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Efficacy of the *TELL* language and literacy curriculum for preschoolers with developmental speech and/or language impairment☆

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ABSTRACT

The purpose of this investigation was to examine the efficacy of a new preschool oral language and early literacy curriculum package (*Teaching Early Literacy and Language* [*TELL*]) for children with developmental speech and/or language impairment (DSLI) either as a primary (e.g., specific to speech and/or language) or secondary impairment (e.g., developmental delay that includes DSLI). Participants included 118 children (30 females, 88 males, *M* age = 53.58 months) with DLSI and their 29 preschool teachers. The design was a randomized controlled trial (RCT) with assignment to experimental versus contrast conditions at the classroom level. Teachers in *TELL* classes received formal training, in-class support, and mentoring to implement the curriculum. Dependent measures for the children included scores on the *Clinical Evaluation of Language Fundamentals-Preschool 2nd* edition (*CELF-P2*), the *Phonological Awareness Literacy Screening for Preschool* (*PALS-PreK*), the *Renfrew Bus Story* (*BUS*), and a receptive and expressive vocabulary measure developed for this investigation (VOCAB). Results indicated that when compared to the contrast group, children in the *TELL* condition demonstrated greater gains on the phonological awareness subtest of the *CELF-P2*, the sentence length score of the *BUS*, the letter sounds, beginning sound awareness, and rhyme awareness subtests of the *PALS-PreK*, and *VOCAB*. Results suggest that the *TELL* curriculum package has promise for promoting gains in early literacy and oral language skills in preschool children with DLSI.

Thirteen percent of 4- and 5-year olds in U.S. preschools receive special education services (United States Department of Education, 2007). Of these, 82% demonstrate developmental speech and/or language impairment (DSLI), either as a primary diagnosis (i.e., no impairments other than speech and/or language), or as a condition secondary to another primary diagnosis (e.g., developmental delay, mental retardation). Children with speech impairments have difficulty with articulation (e.g., substituting one sound for another, as in "thay" instead of "say") and may demonstrate phonological pattern errors (e.g., omitting final consonants). Children with language impairment demonstrate atypical development of language form (e.g., phonology, morphology, grammar), content (e.g., semantics, vocabulary), or use of oral language.

Oral language and literacy development are highly correlated in young children (Boudreau & Hedberg, 1999; Dickinson & Tabors, 1991; Lonigan, Burgess, & Anthony, 2000) and DSLI significantly increases risk for poor reading outcomes (e.g., Larney, 2002; Schuele, 2004; Sices, Taylor, Freebairn, Hansen, & Lewis, 2007). As a result, effective early childhood programs are needed to promote oral language and literacy development (National Early Literacy Panel [NELP], 2008), particularly in at-risk children (Justice, Chow, Capellini, Flanigan, & Colton, 2003). The purpose of this study was to evaluate the efficacy of a curriculum designed to improve the oral language and literacy development of preschoolers with DSLI. The curriculum is entitled "Teaching Early Literacy and Language" and will be referred to as *TELL*. As an efficacy study, the goal of this research was to demonstrate the causal impact of the *TELL* curriculum when the implementation was controlled by researchers.

1. Foundations of conventional literacy development: oral language and code-related skills

Conventional literacy skills refer to those essential for all literacy activities including decoding, reading comprehension, oral

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reading fluency, writing, and spelling (NELP, 2008). The foundations of conventional literacy are developed during the preschool years and include oral language and code-related skills defined as skills with a specific focus on understanding the alphabetic code. Components of *oral language* that provide an important foundation for conventional literacy include semantic (e.g., receptive and expressive vocabulary), syntactic (e.g., grammar and syntax), narrative discourse (e.g., story retelling), and conceptual knowledge (e.g., background information). *Code-focused* skills serving as a foundation for conventional literacy development include concepts of print (e.g., directionality), beginning writing (e.g., name writing), grapheme knowledge (e.g., letter names), grapheme–phoneme correspondence (sounds made by each letter), and phonological awareness (e.g., combining sounds to form a word, matching words with the same initial sound). Collectively, these code-focused skills have been referred to as emergent, precursor, or early literacy skills (e.g., NELP, 2008). In the present article, the term '*early literacy skills*' refers to these code-focused skills.

