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Title: Experimental Evaluation of the Tools of the Mind Preschool Curriculum

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Abstract Body

Limit 4 pages single-spaced.

Background / Context:

This paper will focus on the results of our ongoing experimental evaluation of the *Tools of the Mind* Prekindergarten Curriculum (Bedrova & Leong, 2007), which is being conducted in Tennessee and North Carolina. The *Tools of the Mind* curriculum approach follows from socio-cultural perspectives on child development that emphasize how children acquire skills and "cultural tools" (e.g., spoken and written language, pretend play, the use of numbers, diagrams and maps) in collaboration with knowledgeable others. In the *Tools* approach, the tactics, mediators, forms of talk, and activities the teacher uses to foster learning are themselves designed to be part of what the student learns. *Tools* teaches teachers to use dynamic assessment and scaffolding techniques that will help children internalize the learning tools, that is, to use the mediators introduced by the teacher and then create their own, to apply self-talk and writing, and to use shared activities and dramatic play in ways that help them attend, self-monitor, solve problems, plan, and remember.

Purpose / Objective / Research Question / Focus of Study:

The aim of the *Tools of the Mind* prekindergarten curriculum is to enhance children's executive function skills within an instructional context that promotes the basic academic and social skills that prepare them for kindergarten and beyond. To investigate the effectiveness of *Tools* in achieving this aim, we are conducting a longitudinal randomized experiment to answer the following questions:

1. Do children in *Tools of the Mind* classrooms improve more in literacy, math, social skills, and behavior problems during the preschool year than children in "business as usual" control classrooms? Are those gains sustained through kindergarten and first grade?
2. Do children in *Tools of the Mind* classrooms show greater gains in executive function than children in the control classrooms? Do those gains mediate the curriculum effects on literacy, math, and social skills outcomes?
3. Are there differential effects of *Tools of the Mind* associated with characteristics of the children or the classrooms?

Setting:

Four school districts in Tennessee and two in North Carolina are participating in the study. The four Tennessee districts and one of the North Carolina districts experienced their test year during the 2010-2011 school year; the presentation will focus on these school districts. The second North Carolina district is experiencing its test year in 2011-2012. All the prekindergarten programs in these schools are funded through grants from their states and/or Title I, thus all families must meet the income guidelines for free or reduced-price lunch in order to enroll their children. The 2010-2011 school districts are:

1. Lebanon Special School District, an independent district for the city of Lebanon that is embedded within the Wilson county district, is located east of Nashville, TN. It serves more than 3,000 prekindergarten to 8th grade students in five schools with 25% minority and a poverty rate of 51%. It has 5 prekindergarten classrooms in 5 schools.
2. Wilson County School District is east of Nashville, TN, in a predominantly rural county that is experiencing a dramatic increase in the number of Hispanic children. It serves more than 13,000 students in prekindergarten to 12th grade with a poverty rate of 23% and 11% minorities. It has 10 prekindergarten classrooms in 9 schools.
3. Franklin Special School District serves the city of Franklin and embedded within, but independent from, the Williamson County school district. This K-8 school system is south of Nashville, TN, and serves 3,900 students in 7 schools. It serves 32% minority students with 30% economically disadvantaged and has 7 prekindergarten classrooms in 4 schools.
4. Cannon County Schools is southeast of Nashville, TN, in a predominantly rural, poor county. It serves 2,177 children, prekindergarten to 12th grade, the majority of which qualify for free or reduced-price lunch (52%) but a low percentage (3.2%) is minority. It has 4 prekindergarten classes in 4 schools.
5. Guilford County School System is an urban system serving 70,000 children in the piedmont region of North Carolina. This school system serves a majority of minority students (58%), nearly half the students qualify for free or reduced-price lunch (49%). It has 77 prekindergarten classes in 45 schools, and 30 of those classrooms in 22 schools participated in the research.

Population / Participants / Subjects:

In all, 847 children from 60 classrooms in 44 schools were seen at the beginning of prekindergarten and 801 children at the end of prekindergarten. Demographics for the participating children are shown in Table 1 (please insert Table 1 here). Overall, the sample of students was diverse in terms of ethnicity and language background, with multiple minority groups represented. Close to 30% of the students were English language learners.

