

**Enhancing Executive Function and Achievement in Prekindergarten Classrooms:
The Effectiveness of *Tools of the Mind*
SYMPOSIUM OVERVIEW**

The concept of Executive Function (EF) applied to classroom settings has been around for many years but under different names: self regulation (Bedrova & Leong, 2005); learning dispositions (Katz, 1995); work-related skills (Cooper & Farran, 1988); approaches to learning (NCES, 2010). Shared among them are three essential elements of EF (Hughes, 2011): inhibitory control, working memory, and attentional flexibility. Strong relationships between EF and tested content knowledge and school grades have been found in both early and late elementary grades, especially for mathematics (e.g., Best, Miller, & Naglieri, 2011; Lan, Legare, Ponitz, Li, & Morrison, 2011; Monette, Bigras, & Guay, 2011).

These findings have led several researchers to urge attention to the development of EF in early childhood classrooms. Three articles in 2011 alone have called for research into curricula that might facilitate the development of this important set of skills (Best et al., 2011; Diamond & Lee, 2011; Hughes, 2011). The one curriculum mentioned by all has been *Tools of the Mind*, an approach developed by Bedrova and Leong (2007). *Tools of the Mind* is a comprehensive, full-day early childhood curriculum with from 40-65 Vygotskian-based activities but whose central activity is socio dramatic play. *Tools* is focused on helping children develop learning dispositions (self-regulation) while they are also learning academic skills.

Despite the appeal of *Tools of the Mind* and its wide publicity in the public media, in 2008 What Works Clearinghouse found no evidence that it was effective. A primary problem was that there was only one relatively small study that met criteria (Barnett et al., 2008). Since that review, IES and NICHD have funded several longitudinal, large scale randomized trials of the curriculum. This symposium will present findings from several of them.

First is a cluster randomized field-based trial presenting data collected in the second year of implementation in 60 prekindergarten classrooms in Tennessee and North Carolina. More than 800 children were assessed for achievement in language, literacy, and early mathematics, a variety of EF measures, and teacher ratings of EF and social skills. Data will be presented on the relative effectiveness of the 32 *Tools* classrooms compared to 28 classrooms following a variety of other curricula. The second paper presents data from a cluster-randomized design involving 117 prekindergarten and Head Start classrooms with over 2000 children in New Mexico and Massachusetts. Child outcomes in literacy, language and EF were collected comparing a literacy curriculum, *Tools*, a combination of the two, and a business as usual control group of classrooms. The third paper will present data from a cluster randomized control trial comparing a mathematics curriculum alone, mathematics combined with the *Tools* approach to play, and a business as usual control group. Measures of EF were collected on 826 children in 84 classrooms in California. The final paper is from a project in its first year of implementation, focused on the adaptation of *Tools* specifically for ELL children. This project involves 60 classrooms in New York and Florida. Greg Duncan will serve as a discussant, pulling together these four large studies.

References

- Barnett, W., Jung, K., Yarosz, D., Thomas, J., Hornbeck, A., Stechuk, R., & Burns, S. (2008). Educational effects of the *Tools of the Mind* curriculum: A randomized trial. *Early Childhood Research Quarterly, 23*(3), 299–313.
- Best, J. R., Miller, P. H., & Naglieri, J. A. (2011). Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample. *Learning and Individual Differences, 21*, 327-336.
- Bodrova, E. & Leong, D. (2007). *Tools of the Mind: The Vygotskian approach to early childhood education*. Second edition. New York, Merrill/Prentice Hall.
- Bodrova, E., & Leong, D.J. (2005). Self-regulation as a key to school readiness: How can early childhood teachers promote this critical competence? In M. Zaslow & I. Martinez-Beck (Eds.), *Critical issues in early childhood professional development*, pg. 223–70. Baltimore: Brookes.
- Cooper, D., & Farran, D. C. (1988). Behavioral risk in kindergarten. *Early Childhood Research Quarterly, 3*, 1-20.
- Diamond, A. & Lee, K. (2011). Interventions shown to aid executive function development in children 4-12 years old. *Science, 333*, 959-964.
- Hughes, C. (2011). Changes and challenges in 20 years of research into the development of executive function. *Infant and Child Development, 20*, 251-271.
- Katz, L. G. (1995). Dispositions in early childhood education. In L. G. Katz (Ed.), *Talks with teachers of young children. A collection*. Norwood, NJ: Ablex.
- Lan, X., Legare, C., Ponitz, C., Li, S., & Morrison, F. (2011). Investigating the links between the subcomponents of executive function and academic achievement: A cross-cultural analysis of Chinese and American preschoolers. *Journal of Experimental Child Psychology, 108*, 677-692.
- Monette, S., Bigras, M., & Guay, M. -C. (2011). The role of the executive functions in school achievement at the end of Grade 1. *Journal of Experimental Child Psychology, 109*, 158-173.
- National Center for Educational Statistics (2010). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) Kindergarten Through Fifth Grade Approaches to Learning and Self-Description Questionnaire (SDQ) Items and Public-Use Data Files*. (<http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2010070>).

Abstract Title Page
Not included in page count.

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

Authors and Affiliations:

Sandra Jo Wilson, Ph.D.

Senior Research Associate
Associate Director, Peabody Research Institute
Vanderbilt University
230 Appleton Place, PMB 181
Nashville, TN 37203-5721
Phone: (615) 343-7215
email: sandra.j.wilson@vanderbilt.edu

Dale C. Farran, PhD

Professor of Education and Psychology
Department of Teaching and Learning
Senior Associate Director, Peabody Research Institute
Vanderbilt University
230 Appleton Place, PMB 181
Nashville, TN 37203-5721
Phone: (615) 343-9515
email: dale.farran@vanderbilt.edu

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

Not included in page count.

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.