Research indicates that oral language and early literacy skills in preschoolers predict decoding ability and reading comprehension in early elementary school (Anderson & Nagy, 1992; Bishop & Adams, 1990; Catts, Fey, Zhang, & Tomblin, 1999; Kendeou, van den Broek, White, & Lynch, 2009; NELP, 2008; NICHD-ECCRN, 2005; Strickland & Shanahan, 2004). For example, in the NELP meta-analysis, preschoolers' concepts about print, phonological awareness, alphabet knowledge, and the ability to write their name were highly correlated with later reading decoding. Recent research supports the NELP findings. Puolakanaho et al. (2008) found that phonological and language processing measures administered to 3–5-year olds predicted reading accuracy at the end of second grade. Kendeou et al. (2009) found that decoding skills (e.g., combining sounds to form a word) in preschool uniquely predicted decoding skills two years later in elementary school.

Some studies indicate that the relationship between oral language and reading comprehension does not emerge until children have learned to decode (Kendeou et al., 2009; Speece, Roth, Cooper, & de la Paz, 1999; Storch & Whitehurst, 2002; Vellutino, Tunmer, Jaccard, & Chen, 2007), but others indicate an earlier association. These differences may be due to the dynamic relationship between oral language and early literacy development. For example, Kendeou et al. (2009) found that preschool oral language predicted preschool decoding (i.e., phonics), but by second grade oral language and decoding independently predicted reading comprehension. Different findings may also be due to frequent use of receptive vocabulary as the only measure of oral language, which may not capture the important relationship between oral language and reading development (Dickinson & Tabors, 1991; Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003). Indeed, NELP (2008) findings showed that measures of more complex language skills (e.g., grammar, listening comprehension, and ability to define words) were stronger predictors of later reading achievement than vocabulary.

Clearly the preschool years are an essential time for children to acquire skills that are important for the development of conventional literacy skills. The presence of DSLI poses a significant risk factor for later literacy difficulties and for reading failure (e.g., Hammer, Farkas, & Maczuga, 2010; Johnson, Beitchman, & Brownlie, 2010; Schuele, 2004; Schuele & Boudreau, 2008; Sices et al., 2007), and children who enter kindergarten with oral language and early literacy skill deficits are at high risk for reading failure (e.g., Missall, McConnell, & Cadigan, 2006; Scarborough, 2002; Torgesen, 2002). Both speech and language impairment are associated with problems learning to read (Aram & Hall, 1989; Bashir & Scavuzzo, 1992; Bird, Bishop, & Freeman, 1995; Bishop & Adams, 1990; Lewis, Freebairn, & Taylor, 2000; Nathan, Stackhouse, Goulandris, & Snowling, 2004; Rvachew & Grawburg, 2006; Schuele, 2004). Further, preschoolers with language impairment demonstrate persistently depressed academic achievement, greater grade retention, and lower rates of post-secondary school attendance than their peers with typical development (Aram & Nation, 1980; Catts, Fey, Tomblin, & Zhang, 2002; Hall & Tomblin, 1978). Given these risk factors, it is important to address the oral language and early literacy skills of children with DSLI during the preschool years and to increase their ability to benefit from reading and writing instruction in elementary school.

1.1. Oral language and early literacy interventions and curricula

Oral language and early literacy *interventions* typically target one specific skill (e.g., vocabulary, identification of beginning sounds in a word) or small set of skills (e.g., inferential language, print concepts, letter sounds and identification) over a relatively short period of time (e.g., weeks). This is in contrast to *curricula* that include a scope and sequence of instruction intended to teach multiple skills over an extended time period (e.g., school year). More empirical evidence is available for interventions for children with typical development, or those who are at-risk due to poverty, than for children with DSLI.