Sixty teachers participated in the study, with 32 in the Tools condition and 28 in the comparison condition. Overall, teachers averaged 12 years of teaching experience, with seven years in preschool classrooms. All teachers had at least a Bachelor's degree, and over half had completed coursework toward or obtained a Master's degree. In addition, each classroom had at least one assistant.

Intervention / Program / Practice:.

Tools of the Mind is based on an interactive sequence of change (shown in Figure 1) whereby teachers use assessment and scaffolding to tailor their use and modeling of specific tactics. These are internalized by their students as cognitive tools, which are then used independently and manifested in observable behaviors in the classroom. That set of

behaviors we call *learning-related self-regulation or executive function*. As we describe in the data collection section below, our set of outcome measures includes indicators of both executive function and other key literacy, language, math, and social & emotional skills outcomes. Operationally, *Tools of the Mind* is both a curriculum and a professional development program for teachers. As a curriculum, the focus is on 61 Vygotskian activities designed to promote children's meta-cognitive development. As a part of this evaluation, a detailed fidelity of implementation system was devised that tallied the 61 activities teachers enacted, the steps they completed, mediators used and the inclusion of incorrect actions ("should not's") as identified by the curriculum developers.

Research Design:

This large-scale experimental study was designed to test the effectiveness of the *Tools of the Mind* curriculum when compared to the usual curriculum and practice occurring in the participating school systems. Because it is advantageous for the *Tools* professional development if all the prekindergarten teachers within a school are trained together and encouraged to support each other during implementation, schools were the unit of randomization. This scheme was also intended to minimize interaction between experimental and control teachers that might have compromised the comparison. The schools were blocked by district, with the large Guilford, NC district divided into two blocks. Within each block, half the schools were assigned to the *Tools* condition and half to the practice as usual control condition (with slight variations due to the uneven number of schools in some districts). All the prekindergarten classrooms within each school then participated in the condition to which the school was assigned.

The teachers in the classrooms assigned to the control condition continued to practice as usual with whatever curriculum they were using, which varied from district to district. The teachers in the *Tools* condition began the professional development sequence for *Tools* and began implementing the *Tools* curriculum the first year of the study (the 2009-2010 school year). However, that first year was a training and practice year for the teachers and no measures were taken on the children to assess curriculum effects. The second year (2010-2011) was the test year for the classrooms we report on here.

Data Collection and Analysis:

We used a battery of child achievement measures as well as a number of direct assessments of self-regulation and teacher and assessor behavior rating measures to assess the effects of the curriculum. Achievement measures included 7 subtests from the Woodcock-Johnson that examine literacy, language, and math skills. The direct assessments of self-regulation were selected to capture one or more components of executive function including attentiveness, attention shifting, inhibitory control, persistence, and working memory. Teachers reported on children's classroom behavior and language ability. In addition, assessors rated children's self-regulatory behaviors during the assessment sessions.

Children were consented in both the intervention and comparison classrooms and tested on executive function and their academic preparation for kindergarten at the beginning and end of preschool. Children were individually assessed by trained and certified assessors in two 20-minute sessions. Teachers rated the children's social skills and classroom behavioral competencies in the fall (after 6 weeks of school) and in May.

Findings / Results:

The students in the treatment and comparison groups were similar on all demographic variables. Furthermore, randomization checks have shown that the treatment and comparison groups were similar on all pretest assessments and ratings, with no significant differences between the *Tools* and comparison groups on any measure.

The effectiveness of the Tools curriculum was tested using multi-level regression models with students nested within classrooms, schools, and district blocks. The models for each outcome included pretest scores, age, interval between assessments, gender, ELL status, and ethnicity as covariates.

Our results show that there were no significant treatment effects on any of our outcome variables. Students in *Tools* classrooms performed about equally well on all outcome variables, including the executive function measures, after receiving a year of the curriculum as students who received the usual preschool curriculum. Similarly there were no differences between the two sets of classrooms in teacher ratings of social and behavioral competence. In addition, the *Tools* curriculum did not appear to result in significantly better outcomes for any student subgroups (i.e., ELL, ethnic groups, gender) when compared to the control condition. Gains on all outcomes were observed across the preschool year in both *Tools* and comparison classrooms.

The presentation will summarize and report on the statistical models tested, examine the effects of the curriculum for demographic and regional subgroups of students. Descriptives for the main outcomes are shown in Table 2 (please insert Table 2 here).