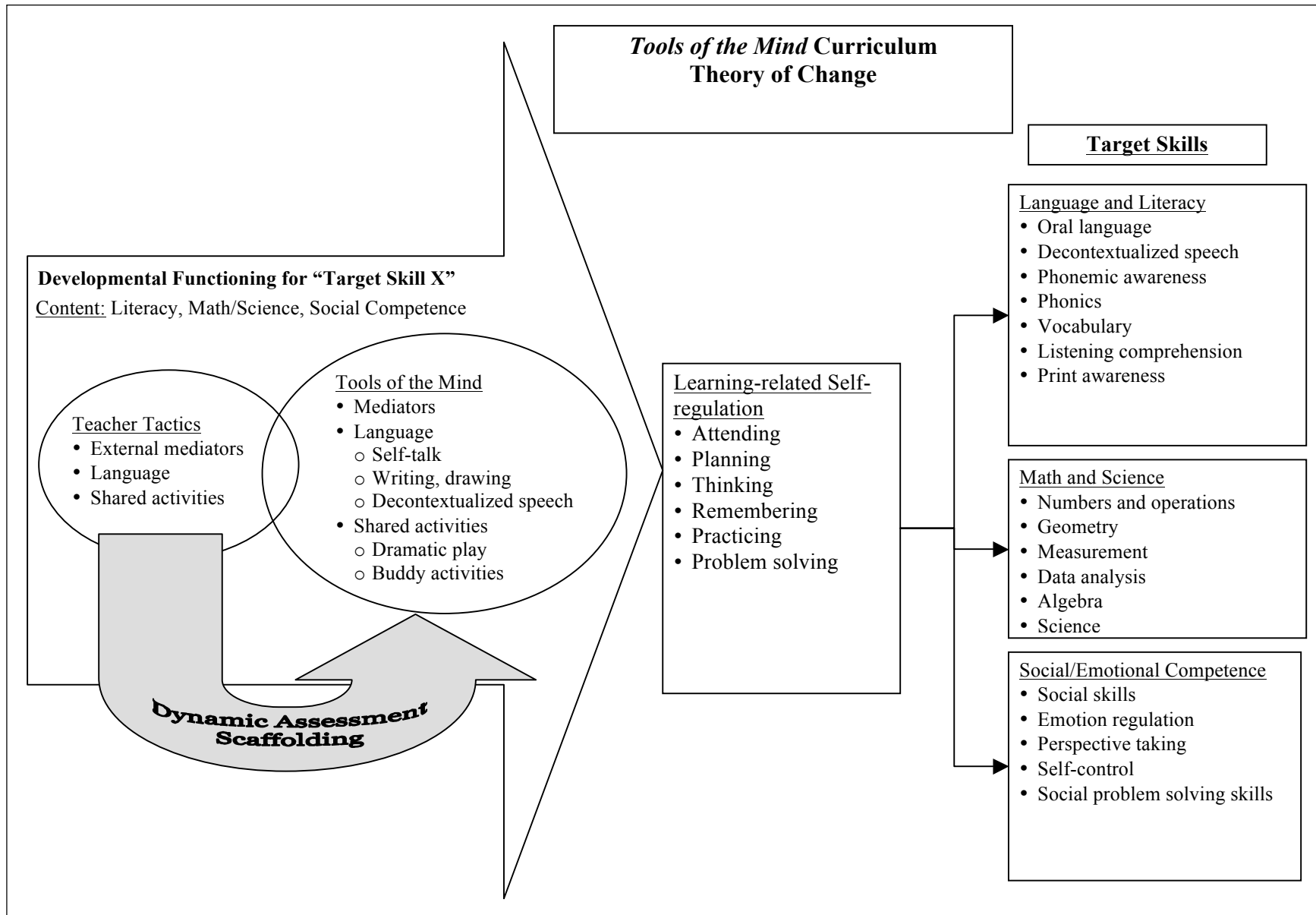
Appendix B. Tables and Figures

Not included in page count.

Variable	Tools		Comparison	
	<i>n</i>	%	<i>n</i>	%
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



Abstract Title Page

Title:

Comparing Skills-Focused and Self-Regulation Focused Preschool Curricula: Impacts on Academic and Self-Regulatory Skills

Authors and Affiliations:

Christopher J. Lonigan, Ph.D. (Presenter)
Department of Psychology & Florida Center for Reading Research
Florida State University
1107 W. Call Street
Tallahassee FL 32306-4301

Beth M. Phillips, Ph.D.
Department of Educational Psychology and Learning Systems &
Florida Center for Reading Research
Florida State University
2010 Levy Ave., Suite 100
Tallahassee FL 32310

Abstract Body

Background:

Accumulating research evidence has highlighted that the developmental sequence of skills important for educational success originates before children begin formal schooling (e.g., Lonigan, Schatschneider, & Westberg, 2008a; Whitehurst & Lonigan, 1998), and an increasing amount of research evidence indicates that significant gaps exist in the development of early language and literacy skills and subsequent educational achievement between children from different socio-economic backgrounds (e.g., Hart & Risley, 1995; Lonigan, Burgess, Anthony, & Barker, 1998). The body of research evidence also has demonstrated the value of early intervention for promoting development of these skills (e.g., Lonigan, Schatschneider, & Westberg, 2008b). Despite evidence that teacher-directed instruction can have significant and meaningful impacts on young children's early literacy and reading skills, it is not uncommon to encounter a philosophy of early childhood education fixed in a vague constructivist, child-directed notion of learning that eschews a focus on specific skill outcomes and teacher-directed learning opportunities (as opposed to teacher-created environments in which a child selects the learning to be done). Teacher-directed instruction and a focus on specific skills quickly earn the pejorative label "developmentally inappropriate" and are deemed harmful to children's development. Objections to providing young children more or more directed early educational experiences are often rooted in concerns that early instruction in academic skills will result in negative consequences, particularly in the domains of children's socio-emotional development and motivation (e.g., Stipek et al., 1998; Stipek, Feiler, Daniels, & Milburn, 1995).

Along these lines, hypotheses concerning why some children fail to develop the skills requisite for taking advantage of regular instruction concern the role of self-regulation or executive functions in learning (e.g., Diamond, 2010; Diamond, Barnett, Thomas, & Munro, 2007). That is, to be effective learners, children are assumed to need to be able to bring their attention to bear on the learning task, to evaluate their own efforts and self-correct. These skills are assumed to play a role both in children's ability to take advantage of instruction and also in their ability to control their behavior in the classroom in adaptive and productive ways. Research has shown that children's self-regulation is related to their academic achievement--both in preschool and early elementary school grades (e.g., Blair & Razza, 2007; Duncan et al., 2007; McClelland et al., 2006; Monette, Bigras, & Guay, 2011). Such associations between children's self-regulation and academic outcomes have resulted in calls for early instruction to focus on promoting children's self-regulation skills instead of (or in addition to) promoting early academic skills (e.g., Diamond, 2010). To date, however, there have been few studies that have directed examined the relative benefits of skills- versus self-regulation-focused preschool curricula.