The NELP (2008) report included meta-analyses of code-focused, shared-reading, and language-enhancement interventions. Reviewed *code-focused* interventions were designed to teach children how to crack the alphabetic code and typically targeted phonological awareness skills (e.g., beginning sounds of words, combining sounds to form words, counting syllables), although some interventions also targeted alphabet knowledge (letter names and sounds) as well as print concepts (e.g., print directionality, identification of book title and author). *Shared reading* interventions focused on the interaction between the reader and child and included various strategies to engage the child actively in the storytelling (e.g., defining vocabulary, identifying components of a book, predicting what might occur next). Some of the interventions used a dialogic reading protocol (e.g., Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; Wasik & Bond, 2001; Whitehurst et al., 1988) and others engaged children through planned questions and comments during the interactions. Language enhancement interventions all included instructional strategies intended to promote some aspect of children's oral language (e.g., vocabulary, grammar, receptive and/or expressive language skills).

Results of the NELP meta-analyses indicated that code-focused instructional strategies were highly successful in promoting children's gains in phonological awareness, alphabet knowledge, and print concepts. The shared-reading interventions consistently demonstrated positive effects on children's oral language skills and print concepts. The language enhancement interventions, as might be expected, were associated with significant gains in the children's language. It was also noted that the successful interventions were typically conducted as individual (i.e., one-on-one) or small-group instructional activities.

Oral language interventions for children with DSLI. Research focused specifically on young children with DSLI has resulted in a substantive empirical literature that delineates effective oral language interventions (for a review see Fey, 1986; Leonard, 1998, or Paul, 2007). The vast majority of intervention strategies for young children with DSLI are consistent with both social constructivist (Vygotsky, 1997) and transactional (e.g., Sameroff & Fiese, 2000) theories of learning and development. The adult–child interaction typically serves as the intervention context, with the adult responding to a child's attentional lead by providing language input that highlights the desired linguistic target. As children make progress, the adult linguistic input is scaffolded to promote children's acquisition of more complex language behavior. Within this framework interactive language teaching practices for preschool-

ers with DSLI are conceptualized as those that (a) *support* language acquisition and use, or (b) *enable* children to expand their linguistic repertoires and learn new words, grammatical structures, and grammatical morphemes. *Supportive* strategies include such things as responding to children's communication attempts, engaging a child, allowing sufficient time for a child to respond, encouraging peer interactions, and providing natural opportunities for language use. *Enabling* practices are more focused and include, among others, explicit models of linguistic behavior, descriptions, comments, definitions, and use of direct cues and prompts within the context of an ongoing activity. Supportive practices are important to the success of enabling practices, but by themselves are not likely to have a substantive impact on language development in children with DSLI (e.g., Smith, Warren, Yoder, & Feurer, 2004).

Most research evaluating the effectiveness of oral language interventions for preschoolers with DSLI has been conducted with small groups of children or in one-on-one settings; however, some work demonstrates the efficacy of oral language teaching within preschool classrooms. Wilcox, Kouri, and Caswell (1991) found that when preschoolers with DSLI received oral language intervention within a classroom context, they demonstrated better generalization of newly acquired words than children who were served in an individual pull-out model. *In addition*, Schwartz, Carta, and Grant (1996) found that preschoolers with disabilities, including those with DSLI, demonstrated significant language gains in classrooms where their teachers integrated language teaching within ongoing activities and routines.

Early literacy interventions for children with DSLI. Few studies have tested interventions designed to improve code-focused skills in children with DSLI; however, those that have included children with DSLI demonstrated positive effects. Examples of code-focused interventions include teaching children to recognize words that rhyme, letter names, identification of beginning sounds in words, or combining sounds to produce words. Shared storybook reading appears to be a promising context for teaching code-focused skills to children with DSLI. Lovelace and Stewart (2007) conducted a single-subject, multiple baseline design across five participants who were provided scripted teaching during shared book-reading that focused on print concepts (e.g., "show me the front of the book," "show me a letter"). Results indicated that each participant showed 'an immediate, abrupt improvement in their print concepts performance' when treatment was implemented, and performance remained above baseline for the duration of the study. Other studies of code-focused interventions that included children with DSLI demonstrated similar positive effects (e.g., Gillon, 2000; Justice et al., 2003; Justice, McGinty, Piasta, Kaderavek, & Fan, 2010; Katims, 1991; Notari-Syverson & O'Connor, 1996; O'Connor, Jenkins, Leicester, & Slocum, 1993). Collectively these results indicate that phonological awareness, print concepts, and letter knowledge instruction can be effective for children with DSLI and an interactive reading approach, such as dialogic reading, has the potential to increase the code-focused skills of children with DSLI when these skills are targeted during shared book reading.

