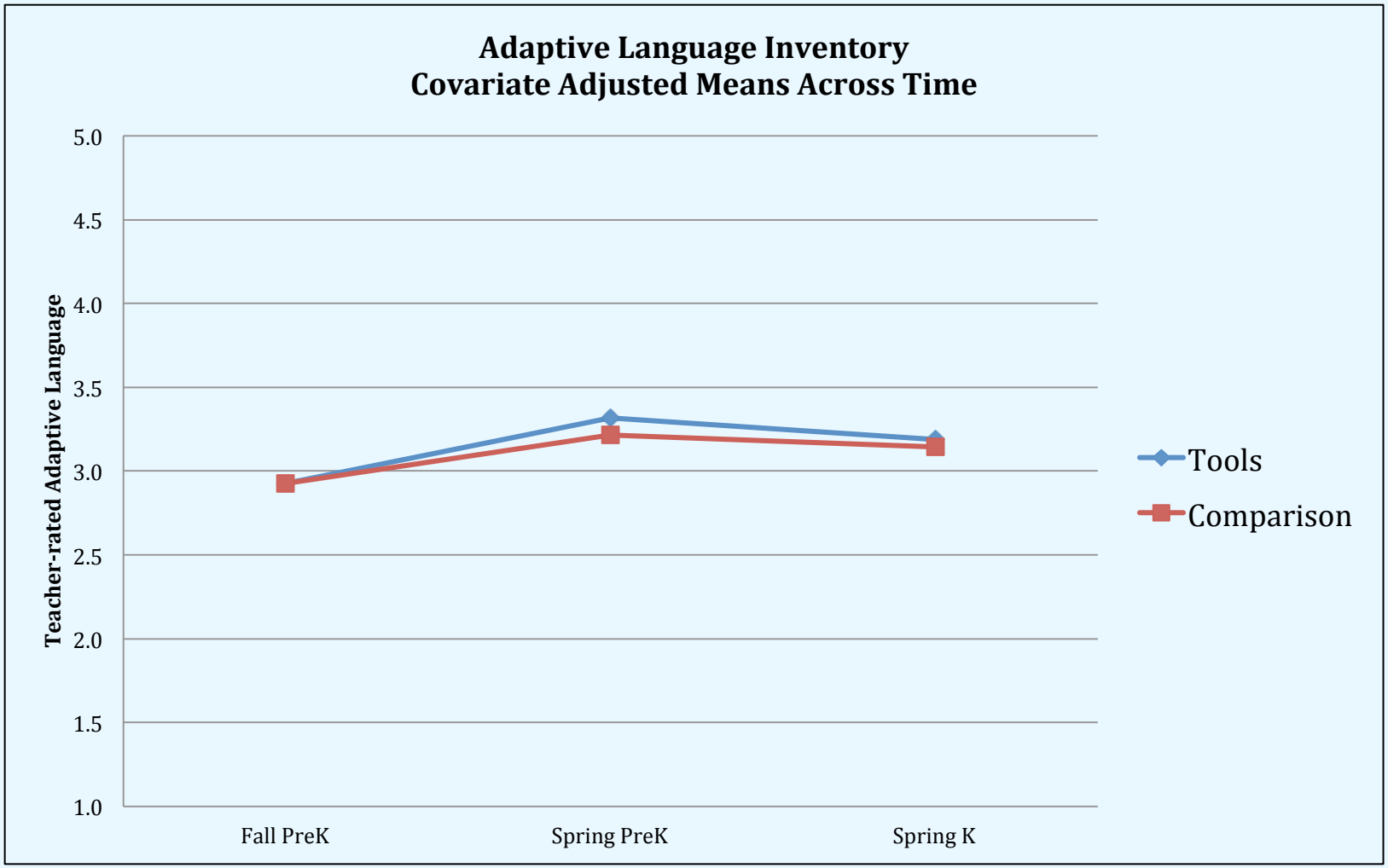


Effects of *Tools* on Teacher Ratings of Social and Behavioral Skills including Cohorts 1 & 2