Purpose & Research Question:

The primary goal of this study was to evaluate the relative effectiveness of a skills-focused preschool curriculum versus a curriculum designed to foster children's self-regulation skills. Additionally, the study was designed to evaluate if adding a self-regulation component to a skills-based curriculum would enhance children's outcomes in academic skills, self-regulation skills, or both. Through manipulation of curricula used by classrooms, the study tested the value of providing preschool children at risk of academic difficulties with explicit practice in self-regulation skills over and above the impacts of language and literacy interventions on their own.

Setting:

This study was conducted in public preschool programs--school district pre-k and Head Start programs--in New Mexico and Massachusetts.

Population / Participants / Subjects:

The complete sample (i.e., children assessed at both fall testing and posttesting) included 2,564 children who ranged in age from 28 to 73 months of age (mean age = 52.7 months; SD = 6.37) at the time of fall testing. There were slightly more boys (55%) than girls in the sample. On children for whom ethnicity data were available (75% of sample), the majority was Latino (52%) and 38% were white non-Latino. Approximately 25% of the sample were receiving some type of special education services and had an Individualized Education Plan. At the time of fall testing, children scored in the low-average range (i.e., standard scores of 87 - 93) on standardized tests of oral language and reading-related skills (i.e., phonological awareness, print knowledge).

Intervention / Program / Practice:

The instructional activities of classrooms/centers in the study were governed by one of four curriculum conditions:

- *Literacy Express Comprehensive Preschool Curriculum* (LECPC; Lonigan, Clancy-Menchetti, Phillips, McDowell, & Farver, 2005). LECPC is a comprehensive curriculum that is structured around 10 thematic units lasting from 3- to 5-weeks each. The core of the curriculum involves three types of small-group activities that were developed, tested, and shown to produce significant gains in preschool children's emergent literacy skills (Lonigan, 2004), including oral language, phonological awareness, and print knowledge. Children are to be exposed to each of these small-group activities nearly every day throughout the school year. Each small-group activity is designed to last about 10- to 15-minutes. The rest of the day is structured by the teacher who selects from multiple examples of large-group activities.
- *Tools of the Mind* (TOM; Leong & Hensen, 2005). The TOM curriculum was developed so that practices designed to help children develop cognitive, behavioral, and emotional self-regulation skills were explicitly embedded within instructional activities. Two activities, play plans and support for play, are the central self-regulation activities in TOM. In the "Free Play/Learning Center Play Plans," children make a written plan that describes which center they are going to play in and what they are doing to do there, the role, and the actions. This activity is intended to promote meta-play (the ability to think about play actions) and the ability to create pretend scenarios using language. At the beginning of the year, the play plans usually consist of a scribble; teachers help children make their drawing of the play a more and more detailed representation of their plan and begin to use "scaffolded writing" to write the plan. During "Center Play Interactions," teachers help children learn to *enact their written play plan*, which serves as a blueprint to get the play in the centers started. Self-regulation is promoted during play itself, and teachers intervene to make sure that children can invent multiple themes, roles, and pretend scenarios that will enable them to stay involved and active in the same center for 40 to 60 minutes at a time.
- *Combined Curriculum* (Combination). A combined curriculum condition included the core LECPC themes, small-group activities, and extension activities as well as the play-planning component of the TOM curriculum. This core curriculum element involved children spending time in supporting writing of a play plan before each day's play at center time and then engaging in role-based imaginative play. Theme-related centers were created in classrooms to support

sustained make-believe play and the associated language and social-emotional aspects of mutually developing play activities with peers. Teachers received professional development regarding to how support the development of more sophisticated and self-regulated play by the children.

- *Business as Usual* (BAU). BAU curricula represented whatever curriculum was in use by a center/classroom prior to the study. BAU curricula typically included some variation of High Scope or Creative Curriculum.

Research Design:

This study used a cluster-randomized design in which 117 preschool centers (or classrooms in large multi-classroom centers) were randomly assigned to study condition. Preschool classrooms and centers were recruited for the project in New Mexico and Massachusetts in two cohorts. There were 42 centers/classrooms in Massachusetts (12 in Cohort 1) and 75 centers/classrooms in New Mexico (39 in Cohort 1). Prior to assignment to condition, centers/classrooms were matched into groups of four on site characteristics (i.e., district preschool, Head Start center) and results of the prior year's state-wide assessment of reading for the school that children in the pre-k center/classroom would attend the following year. Within each matched group, centers/classrooms were randomized to one of the four curriculum conditions (i.e., LECPC, TOM, Combination, or BAU). To allow investigation of the effects of familiarity with curriculum, each classroom participated in two years of the project, holding the same curriculum group assignment across both years (i.e., two cohorts of children were assessed for each classroom in consecutive years).

Data Collection and Analysis:

Measures. Within each participating classroom, a random sample of children for whom consent was obtained--the majority of children in each classroom--were selected to completed fall assessments and end-of-preschool-year posttests. These children completed the Bracken Basic Concept Scales-Revised (BBCS-R), which measures children's knowledge of in six domains (i.e., colors, letters, counting, size, comparisons, shapes), and the Test of Preschool Early Literacy (Lonigan, Wagner, Torgesen, & Rashotte, 2007), which includes a Definitional Vocabulary subtest, two phonological awareness subtests (Blending, Elision), and a Print Knowledge subtest. In addition to measures of academic outcomes, children's classroom teachers completed the Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia, Espy, & Isquith, 2003), and children were administered the Head-Toes-Knees-Shoulders Task (HTKS; Ponitz, McClelland, Matthews, & Morrison, 2009).

Analyses. These preliminary analyses used multi-level models with preschool center/classroom as a random factor and restricted maximum likelihood estimation to determine the impacts of the different curriculum conditions. In addition to the fixed effects of curriculum condition, state (i.e., Massachusetts, New Mexico) and classroom year of implementation (i.e., first versus second year of curriculum implementation) were included in the models. All models included children's ages, sex, and fall scores on the outcome measure as covariates. The questions of primary interest for these analyses were the impacts of the three experimental curriculum conditions relative to the control condition--as well as the impact of the TOM curriculum relative to LECPC--on both academic and socio-emotional outcomes. Consequently, these four two-group contrasts within models were examined (i.e., LECPC vs BAU, TOM vs BAU,

Combination vs BAU, LECPC vs TOM). In addition, the interactions between these two-group contrasts within state and classroom year of implementation were examined for each outcome.