Conclusions:

Given the widespread interest and growing adoption of the *Tools of the Mind* curriculum, the curriculum developers and research team at the Peabody Research Institute agreed that a rigorous experimental evaluation of the curriculum was necessary. While analyses thus far have not shown significant treatment effects, results from the Kindergarten and future 1st grade assessments might evidence results that appear late as the cognitive demands of schooling increase. Furthermore, our results have not shown the curriculum to be any less effective than the curricula used in the comparison classrooms. Further analyses are being conducted to examine classroom processes in *Tools* and comparison classrooms more closely to investigate the theoretical model of the *Tools* approach.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

Bodrova, E. & Leong, D. (2007). *Tools of the Mind: The Vygotskian approach to early childhood education.* Second edition. New York, Merrill/Prentice Hall.

Appendix B. Tables and Figures

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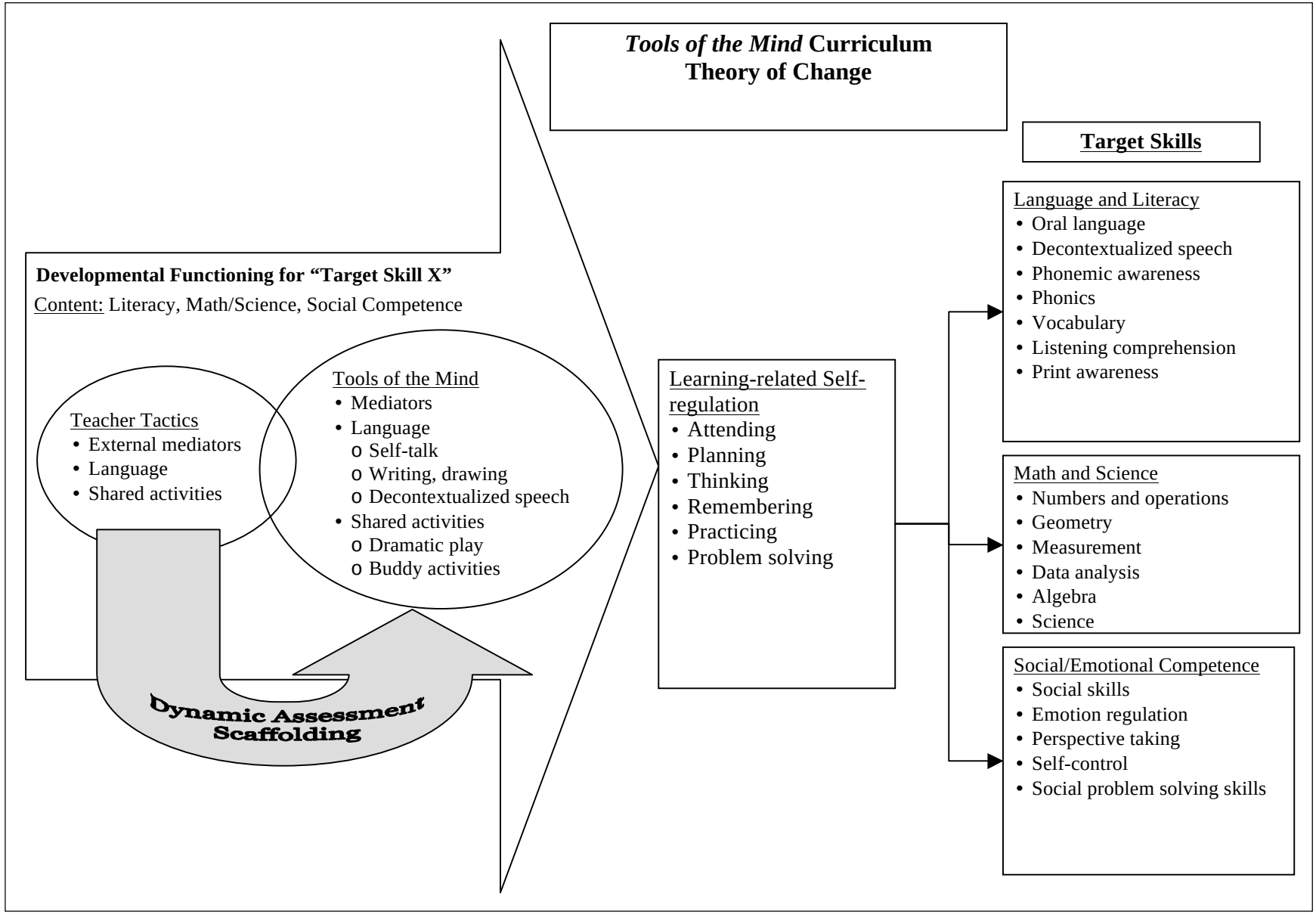
Table 1. Demographics				
Variable	**Tools**		**Comparison**	
	n	***%***	***n***	***%***
Male	262	53%	217	57%
Female	237	47%	162	43%
ELL	137	28%	110	29%
Not ELL	362	72%	269	71%
Black/African American	145	29%	86	23%
Hispanic/Latino	119	24%	95	25%
Caucasian	192	38%	157	41%
Other	43	9%	41	11%
Age at pretest	4.5 years	54m	4.6 years	55m
Age at posttest	5.2 years	62m	5.2 years	62m