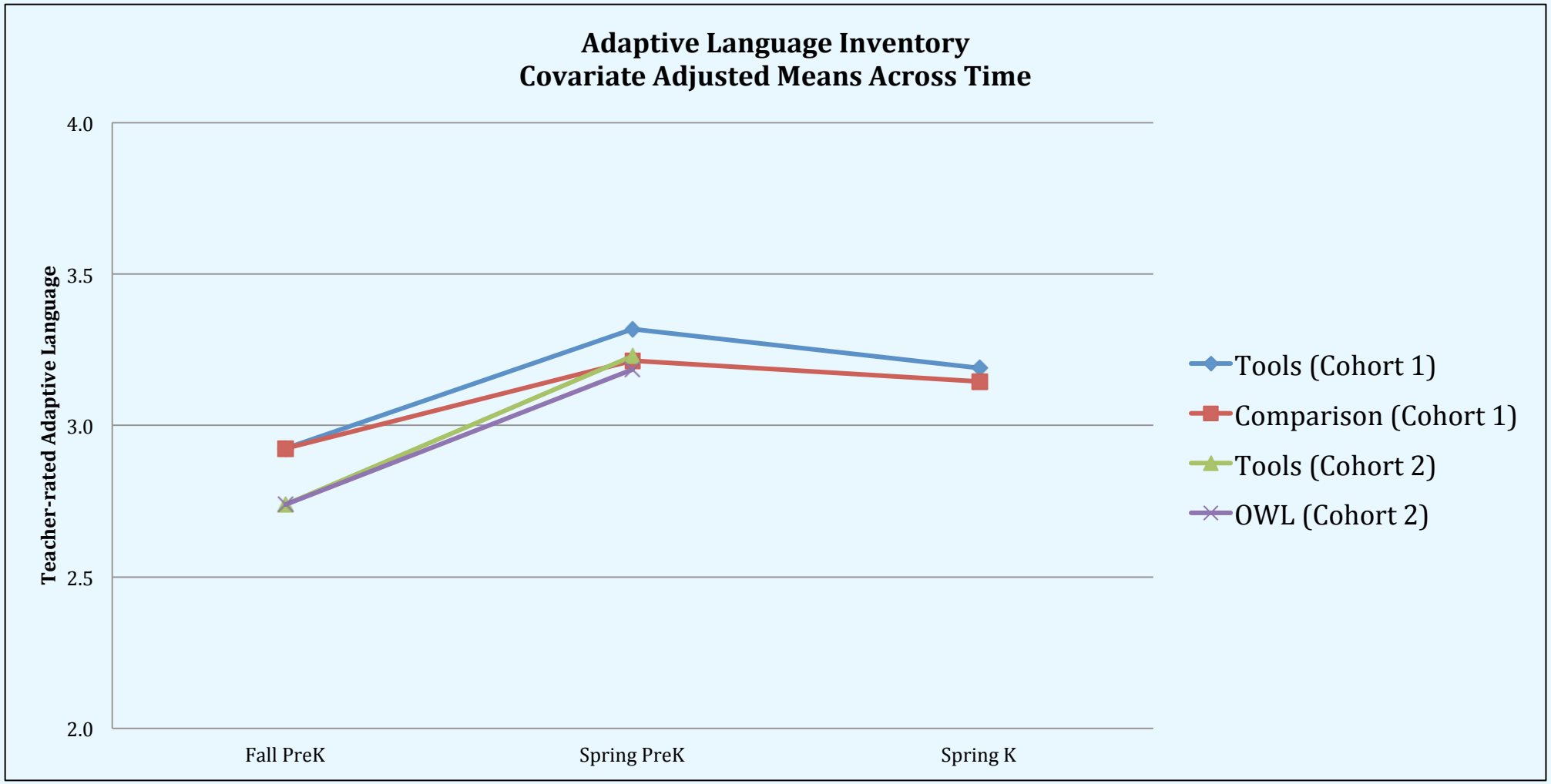




Effects of *Tools* on Teacher Ratings of Adaptive Language



Effects of *Tools* on Teacher Ratings of Adaptive Language including Cohorts 1 & 2



Effects of Tools of the Mind on Cohort 1 Kindergarten Teacher General Ratings of Readiness Skills and Behaviors

	Preparedness (n=803)		Peer Relationships (n=803)		Behavior Problems[a] (n=803)		Feelings About School (n=803)	
	b	se	b	se	b	se	b	se
Intercept	-2.73	2.63	4.09	1.90	-.77	2.45	2.92	.62
Tools Condition (vs. Comparison)	-.03	.18	-.06	.13	-.09	.17	-.01	.04

Given the consistent advantage the cohort 1 control group children appeared to have in kindergarten, we developed composite scores from principal components analyses for both achievement and self regulation.

COMPONENT SCORE ANALYSES

Effects of *Tools of the Mind* on Woodcock Johnson Achievement and Self-Regulation Composites

	WJ Composite (n=797)		SR Composite (n=797)	
	b	se	b	se
Intercept	1.87	1.12	1.30	1.33
Tools Condition (vs. Comparison)	-.16†	.08	-.01	.09
Pretest	.89*	.04	.64*	.04
Gender	-.05	.06	-.05	.07
ELL=Yes	.59*	.08	.04	.08
Age at Pretest	-.02*	.01	-.01	.01
Interval from Pretest to K Testing	-.06	.05	-.04	.06
Interactions				
Condition x Pretest	-.03	.06	-.02	.06
Condition x Gender	-.05	.09	-.02	.11
Condition x ELL	.14	.12	-.21†	.12

† $p < .10$

Summary of Results

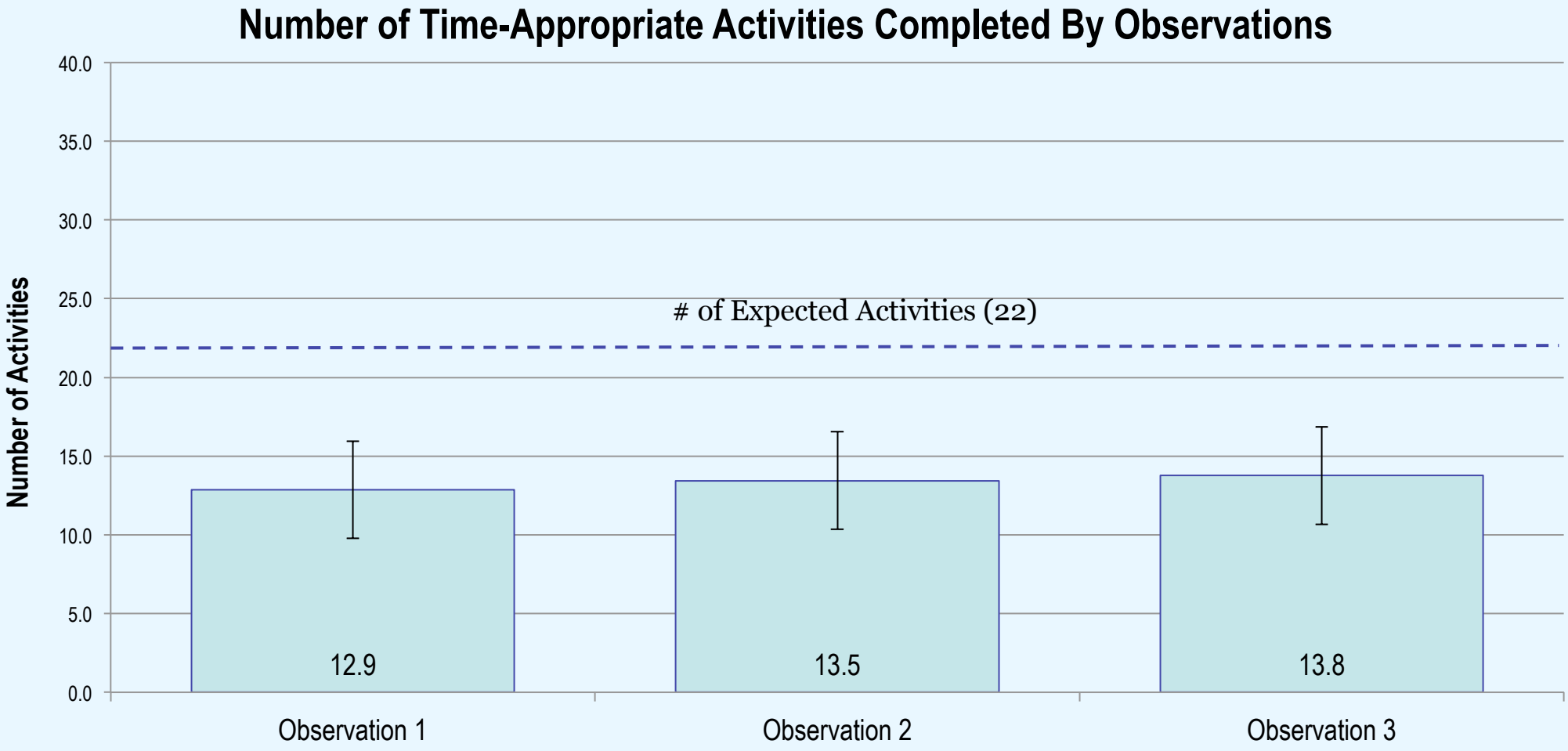
- No effects for *Tools of the Mind* on literacy, language, or mathematics gains when compared to comparison classrooms at the end of pre-k.
- Second cohort received intense coaching, changes led by developers following cohort 1 results. Did not result in differences in child outcomes.
- At the end of kindergarten cohort 1 children from comparison classrooms scored higher on two WJ subtests, with a marginally significant trend for them to score higher on all achievement outcomes.
- No significant effects for *Tools* on self-regulation gains at both outcome points, with mixed trends, suggesting comparison classrooms may have favored ELL children. No effects for cohort 2.
- No significant effects on teacher ratings for either time or cohort.
- *Tools of the Mind* was not found to be consistently more or less effective for demographic subgroups or low scorers at baseline.