Findings / Results:

Academic outcomes. Results for the two-group curriculum contrasts for a selected group of academic outcome measures, in terms of student-level effect sizes, are shown in Table B1. These results reveal a clear advantage of the LECPC and Combination curricula for outcomes measuring code-related aspects of reading-related skills (i.e., print knowledge, phonological awareness). Children in classrooms assigned to the LECPC or Combination conditions outscored children in BAU classrooms on these measures, and the effect was consistent across states and across year of classroom implementation (i.e., the contrast by state and contrast by implementation-year interaction terms were not significant for any comparison). Across outcome measures, children in TOM classrooms did not score higher than children in BAU classrooms; however, there was a trend for children in TOM classrooms to score lower than children in BAU classrooms on measures of phonological awareness, and this negative effect was significant for schools in Massachusetts but not for schools in New Mexico. Similarly, children in TOM classrooms scored below children in BAU classrooms on the TOPEL Print Knowledge subscale in Massachusetts but not in New Mexico. Children in LECPC classrooms also outscored children in TOM classrooms on measures of print knowledge and phonological awareness, and they also scored higher than children in TOM classrooms on the single-word vocabulary measure.

Socio-emotional outcomes. Results for the two-group curriculum contrasts for a selected group of socio-emotional outcome measures, in terms of student-level effect sizes, are shown in Table B2. None of the two-group contrasts were significant for any of the socio-emotional outcomes, indicating that there was no general advantage of any curriculum on children's self-regulation. The TOM versus BAU contrast, however, was modified by a contrast-by-year-of-implementation interaction. Follow-up analyses revealed that although the contrast between TOM and BAU conditions was not statistically significant in either year of implementation, it changed direction from one year to the next, and for some outcome measures, it was marginally significant in one year (although the year and direction for these marginally significant effects were not consistent).

Conclusions:

The results of this study fail to support the effectiveness of the TOM curriculum for either children's self-regulation skills or their academic skills. In contrast, both variations of the skills-based LECPC curriculum produced positive outcomes on children's academic skills with no concomitant negative impact on children's self-regulation. The addition of a core self-regulatory aspect of the TOM curriculum (i.e., play planning) to LECPC appeared to have little impact. Overall, these results suggest that greater caution is warranted in statements of the promise of self-regulation as a primary mechanism for improving children's academic outcomes. This study provides no support for concerns that skills-focused curricula will have a negative impact on children's socio-emotional skills. Of course, implementation of all curricula was variable across teachers. It may be that full-dosage levels of TOM would produce different results; however, the results of this study likely approximate the upper-end of the level of support for implementation in typical educational settings and therefore represent the likely effects of these curriculum variations.

Appendices

Appendix A. References

- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*, 647-663.
- Diamond, A. (2010). The evidence base for improving school outcomes by addressing the whole children and address skills and attitudes, not just content. *Early Education and Development, 21*, 780-793.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*, 1387-1388.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani, L. S., et al. (2007). School readiness and later achievement. *Developmental Psychology, 43*, 1428-1446.
- Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *Behavior Rating Inventory of Executive Function - Preschool Version*. Odessa, FL: Psychological Assessment Resources.
- Leong, D. J., & Hensen, R. (2005). *Tools of the mind preschool curriculum research project manual* (2nd ed.). Denver, CO: Center for Improving Early Learning, Metropolitan State College of Denver.
- Lonigan, C. J. (2004, August). *Evaluation of Components of a Pre-Literacy Intervention with Children At-Risk*. Paper presented at the Annual Convention of the American Psychological Association. Honolulu HI.
- Lonigan, C. J., Clancy-Menchetti, J., Phillips, B. M., McDowell, K., & Farver, J. M. (2005). *Literacy Express: A Preschool Curriculum*. Tallahassee, FL: Literacy Express.
- Lonigan, C. J., Schatschneider, C., & Westberg, L. (2008a). Identification of children's skills and abilities linked to later outcomes in reading, writing, and spelling. In *Developing Early Literacy: Report of the National Early Literacy Panel* (pp. 55-106). Washington, DC: National Institute for Literacy.
- Lonigan, C. J., Schatschnieder, C., & Westberg, L. (2008b). Impact of code-focused interventions on young children's early literacy skills. In *Developing Early Literacy:*

- Report of the National Early Literacy Panel* (pp. 107-151). Washington, DC: National Institute for Literacy.
- Lonigan, C. J., Wagner, R. K., Torgesen, J. K., & Rashotte, C. (2007). *Test of Preschool Early Literacy*. Austin, TX: ProEd.
- McClelland, M. M., Cameron, C. E., Connor, C. M., Farris, C. L., Jewkes, A. M., & Morrison, F. J. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology, 43*, 947-59.
- Monette, S., Bigras, M., & Guay, M. (2011). The role of the executive functions in school achievement at the end of Grade 1. *Journal of Experimental Child Psychology, 109*, 158-173.
- Ponitz, C. C., McClelland, M. M., Matthews, J.S., & Morrison, F. J. (2009). A structured observation of behavioral self-regulation and its contribution to kindergarten outcomes. *Developmental Psychology, 45*, 605-619.
- Stipek, D. J., Feiler, R., Byler, P., Ryan, R., Milbuiw, S., & Salmon, J. M. (1998). Good beginnings: What difference does the program make in preparing young children for school? *Journal of Applied Developmental Psychology, 19*, 41-66.
- Stipek, D., Feiler, R., Daniels, D., & Milburn, S. (1995). Effects of different instructional approaches on young children's achievement and motivation. *Child Development, 66*, 209-223.
- Whitehurst, G. J. & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*, 848-872.

Appendix B. Tables and Figures

Table B1

Student-Level Effect Sizes (adjusted for covariates) for Two-Group Curriculum Contrasts on Academic Outcome Measures at End of Preschool

Outcome Measures	Two-Group Contrasts			
	LECPC vs BAU	TOM vs BAU	Combination vs BAU	LECPC vs TOM
TOPEL Definitional Vocabulary				
Single-Word Vocabulary	.09	-.04	.07	.13
Definitions	.01	-.03	.08	.05
TOPEL Print Knowledge	.17	-.07	.11	.24
TOPEL Phonological Awareness				
Elision scale	-.02	-.10	.13	.08
Blending scale	.16	-.14	.25	.30
Bracken Basic Concepts Scales				
School Readiness Total	.06	-.05	.08	.11
Letters Subscale	.17	-.06	.17	.23

Note. Effect sizes shown in bold significant or marginally significant at $p < .10$.