Oral language and early literacy curricula. In contrast to interventions targeting specific skill sets, preschool curricula are typically delivered over an entire school year. Empirical evidence assessing the efficacy of oral language and early literacy *curricula* is beginning to emerge for children with typical development (e.g., Assel, Landry, Swank, & Gunnewig, 2007; Preschool Curriculum Evaluation Research Consortium [PCER], 2008). Unfortunately, the evidence for children with DSLI is limited at best. The U.S. Department of Education's What Works Clearinghouse (WWC) most recent report (2010) includes the most up-to-date effectiveness data for currently-available preschool curricula. Of the 18 curricula reviewed by the WWC, only *Literacy Express* (Florida Department of Education, 2007) demonstrated *positive* effects for oral language and code-focused skills (i.e., print knowledge and phonological processing). One demonstrated positive effects for phonological processing (*Daisy Quest*), and another demonstrated positive effects for alphabet knowledge (*Success for All*). Several demonstrated *potentially positive* effects in code-related (*Bright Beginnings*, *Sound Foundations*) or oral language skills (*Headsprout Early Reading*, *Doors to Discovery*). Most of this research included preschoolers at-risk for poor literacy development due to poverty, but some research also included children with developmental disabilities (which likely included some children with DSLI). However, none of these studies separated children with and without DSLI in their analyses and the impact of the curriculum for preschoolers with DSLI remains unknown.

Early childhood curricula have the potential to improve the oral language and early literacy skills of children with typical development; however, limited research with children with DSLI constrains the extent to which preschool programs serving children with DSLI are able to select evidence-based oral language and early literacy curricula for this population of children. Although the NELP (2008) report suggested that targeted oral language and early literacy interventions may be equally effective for children with typical development, children at risk due to poverty, and children with DSLI, this finding is tempered by the fact that a reduced number of studies reviewed for the NELP report included children with DSLI. Further, this finding may be restricted to targeted interventions and may not extend to oral language and early literacy curricula. A significant proportion of preschoolers who attend public school, Head Start, and community-based preschools demonstrate DSLI and it is important for early childhood educators to have access to curricula that promote oral language and early literacy growth in all children, including those with DSLI.

1.2. The classroom learning environment

When examining the efficacy of a curriculum, it is important to consider factors in the classroom learning environment that support implementation of a curriculum. This is particularly important for children with DSLI who have failed to acquire age-appropriate language within typical learning contexts and often require extra and intensive support in their learning environments to make progress in acquisition of oral language and code-focused skills. Variables important to the language and early literacy learning context include teachers' abilities to (a) create a literacy- and language-rich environment that supports the curriculum, (b) use evidence-based teaching practices that promote the growth of oral language and code-focused skills, and (c) implement the curriculum with fidelity. Literacy-rich classroom environments support the development of code-focused skills by providing experience with literacy materials including books, writing materials, print, music, and routines that support literacy learning. When children have access to literacy props and when teachers support children's interactions with these materials, there is a corresponding increase in literacy behaviors (Nixon & Topping, 2001; Wayne, DiCarlo, Burts, & Benedict, 2007). For example, Missall et al. (2006) reported that code-focused skill growth in preschoolers with DSLI was correlated with the quality of academic materials present in their preschool classrooms.

Just as literacy-rich environments are important for code-focused skills, a language-rich environment is important for oral language growth, especially for children with DSLI. The quantity and quality of language input received by children is directly related to their language development (e.g., Dickinson & Smith, 1994; Girolametto & Weitzman, 2002; Hart & Risley, 1995). For this reason, preschool teachers must understand the importance of supportive and enabling language teaching practices, how they relate to children's oral language growth, and how to use supports

effectively in their classrooms. However, research indicates that early childhood teachers vary considerably in their ability to provide language support for children (Dickinson & Keebler, 1989; Girolametto, Weitzman, & Greenberg, 2003; Justice, Mashburn, Hamre, & Pianta, 2008; Mahoney & Wheeden, 1999). In fact, the quality of language experienced by many preschoolers is not sufficient to promote language growth (Turnbull, Anthony, Justice, & Bowles, 2009). Many preschool teachers use a predominance of directive language (e.g., Girolametto et al., 2003; Turnbull et al., 2009) that does not extend talk beyond the here and now (Dickinson & Tabors, 1991).