DID TEACHERS IMPLEMENT *TOOLS OF THE MIND*?

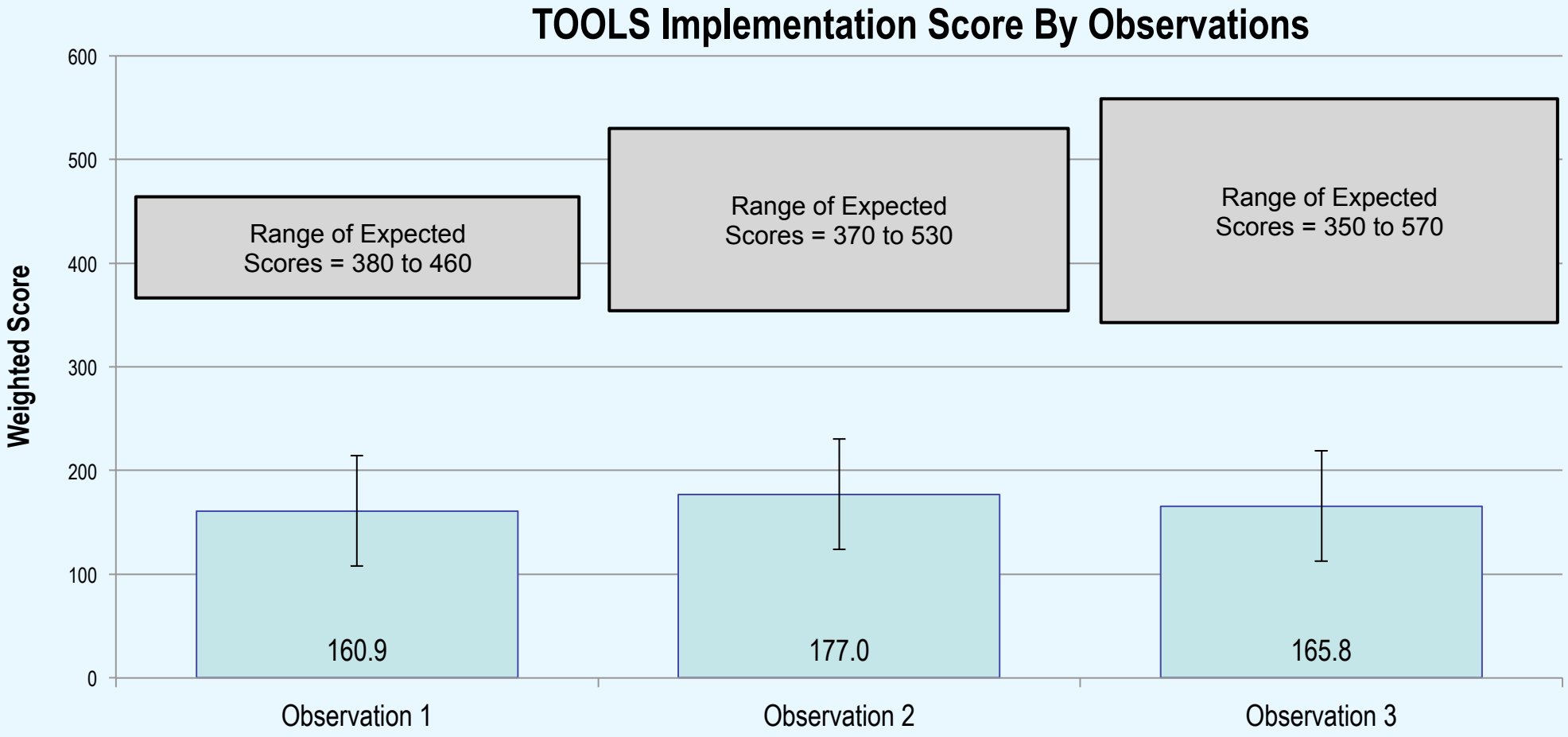
Developing a Fidelity Instrument for *Tools*