Table B2

Student-Level Effect Sizes (adjusted for covariates) for Two-Group Curriculum Contrasts on Socio-Emotional Outcome Measures at End of Preschool

Outcome Measures	Two-Group Contrasts			
	LECPC vs BAU	TOM vs BAU	Combination vs BAU	LECPC vs TOM
BRIEF-P				
Global Executive Composite	-.02	.00	-.02	-.01
Inhibitory Self Control Scale	.00	-.02	-.01	.02
Flexibility Scale	.01	.03	-.03	-.02
Emergent Metacognition Scale	-.04	.00	-.03	-.04
Head-Toes-Knees Shoulders	-.12	-.03	-.02	-.09

Note. No effect was significant or marginally significant at $p < .10$.

Abstract Title Page

Title: The efficacy of an intervention synthesizing scaffolding designed to promote self-regulation with an early mathematics curriculum: Effects on executive function

Authors and Affiliations:

Douglas H. Clements, PhD, University at Buffalo (PRESENTER)
University at Buffalo, State University of New York
Department of Learning and Instruction
505 Baldy Hall
Buffalo, NY 14260

Julie Sarama, PhD, University at Buffalo

Fatih Unlu
Associate
Abt Associates Inc.
55 Wheeler St., Cambridge, MA 02138

Carolyn Layzer
Senior Associate
Abt Associates Inc.
55 Wheeler St., Cambridge, MA 02138

Abstract Body

Background / Context:

Early childhood education is replete with debates about the role of content-focused, or "academic" curricula and more global goals and approaches. There is little research on the issue of whether such approaches stand in opposition, competing for time in the early childhood classroom, or whether they can be synergistically combined, each to the benefit of their own as well as the other's goals. We conducted an efficacy trial of one approach to such a synthesis, by evaluating the integration of two empirically-tested interventions, identifying mediators and moderators of effects, with children from low-income families.

Purpose and Research Question:

Our goal is twofold. First, we wished to produce a theoretically-based approach to this synthesis. Child-centered programs have a long history. However, concerns about children's achievement, and the pressure of content-specific standards, have set up a perceived conflict, in which educators believe they are being asked to abandon child-centered approaches, or, at least, to compromise and squeeze in, as one teacher put it, "Literacy on Monday-Wednesday-Friday, math on Tuesday-Thursday, and socioemotional during our shortened play periods." We hope that our approach, *if* shown to be efficacious, will serve as a model that others can use to successfully and *synergistically* combine these strategies so the whole is *more* than the sum of its integrated, not conflicting, parts.

Second, and more importantly, we are producing a rigorous evaluation of the efficacy of this approach. The research is also designed to answer *which components* are responsible for its effects, and *why* these components led to the outcomes. Thus, we are empirically testing our hypotheses, which will provide an evidentiary basis for researchers and practitioners. This report is the first (and only partial) description of our findings.

The two interventions we synthesized are both theoretically and empirically grounded. The NSF-supported *Building Blocks* (BB) project produced a research-based math curriculum that addresses geometric and spatial ideas and skills and quantitative ideas and skills (mathematical building blocks). The approach of BB is finding the math in, and developing math from, children's activity (including children's building blocks). Funded by the NSF and IES, three RCT evaluations have documented BB's positive effects on young children's math achievement (e.g., Clements & Sarama, 2007, 2008). Increasing math proficiency is significant. The role of mathematics in young children's development is often taken by many as important but secondary to academic areas such as language and literacy. Rigorous studies show mathematics to be of primary importance. Using each of six longitudinal data sets, the strongest predictors of later achievement are early *math* skills, followed by reading skills and then attention (Duncan et al., 2007).

Also documented, albeit not as extensively, are the facilitative effects of scaffolding designed to promote self-regulation (SSR) through make-believe play, an activity at the core of the child-centered approach. Self-regulation is important in facilitating learning and retention, especially for children at risk for later school failure. When explicit content-oriented instruction is mistakenly implemented as (only) teacher-led activities at the expense of engaging children in

activities of their choice, children practice being “teacher-regulated” and are not given an opportunity to develop self-regulated behaviors which affects their ability to later engage in learning behaviors of their own accord. Our belief is that the dichotomy between explicit instruction and child-centered approach is a false one and that it is possible to design a program that would combine an explicit focus on content with equally explicit focus on promoting self-regulatory behaviors. The use of specific pedagogical strategies that optimize make-believe play have been proven successful in improving young children’s self-regulation competencies and academic achievement (e.g., Bodrova & Leong, 2005). Used as a part of a comprehensive preschool curriculum as well as a part of an early literacy intervention, these strategies have been proven successful in improving young children’s self-regulation and academic achievement (Barnett, Yarosz, Thomas, & Hornbeck, 2006; Bodrova & Leong, 2001; Bodrova, Leong, Norford, & Paynter, 2003; Diamond, Barnett, Thomas, & Munro, 2007).

There is empirical support for the notion that curricula designed to improve self-regulation skills and enhance early academic abilities are most effective in helping children succeed in school (e.g., Blair & Razza, 2007). Further, young children's self-regulation scores correlate with both concurrent and future mathematics achievement scores (even more strongly than IQ). However, the evidence of the relationship between self-regulation and math achievement has been collected primarily on older children and using general measures (e.g., executive function measures against math tests). We need research that investigates the foundation of these abilities and analyzes cause and effect relationships among specific components of these abilities.

The research question we address is: What are the immediate effects of the synthesized intervention, as implemented under diverse conditions, on children’s self-regulation?

Thus, we focus on a single outcome domain and then explore factors that may have influenced it, using a three-armed cluster randomized trial and hierarchical linear models (HLM) explained in more detail below. We first analyze whether any of the 3 conditions resulted in a statistically significantly different level of executive function skills and then we will present our empirically-based hypotheses about why such differences might have occurred.

Setting:

The performance site for this study includes 4-year-old classrooms in public preschools and child development centers in three school districts in San Diego County, California.