A final aspect of the learning environment that is important to studies of curriculum effectiveness is fidelity of implementation, defined as the degree to which the planned curricular content is delivered with the intended teaching methods and activities. Both quantity and quality are important (Hulleman & Cordray, 2009; Kaderavek & Justice, 2010). Quantity of implementation, often referred to as procedural fidelity, is the degree of adherence to the curriculum scope, sequence, and components that distinguish it from other curricula and is relatively straightforward to quantify. Quality of implementation focuses on a teacher's interaction with their students, their ability to provide a supportive learning context, and their ability to use evidence-based practices (Howes et al., 2008; Justice et al., 2008). Curriculum research indicates that it is easier for teachers to attend to procedural fidelity than to the quality of curriculum delivery, yet it is the quality of delivery that has been found to exert a positive influence on children's outcomes (e.g., Hamre et al., 2010; Odom et al., 2010).

1.3. Purpose and TELL development

The primary purpose of this investigation was to evaluate the efficacy of the *TELL* curriculum that was designed to teach preschool children with DSLI early literacy and oral language skills that predict subsequent reading success. *TELL* is a universal curriculum. That is, *TELL* was designed to meet the needs of (a) preschoolers with a wide variety of developmental characteristics and (b) their teachers who require a broad array of skills to promote oral language and early literacy growth. In addition, *TELL* targets common language goals typically found on the Individual Education Plans (IEPs) of young children with DSLI, because special education teachers and speech-language-pathologists (SLPs) must address these goals in their early childhood classrooms.

Preschool teachers (regular and special education) and SLPs partnered with us in the development of *TELL*. The *TELL* development process included three phases that spanned 15 months. Phase I focused on the conceptualization and initial development of the curriculum, including reviews of research regarding (a) the development of skills that contribute to young children's reading success during formal schooling, and (b) teaching and intervention practices that have been found to result in improvements in children's early literacy and oral language skills for children with typical development and those at-risk, including those with DSLI. During this phase significant input was obtained from preschool classroom teachers and the SLPs. Phase II included "try-outs" in 10 test classes that enrolled children with DSLI and typical development. Phase III consisted of meetings with the preschool teachers and SLPs to discuss what worked, what did not, and what should be deleted or retained and revised, resulting in the *TELL* curriculum that was tested in the present investigation as Phase IV of our development process.

The *TELL* curriculum includes a scope and sequence of instruction, scripted teaching activities, and materials for implementation of oral language and early literacy activities. In addition, we provided professional development for teachers to establish a quality learning environment and fidelity of implementation of *TELL*. The purpose of this study was to determine whether children with DSLI, who were enrolled in *TELL* classes, demonstrated significantly greater gains in targeted early literacy and oral language skills than their peers in contrast classes.

2. Method

2.1. Sample

After securing approval from our institutional IRB and four participating school districts in the Greater Phoenix Metropolitan area, research staff met with preschool teachers in each of the districts to explain the purpose of the research and to request their voluntary participation. Thirty-two teachers volunteered. Distribution of teachers across the four school districts was 5, 5, 3, and 19. The lower numbers of participants were from districts that offered a smaller number of preschool classes (8–12) and the larger numbers of participating teachers were from a district that offered approximately 60 preschool classes. All teachers were paid stipends for their participation, irrespective of their designation as experimental or contrast classes. Experimental teachers were paid higher stipends because they were required to attend professional development classes. Three teachers withdrew from participation during the first three months of the investigation for personal reasons, thus a total of 29 teachers completed the study reported herein.