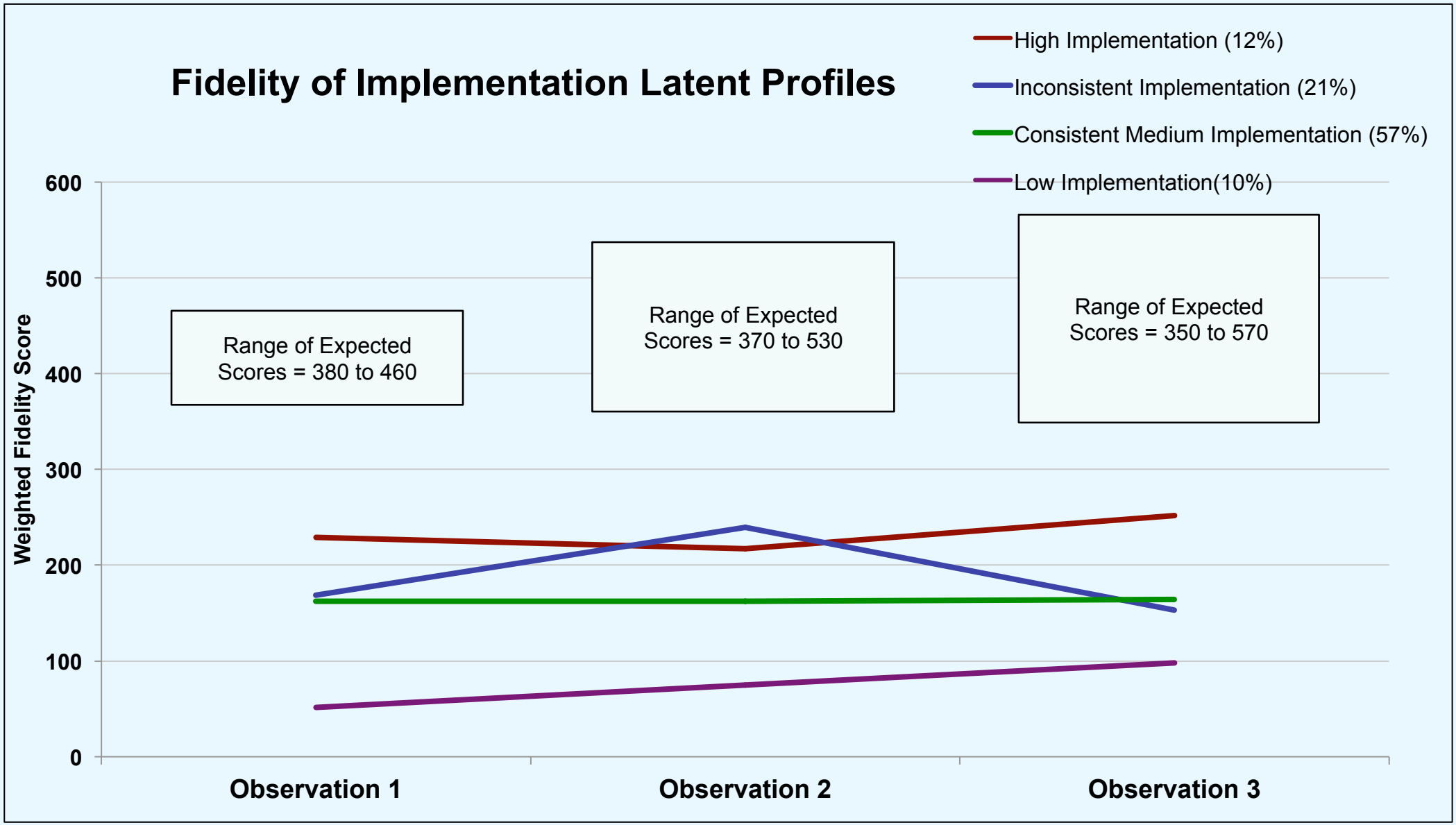
- Developers did not have a full fidelity of implementation instrument and did not identify "core elements" or what would constitute full implementation.
- First year of project was spent developing a fidelity instrument
- Challenges of a dynamic curriculum
  - *Tools* has 61 activities with different implementation requirements
    - Some to be done daily
    - Some are alternatives for each other
    - Some are to be implemented later in the year
  - Each activity has multiple steps
    - Steps to be implemented change across the year
    - Early steps are eliminated, but some are retained while middle ones drop out
  - Many activities have mediators
    - Mediators are supposed to change across the year, some to drop out altogether
- The curriculum provided to teachers was in 4 telephone book sized manuals with additional smaller manuals as supplements

Counting Activities Teachers Enacted at Each Observation



"Weighted" Fidelity Score -- based on difficulty level, ontime implementation and number of steps executed appropriately




Fidelity of Implementation Latent Profiles
High Implementation (12%)
Inconsistent Implementation (21%)
Consistent Medium Implementation (57%)
Low Implementation(10%)
Weighted Fidelity Score
600
500
400
300
200
100
0
Range of Expected Scores = 380 to 460
Range of Expected Scores = 370 to 530
Range of Expected Scores = 350 to 570
Observation 1
Observation 2
Observation 3

Demographic Characteristics of Implementation Profiles

Profile	Yrs Teaching	Yrs Teaching Pre-K	Proportion with Master's
High Implementation (12%)	8.5	4.5	0.40
Inconsistent Implementation (21%)	8.7	7.9	0.22
Consistent Medium (57%)	12.8	7.8	0.17
Low Implementation (10%)	18.8	8.8	0.50

Fidelity of Implementation Summary

- Most *Tools* teachers implemented the activities prescribed in the manual at the appropriate times during the year.
- Teachers in the control classrooms did not implement *Tools* activities.
- Number of activities, steps, and weighted fidelity scores varied across teachers.
- 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.
- **Levels of implementation were not linked to academic or self regulation outcomes at either pre-k or kindergarten.**