Table 2. Pretest and Posttest Descriptives on Academic Outcomes (W scores) and Self-Regulation Direct Assessments

	Tools			Comparison		
	Mean	sd	n	Mean	sd	n
Letter Word Pretest	314.8	25.8	493	312.6	26.2	369
Letter Word Posttest	347.0	22.6	465	348.8	23.3	348
Spelling Pretest	337.7	23.3	493	335.0	23.4	369
Spelling Posttest	372.8	25.4	465	370.7	26.9	348
Academic Knowledge Pretest	427.2	23.4	493	426.6	22.9	369
Academic Knowledge Posttest	443.5	17.1	465	443.0	18.3	348
Oral Comprehension Pretest	439.4	16.1	493	438.8	15.7	369
Oral Comprehension Posttest	450.1	16.2	465	450.4	17.2	348
Picture Vocabulary Pretest	450.9	25.4	493	451.1	24.3	369
Picture Vocabulary Posttest	462.4	15.3	465	463.2	15.0	348
Applied Problems Pretest	381.1	31.8	493	380.6	30.8	369
Applied Problems Posttest	407.6	21.2	465	407.0	22.5	348
Quantitative Concepts Pretest	403.6	12.9	493	402.4	13.0	369
Quantitative Concepts Posttest	421.3	15.1	465	421.3	14.7	348
Dimensional Change Card Sort Pretest	1.3	0.6	493	1.3	0.6	371
Dimensional Change Card Sort Posttest	1.7	0.6	465	1.6	0.6	348
Forward Digit Span Pretest	2.5	1.3	493	2.5	1.3	370
Forward Digit Span Posttest	3.1	1.2	465	3.1	1.1	348
Backward Digit Span Pretest	1.2	1.2	493	1.2	1.1	369
Backward Digit Span Posttest	1.6	1.3	465	1.6	1.4	348
Peg Tapping Pretest	4.4	5.8	493	4.3	5.8	368
Peg Tapping Posttest	9.4	5.6	465	9.2	6.0	348
Head-Toes-Knees-Shoulders Pretest	10.5	13.6	492	9.6	12.2	366
Head-Toes-Knees-Shoulders Posttest	22.4	17.2	464	21.2	17.1	348
Copy Design Pretest	1.1	1.6	492	1.0	1.5	368
Copy Design Posttest	5.2	2.8	465	4.8	2.8	348


Tools of the Mind Curriculum
Theory of Change
Target Skills
Language and Literacy
• Oral language
• Decontextualized speech
• Phonemic awareness
• Phonics
• Vocabulary
• Listening comprehension
• Print awareness
Math and Science
• Numbers and operations
• Geometry
• Measurement
• Data analysis
• Algebra
• Science
Social/Emotional Competence
• Social skills
• Emotion regulation
• Perspective taking
• Self-control
• Social problem solving skills
Learning-related Self-regulation
• Attending
• Planning
• Thinking
• Remembering
• Practicing
• Problem solving
Developmental Functioning for "Target Skill X"
Content: Literacy, Math/Science, Social Competence
Teacher Tactics
• External mediators
• Language
• Shared activities
Tools of the Mind
• Mediators
• Language
o Self-talk
o Writing, drawing
o Decontextualized speech
• Shared activities
o Dramatic play
o Buddy activities
Dynamic Assessment
Scaffolding