Population / Participants / Subjects:

Our analytic sample consists of 826 children in 84, 4-year-old classrooms across the three districts. A large proportion of the classrooms are multi-racial/multi-ethnic, with average demographics across the three districts showing Hispanic children being the majority minority at on average 39%, Asian Pacific Islander 18%, African-American 11%, and non-Hispanic White 31%. On average, 27% of the students are English Language Learners (with roughly 20% having Spanish as the primary language).

Intervention / Program / Practice:

The *Scaffolding Self-regulation* approach combines current research on the development of self-regulation and executive function with Lev Vygotsky's cultural-historical theory of child development to design optimal ways to support the development of self-regulation in young children (Bodrova & Leong, 2007a). The defining feature of this approach is its emphasis on promoting mature, intentional dramatic play as the primary social context allowing children to practice self-regulatory behaviors (Bodrova & Leong, 2007b). Scaffolding self-regulation in non-play activities is accomplished by re-designing the social context for these activities as well as by teaching children to use specific "tools" that assist them in taking control over their behaviors (Bodrova & Leong, 2007c).

Several studies indicate that scaffolding that promotes self-regulation improves mathematics learning. Indeed, in one sample of classrooms using strategies for SSR children did better on math tests without changes in the content of math curriculum (curriculum was focused on literacy and self-regulation) compared to High Scope classrooms (Barnett et al., 2006). We implemented a theoretically-grounded synthesis of the Building Blocks preschool mathematics curriculum (BB) and SSR as the main intervention of interest.

Research Design:

The proposed paper utilizes a three-armed cluster randomized control trial in which classrooms in study schools were randomly assigned to the three study conditions. Random assignment was conducted separately for schools/centers with only one participating classroom (group A) and those with two classrooms (group B). Schools/classrooms in group A were placed into five randomization blocks such that each block consisted of all half-day or full-day PreK classrooms in a given study district.¹ Within each block, schools were then sorted with respect to prior math achievement, % free/reduced price lunch eligible, and %ELL. Schools were randomly assigned to the three conditions three at a time starting at a randomly chosen point in the sorted list and then moving to the top of the list. This is an application of the systematic circular sampling scheme (Lahiri, 1951), which was utilized to ensure three experimental groups that are balanced geographically and in terms of the length of the PreK program and key background characteristics of the schools/centers. For group B schools, random assignment was conducted within each school, where the two conditions classrooms were assigned were determined randomly.

Data Collection and Analysis:

Collection of data in second year of intervention used four measures—the HTKS (Ponitz, McClelland et al., 2009; measures inhibitory control and working memory), Pencil Tap (e.g., Diamond & Taylor, 1996; measures inhibitory control), Forward & Backward Digit Span

¹ The five randomization blocks are: San Diego full-day classrooms, San Diego half-day classrooms, Poway full-day classrooms, Poway half-day classrooms, and South Bay full-day classrooms.

(Wechsler, 1986; Gathercole & Pickering, 2000; measure general attention and verbal working memory, respectively).

For the two fall 2010 (baseline) measures and four spring 2011 (post-test) measures, we conducted three pair-wise comparisons between the three groups (BB vs. Control, BBSR vs. Control, and BB vs. BBSR) as well as a joint test of the statistical difference of the measures across the three groups. The BB vs. Control and BBSR vs. Control differences are referred to as the impact of the BB and BBSR conditions, respectively while the BB vs. BBSR difference is used to assess the effectiveness of the self regulation portion of the synthesized intervention. These pair-wise differences were estimated using a pooled two-level HLM (level 1: students and level 2: classrooms or teachers) that takes into account the clustering of students within teachers/classrooms. The HLM specification included two indicator variables for the BB and BBSR groups (control group being the reference group) as the primary predictors and covariates such as age and baseline measure of the outcome when post-test measures are analyzed. The model also included indicator variables (fixed effects) for the randomization blocks. Following Raudenbush, Spybrook, and Martinez (2007) and Schochet (2008), we modeled these blocks as fixed because we will not be seeking to generalize the study results beyond our sample. Finally, the joint significance test across the three groups is conducted using the estimated pair-wise differences and a t-test.

Findings / Results:

Results of the analyses described above are presented in Exhibit 1 for the two baseline measures and in Exhibit 2 for the four post-test measures. These exhibits include the mean scores in each group (regression adjusted for BB and BBSR and unadjusted for Control, representing the true counterfactual); estimated pair-wise differences or impacts in the original unit of the measures as well as in effect sizes that were calculated using the standard deviation of each measure in Control group; and p-values of the pair-wise differences and the joint significance test. Comparing the group means in Exhibits 1 and 2 suggest that the pencil tapping and HTKS scores increased between fall and spring measurements. Exhibit 1 shows that while none of the estimated pair-wise differences between the study conditions on the pencil tapping score were statistically significant at the usual $p=0.05$ level, the BB vs. Control and BB vs. BBSR differences on the HTKS score were statistically significant and somewhat sizeable (0.24 and 0.34 standard deviations, respectively). Exhibit 2 indicates that all but one of post-program differences analyzed for the four measures were small statistically insignificant. Only the BB vs. Control difference for the backward digit score exceeded 0.2 of a standard deviation, but its p-value was 0.14.

Conclusions:

Adding the SR component to the BB curriculum did not produce the hypothesized impact on children's executive function skills. On the contrary, there is a *very slight* probability that the BB curriculum by itself may have enhanced children's verbal working memory skills. The paper discusses possible explanations for the failure of the synthesized approach to engender development of self-regulation skills.