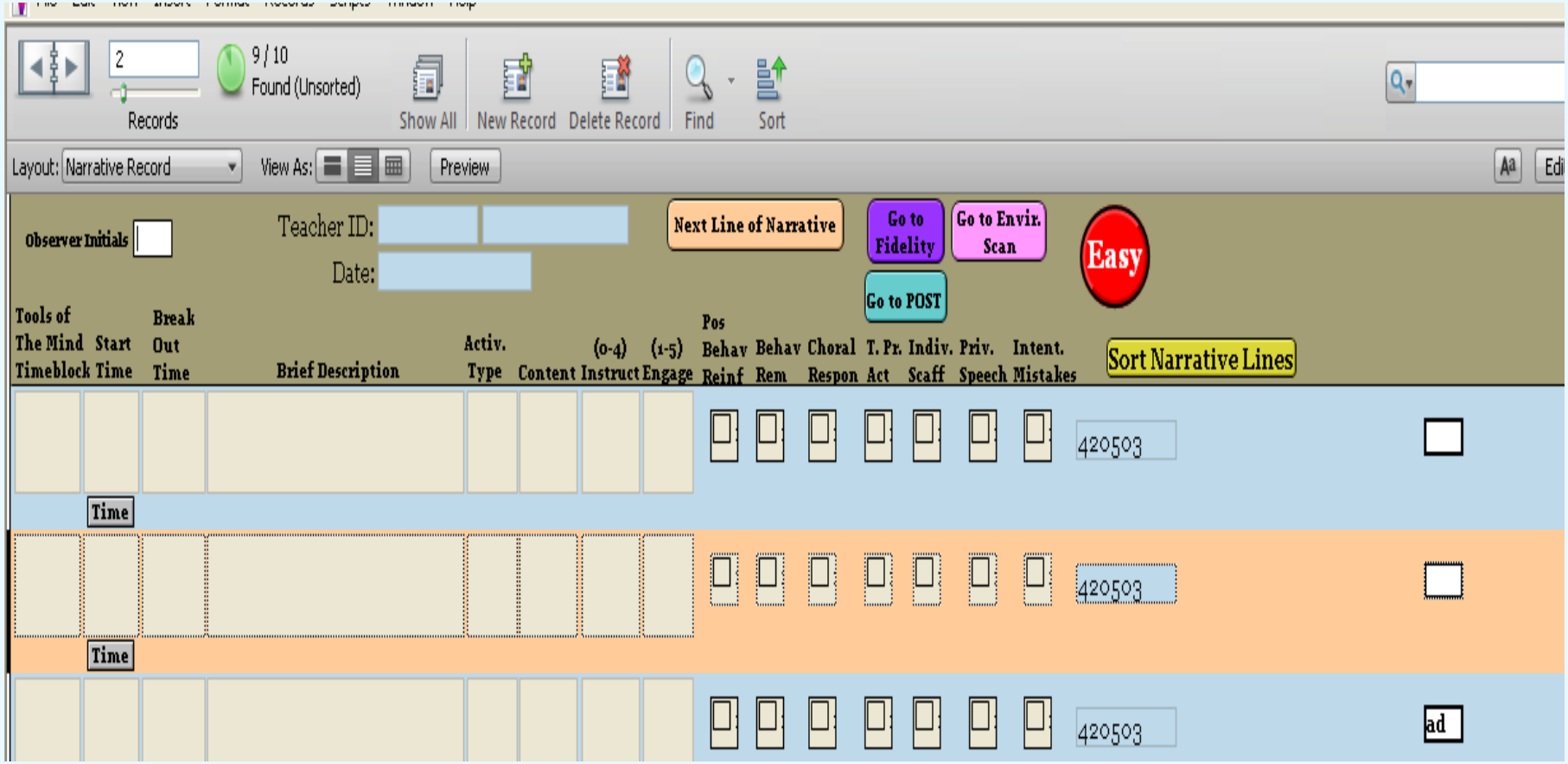
HOW DIFFERENT WERE THE CONTROL CLASSROOMS? COHORT 1

The Counterfactual Condition

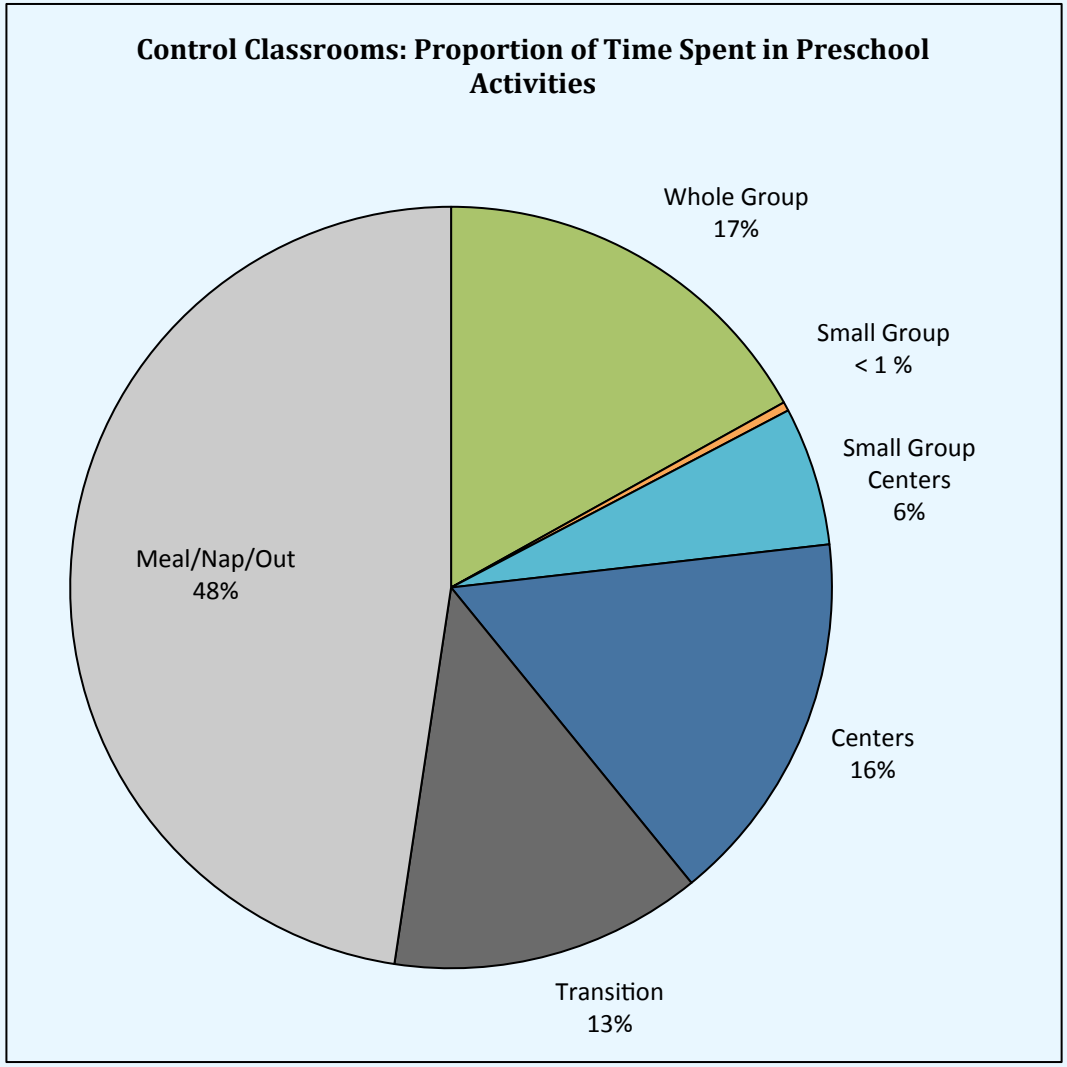
- *Narrative Record* documents how overall classroom time is distributed among activities
  - Describes classrooms "episodes" -- number and amount of time
  - Type of activity and content described per episode
  - Summarized across the entire school day
  - Fidelity of implementation coding linked to the Narrative Record

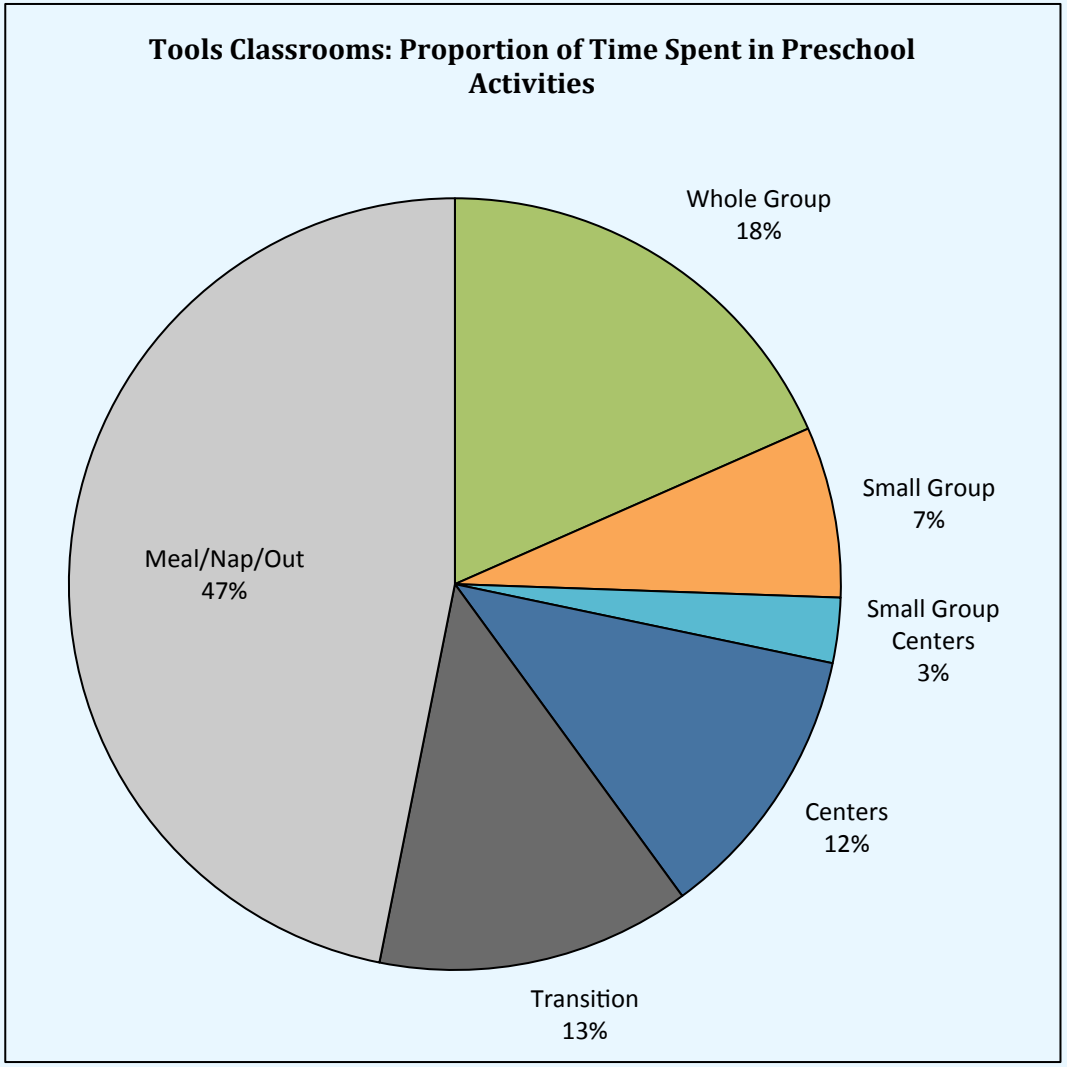
Narrative Record (Farran & Bilbrey, 2004)

- Flexible summary of the way time is spent in classrooms. Can be adapted for specific questions.