Appendices

Appendix A. References

- Barnett, W. S., Yarosz, D. J., Thomas, J., & Hornbeck, A. (2006). *Educational effectiveness of a Vygotskian approach to preschool education: A randomized trial*: National Institute of Early Education Research.
- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*, 647-663.
- Bodrova, E., & Leong, D. J. (2001). *The tools of the mind: A case study of implementing the Vygotskian approach in American early childhood and primary classrooms*. Geneva, Switzerland: International Bureau of Education.
- Bodrova, E., & Leong, D. J. (2005). Self-Regulation as a key to school readiness: How can early childhood teachers promote this critical competency? In M. Zaslow & I. Martinez-Beck (Eds.), *Critical issues in early childhood professional development*. Baltimore, MD: Brookes Publishing.
- Bodrova, E., & Leong, D. J. (2007a). Developing self-regulation: The Vygotskian view. *Academic Exchange Quarterly, 10*(4), 33-37.
- Bodrova, E., & Leong, D. J. (2007b). Play and early literacy: A Vygotskian approach. In K. A. Roskos & J. F. Christie (Eds.), *Play and literacy in early childhood (2nd ed)* (pp. 185-200). Mahwah, NJ: Lawrence Erlbaum Associates.
- Bodrova, E., & Leong, D. J. (2007c). *Tools of the mind: The Vygotskian approach to early childhood education (2nd ed.)*. New York: Merrill/Prentice Hall.
- Bodrova, E., Leong, D. J., Norford, J., & Paynter, D. (2003). It only looks like child's play. *Journal of Staff Development, 24*(2), 47-51.
- Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the *Building Blocks* project. *Journal for Research in Mathematics Education, 38*, 136-163.
- Clements, D. H., & Sarama, J. (2008). Experimental evaluation of the effects of a research-based preschool mathematics curriculum. *American Educational Research Journal, 45*, 443-494.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science, 318*, 1387-1388.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., . . . Japel, C. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428-1446.
- Raudenbush, S. W., Martinez, A., & Spybrook, J. (2007). Strategies for improving precision in group-randomized experiments. *Educational Evaluation and Policy Analysis, 29*(5), 5-29.
- Schochet, P. Z. (2008). Statistical power for random assignment evaluations of education programs. *Journal of Educational and Behavioral Statistics, 33*(1), 62-87.

Exhibit 1. Results from analyses of Fall 2010 Measures (Pre-test)

Measure	Group Means			Estimated Differences			Effect Sizes of Differences			P-Values for Differences			
	BB (Adjusted)	BBSR (Adjusted)	Control (Unadjusted)	BB vs. Control	BBSR vs. Control	BB vs. BBSR	BB vs. Control	BBSR vs. Control	BB vs. BBSR	BB vs. Control	BBSR vs. Control	BB vs. BBSR	Joint Test
Pencil Score	7.157	6.080	6.251	0.906	-0.171	1.077	0.144	-0.027	0.171	0.266	0.825	0.184	0.370
HTKS Score	12.472	8.270	9.446	3.026	-1.176	4.202	0.244	-0.095	0.339	0.045	0.406	0.005	0.017

Exhibit 2. Results from analyses of Spring 2011 Measures (Post-test)

Measure	Group Means			Estimated Differences			Effect Sizes of Differences			P-Values for Differences			
	BB (Adjusted)	BBSR (Adjusted)	Control (Unadjusted)	BB vs. Control	BBSR vs. Control	BB vs. BBSR	BB vs. Control	BBSR vs. Control	BB vs. BBSR	BB vs. Control	BBSR vs. Control	BB vs. BBSR	Joint Test
Pencil Score	10.157	10.175	9.966	0.190	0.209	-0.019	0.032	0.035	-0.003	0.738	0.701	0.974	0.915
HTKS Score	15.258	16.043	14.707	0.551	1.336	-0.786	0.039	0.094	-0.055	0.704	0.332	0.583	0.619
Forward Digit Score	3.944	3.792	3.736	0.208	0.056	0.155	0.159	0.043	0.118	0.225	0.733	0.372	0.459
Backward Digit Score	0.656	0.408	0.450	0.206	-0.042	0.164	0.205	-0.042	0.163	0.136	0.750	0.233	0.295

Abstract Title Page

Title: Tools of the Mind: Promoting the School Readiness of ELLs

Authors and Affiliations:

Carol Scheffner Hammer, Ph.D.
Department of Communication Sciences and Disorders
Temple University
Philadelphia, PA

Clancy Blair, Ph.D.
Department of Applied Psychology
New York University
New York, NY

Lisa Lopez, Ph.D.
Department of Educational Psychology
University of South Florida
Tampa, FL

Deb Leong, Ph.D.
Metro State College of Denver
Denver, CO

Elena Bedrova, Ph.D.
MCREL
Denver, CO

Abstract Body

Background / Context:

The number of Latino children entering the educational system in the US is increasing at a rate greater than that of non-Hispanic White or African American children (Collins & Ribeiro, 2004). Unfortunately, Latino children are at-risk for poor educational outcomes (August & Hakuta, 1997). Statistics show that Latino children score below non-Hispanic Whites in reading and math in Grades 4, 8, and 12 (NCES, 2007) and are more likely to drop out of high school than non-Hispanic Whites (Federal Interagency Forum on Child and Family Statistics, 2007). Economic disadvantage is one factor that places Latino children at risk (August & Hakuta, 1997; Snow, Burns & Griffin, 1998). Twenty-two percent of Latino families live in poverty (DeNavas-Walt, Proctor & Lee, 2005) and 75% of Latino children possess at least one socio-demographic risk factor when entering kindergarten (NCES, 2007). Having a home language other than English is a second major risk factor (Snow et al., 1998). According to the US Department of Education, 27 percent of children from non-English speaking homes have difficulty speaking English, with the vast majority coming from Spanish-speaking homes (NCES, 2007). Because Latino children begin kindergarten with reading and math abilities that lag behind their non-Hispanic White peers, efforts to address the school readiness of Latino, English Language Learners (ELLs) are greatly needed.

Currently, there is a paucity of preschool interventions that have been shown to support the early developmental outcomes of children learning two languages. This research is designed to meet this need through a longitudinal, randomized controlled trial of *Tools of the Mind* (Tools, Bodrova & Leong, 2007), that explicitly focuses on the development of ELL children's oral language, and self-regulation in order to promote school readiness and build foundational skills in literacy, mathematics, and social-emotional competencies.

Purpose / Objective / Research Question / Focus of Study:

The purpose of this research is to examine the efficacy of Tools of the Mind. Specifically, the aims of the research are to:

- 1) Evaluate the short- and long-term outcomes of *Tools of the Mind*, designed to promote school readiness for Latino preschoolers who are English Language Learners and at risk for later school difficulties.
- 2) Examine the impact of *Tools of the Mind* on teachers' usage of key teaching strategies' for promoting ELLs' school readiness outcomes.
- 3) Test a meditational model that investigates the impact of teachers' usage of the key teaching strategies specified in Aim 2 on children's school readiness outcomes.

This presentation will share information about the design of the study and initial data on children's teachers, as child data collection is currently underway.

Setting:

Sixty preschool classrooms in large urban areas in New York and in Florida are participating in the project. The classrooms are part of Head Start and school district programs that serve children from low-SES families. Participating classrooms include between 20% and 80% ELLs.