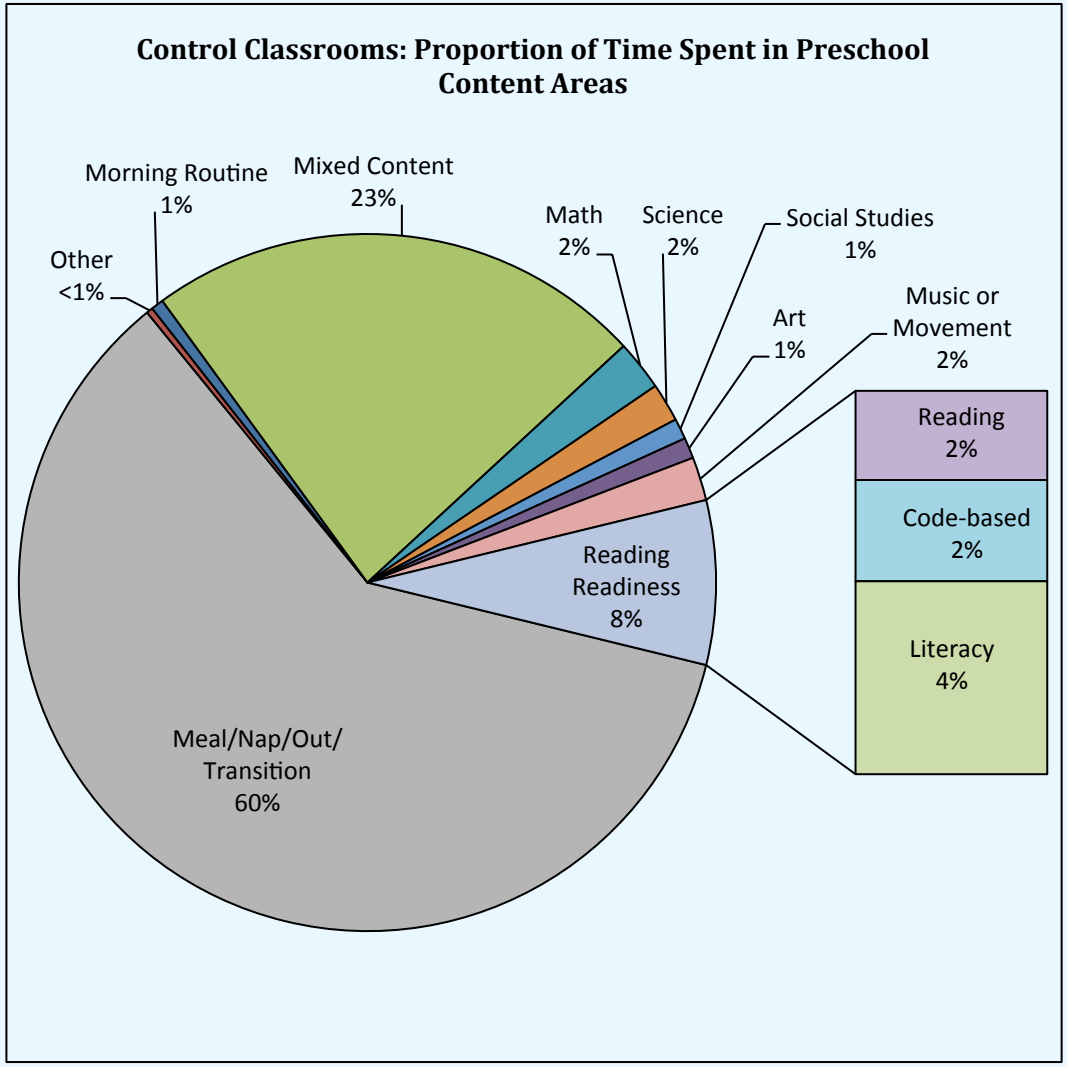


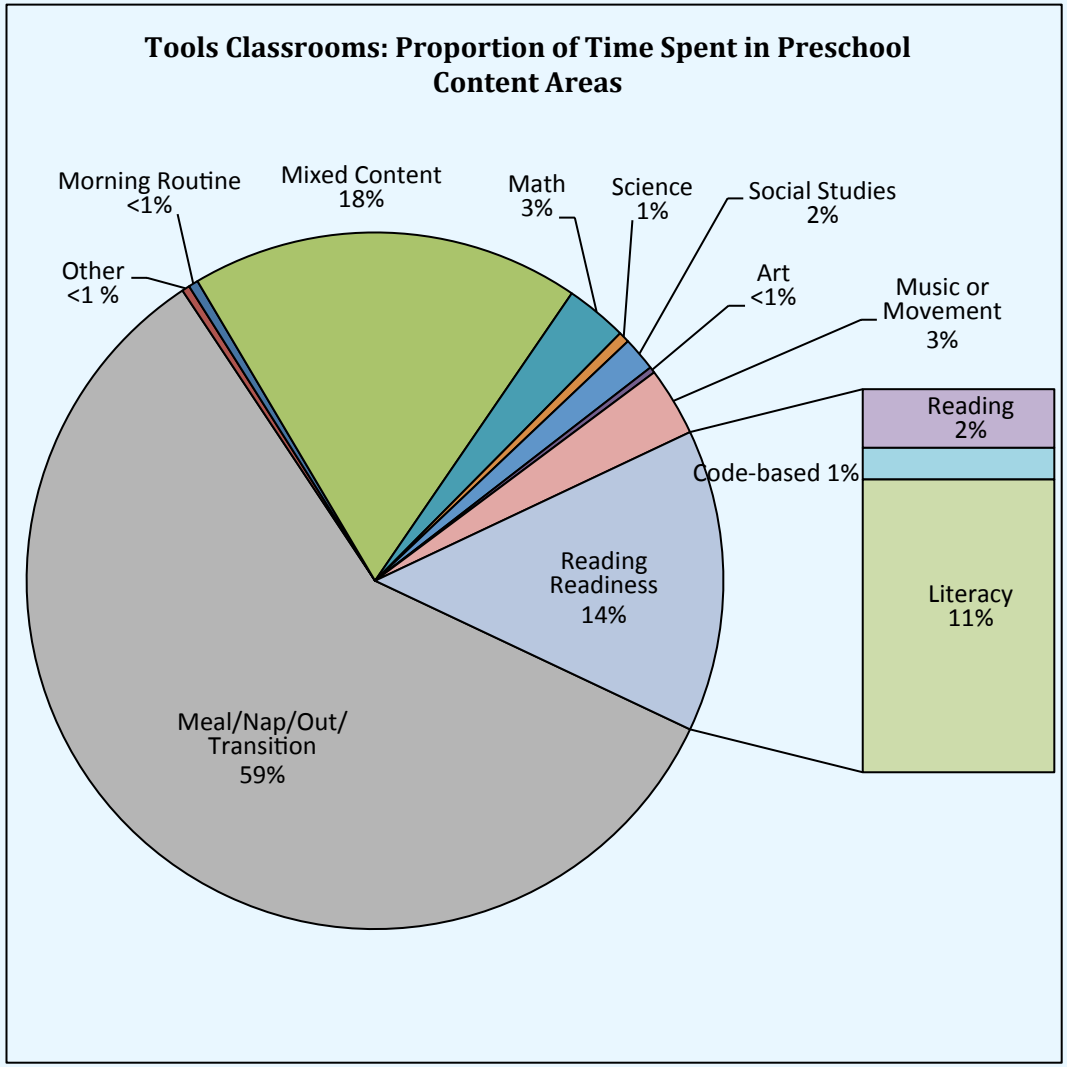
Counterfactual and *Tools* Classrooms Allocated Time Differently





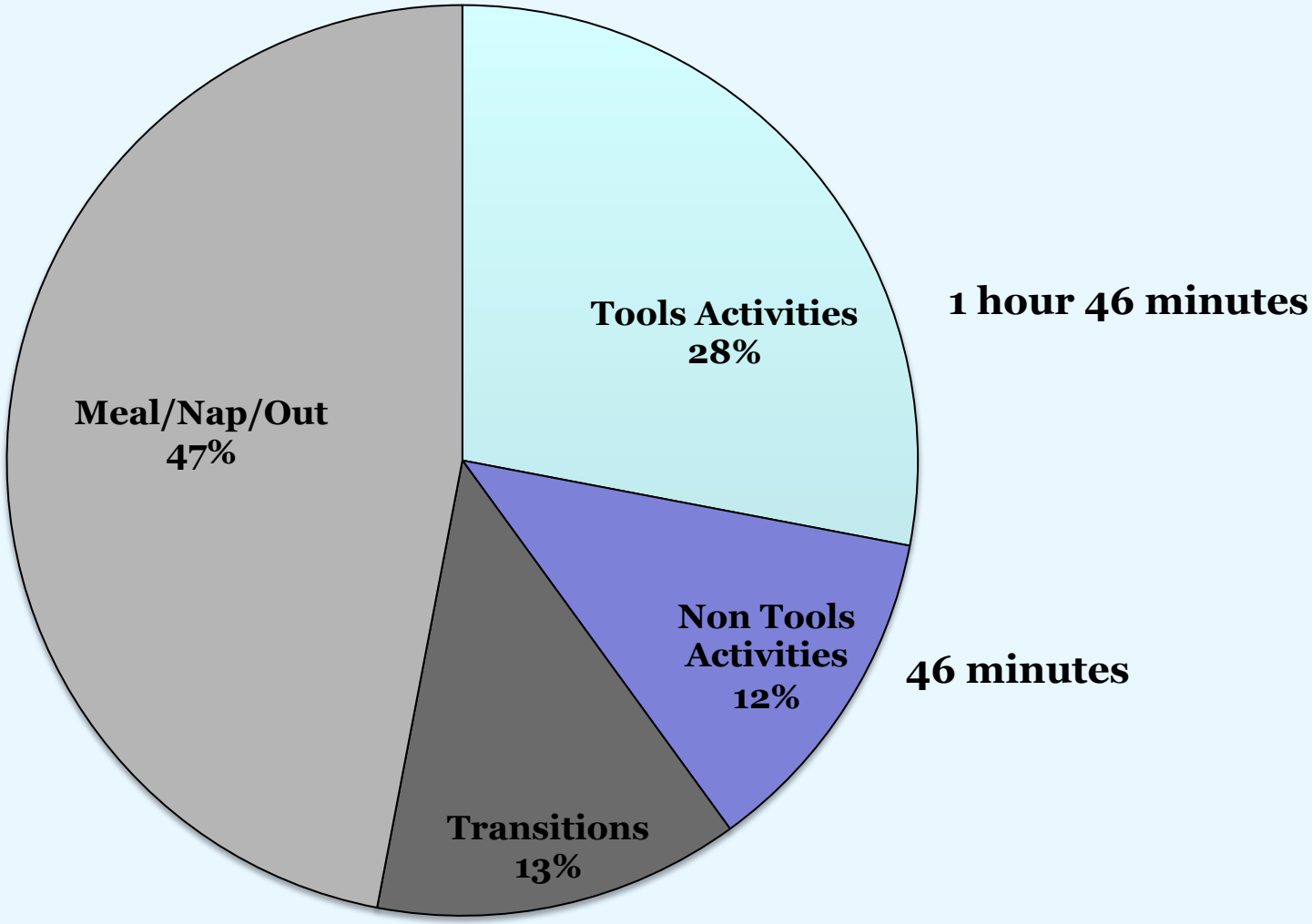
Counterfactual and *Tools* Classroom Teachers Taught Slightly Different Content





Learning Opportunity in *Tools* Classrooms

How much time is there to implement a curriculum, especially one as complex as *Tools of the Mind*?



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 in pre-k or kindergarten follow up for improving either self regulation or achievement.
- Changes in teacher behavior in *Tools* classrooms unrelated to growth in children
- It may not be possible for pre-k teachers to implement such a demanding curriculum in the time they actually have for instructional activities.
- More work is needed to see how flexible the learning time in pre-k classrooms could be and how best to use it.
- More empirical work needed on aspects of prekindergarten classrooms beyond or addition to curricula that are related to child outcomes especially self regulation.

E-mail:
Dale.Farran@vanderbilt.edu

http://peabody.vanderbilt.edu/research/pri/index.php

Peabody Research Institute
Vanderbilt University
Box 0181 GPC, 230 Appleton Place
Nashville, TN 37203-5721
(615) 343-9515