Population / Participants / Subjects:

Teachers & Assistants: Sixty preschool teachers and their assistants are participating in the project. Sixteen percent of the teachers have an associate's degree, 42% have a bachelor's degree and 31% have a master's degree, with the remaining 11% having a CDA or high school degree. Thirty-eight percent are Latino/a, 19% are African American and 43% are White. Thirty-five percent of the teachers speak Spanish.

With regard to the classroom assistants, 69% have a high school degree, 14% have an associate's degree, and 16% have a bachelor's degree. Over half are Latino/a, with 31% being African American and 18% being White. Over half (53%) of the assistants speak Spanish.

Children: Currently, 7 Latino children from each classroom are being enrolled in the study for a total of 420 children who are Spanish-English ELLs. To participate, the children must be typically developing, have no parent/teacher concerns about their development, and come from homes in which Spanish is the predominant language.

Intervention / Program / Practice:

Tools of the Mind is grounded in a Vygotskian theory of development through which teachers scaffold children's learning, primarily by fostering children's self-regulation and language development. Within the program, language is seen as the primary mental tool through which children interact with the world. As such, language development is an aspect of development that when appropriately scaffolded, provides the foundation for the development of higher order thinking skills that underlie self-regulated behavior, social-emotional competence and ultimately school readiness (Bodrova & Leong, 2007).

This project is in its second year. During the first year, teachers and their assistants were trained to implement Tools of the Mind. Specifically, they received 4 days of inservice training (2 days prior to the start of school, 1 day in Oct, 1 day in January and 1 day in March). Throughout the year, teachers received coaching two times a month. During the training and coaching sessions, teachers received information about how to support ELLs' language and literacy development in both English and Spanish as they implemented Tools of the Mind.

In the second year (which is the current year), teachers and their classrooms assistants will receive another 4 days of training on implementing Tools of the Mind. The training builds on the training that they received in their first year. Teachers will also continue to receive coaching

Research Design:

Participating classrooms were randomly assigned to either the control or intervention conditions, taking into account characteristics of the classrooms, teachers, and children. Characteristics of interest included: class size, percentage of ELL children, language(s) spoken by the teachers, teacher race, teacher education, years of experience, and CLASS scores.

Data Collection and Analysis:

In the first year of the study, when the intervention teachers were learning to implement Tools of the Mind and no child data were collected, classroom observations were conducted in the fall using the Language Interaction Snapshot (LISn; Mathematica, 2007) and the ELLCO-Extension (Castro, 2008). The LISn captures the language(s) spoken between children, teachers, and classroom assistants, as well as the language quality and amount of talk that occurred in the classroom. The ELLCO-extension is used to rate the quality with which teachers use strategies that are supportive of ELLs' language and literacy development (e.g., using children's knowledge of their first language to support the acquisition of the second language). Also, the teachers and assistants completed a questionnaire that captured their beliefs about ELLs' language and literacy development and reported instructional practices when working with ELLs. In addition, fidelity of implementation was measured in the spring using a measure created by Farran, Bodrova and Leong.

In the second year of the study, classroom observations will be conducted in the fall and spring using the CLASS, LISn and ELLCO Extension. Also, the teachers will complete the questionnaire about their beliefs and practices related to ELLs. Fidelity of implementation will be formally assessed by independent raters in the fall and spring. In addition, children's language, self-regulation, literacy, math, and social emotional development will be assessed through direct child assessments and teacher questionnaires. Children's language, self-regulation literacy and math abilities will be assessed in both Spanish and English. The assessments will occur in the fall and spring of the children's preschool year with a shorter mid-year assessment of children's language abilities being conducted. See the appendix for a list of the assessments given. Follow up testing will occur at the end of kindergarten and first grade.

Findings / Results / Conclusions:

Analysis of the initial data is underway. In this presentation, we will present the theoretical foundation of the project, the research design, and initial classroom data. Specifically, we will present data from the CLASS, LISn, ELLCO-Extension and the teacher questionnaire for the intervention and control classrooms. Challenges for conducting research in classrooms that serve ELLs will be discussed. Also, next steps in the study will be presented.

Appendices

Appendix A. References

- August, D., & Hakuta, K. (Eds.). (1997). *Improving schooling for language-minority children: A research agenda*. National Research Council and Institute of Medicine. Washington, DC: National Academy Press.
- Bodrova, E., & Leong, D. J. (2007c). *Tools of the mind: The Vygotskian approach to early childhood education* (2nd ed.). New York: Merrill/Prentice Hall.
- Collins, R., & Ribeiro, R. (2004). Toward an early care and education agenda for Hispanic children. *Early Childhood Research and Practice*, 6..
- DeNavas-Walt, C., Proctor, D., & Lee, C. (2005). Income, poverty, and health insurance coverage in the United States: 2004. Washington, DC: U.S. Government Printing Office.
- Federal Interagency Forum on Child and Family Statistics (2007). *America's children: Key national indicators of well-being*. Washington, DC: U.S. Government Printing Office.
- NCES (2007). *The condition of education*. Washington, DC: US Government Printing Office.
- Snow, C. E., Burns, M.S., Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Appendix B. Preschool Assessment Battery

Developmental Area/Assessment	Language		PreK		
	English	Spanish			
Oral Language			Fall	Mid	Spr
Expressive vocabulary Expressive vocabulary of the CELF Preschool 2	X	X	X	X	X
Conceptual vocabulary Expressive One Word Picture Vocabulary Test	Bilingual		X	X	X
Receptive language Sentence Structure of CELF Preschool 2	X	X	X	X	X
Narrative/Expressive Language Abilities Story Retell – Narrative Language Samples	X	X	X		X
Phonological Awareness CELF Preschool 2 Phonological awareness subtest (raw scores only) Use CTOPP in K & 1st	X	X	X		X
Self-regulation					
Executive function Fish Flanker, Dimensional Change Card Sort Working Memory	X	X	X		X
Effortful control Children’s Behavior Questionnaire		X	X		X
Emotion regulation Emotion Regulation Checklist		X	X		X
Reading					
Letter-Word Knowledge WJ/Batería III Letter-Word ID	X	X	X		X
Math					
WJ/Batería III Applied Problems	X	X	X		X
Social-Emotional					
Teacher Observation of Classroom Adaptation		X	X		X
Social Competence Scale		X	X		X
Preschool Learning Behaviors Scale		X	X		X
Penn interactive Peer Play Scale		X	X		X