Teachers/classes were randomly assigned (via lottery) to experimental (*TELL*) or contrast (business as usual) conditions. Our unit of assignment was at the classroom level, stratified by school; to ensure that *TELL* and contrast classes would not be located in the same school building. Of the 29 classes, 18 were located at different schools (one class per school), eight were distributed across four schools (two classes per school), and three were located at one school. Our design was unbalanced purposefully with one third of the classes assigned to the contrast condition ($n = 10$), and two-thirds to the *TELL* condition ($n = 19$). The unbalanced design allowed us to examine the initial efficacy of the curriculum with a larger sample of children with developmental speech and/or language impairment (DSLI) while still retaining a comparison group to determine the promise of the approach. Thirty-eight children with DSLI were enrolled across the 10 contrast classes and 80 children with DSLI across the 19 *TELL* classes.

Teachers and classrooms. Twenty-nine female preschool teachers completed participation in the investigation. All were Caucasian, state certified, and served as the lead teachers for their classes. Table 1 provides demographic information for the teachers by condition.

Twelve to 16 students were enrolled in each class. Class composition included tuition-paying peers with typical development (50–75%) and children with DSLI or other developmental disabilities (25–50%) served through Part B of IDEA. Classes were staffed by the participating lead teachers and one teaching assistant. Occasionally a class had two teaching assistants (depending upon total class size and the complexity of the children's needs). Additional related services were provided by physical and occupational therapists and SLPs, as indicated on children's individualized education plans (IEPs).

Children. All children qualified for IDEA Part B preschool services in Arizona and demonstrated DSLI either as a primary or secondary diagnosis. Their status in terms of DSLI was determined by school district testing and all children demonstrated speech and/or language standard scores that were more than 1.5 *SD* below the mean on a standardized test of speech or language. We developed additional inclusion criteria to ensure that children had sufficient language and cognitive skills to benefit from the *TELL* curriculum and to reflect the typical profile of children with DSLI served in

Table 1
Teacher demographics by condition: means, standard deviations (*SD*), and percent.

Variable	Experimental ($n = 19$)		Contrast ($n = 10$)	
	Mean (*SD*)	%	*Mean* (*SD*)	%
Number of years in teaching profession	9.42 (7.68)		13.80 (6.70)	
Number of years teaching preschool children with disabilities	6.00 (3.80)		11.60 (8.80)	
Education				
Bachelor's degree		31.6		10.0
Master's degree		68.4		90.0
Major				
Elementary education		42.1		20.0
Special education		15.8		20.0
Early childhood education		21.1		30.0
Dual elementary and special education		10.5		–
Early childhood special education		10.5		10.0
Counseling		–		10.0
Missing/response not given		–		10.0

IDEA Part B classes. Criteria included (a) oral motor abilities sufficient for speech production, (b) ability to produce simple sentences (e.g., S + V, S + V + O), and (c) a nonverbal standard score >64 on the Kaufmann Assessment Battery for Children 2nd Edition (K-ABC 2; Kaufman & Kaufman, 2004). Conformance with the first two inclusionary criteria was determined by review of school records supplemented by teacher and SLP reports and direct observation by research staff, which included certified SLPs and teachers with training in early child special education. The K-ABC 2 was administered by research staff. The children's standard scores ranged from 65 to 130 ($M = 93.66$, $SD = 14.90$).

Due to privacy restrictions we did not have information about specific scores or testing instruments that were used for school assessments. However, through review of school records and additional testing that was conducted for the present investigation (e.g., K-ABC; *Clinical Evaluation of Language Fundamentals-Preschool, 2nd* edition [*CELF-P2*]; Wiig, Secord, & Semel, 2004), we determined that that 29 children demonstrated primary impairment in production of speech sounds, 59 demonstrated primary impairment in language, and 30 demonstrated global developmental delay that included speech and/or language impairment.

The number of child participants per class ranged from two to five and included a total of 88 males and 30 females ranging in age from 47 to 64 months ($M = 53.58$, $SD = 3.49$). All children were in their pre-kindergarten year and were expected to enroll in kindergarten the following school year. The children were native English speakers and English was the primary language spoken in their homes. Table 2 includes demographic information by condition for the child participants and their families. There were no significant differences between children in the two conditions with the exception of maternal education, which was higher for children in the *TELL* condition. To control for this difference, our analyses were conducted with maternal education as a covariate (see Section 6).

All children received SLP services through their school districts. Most children received these SLP services during ongoing teaching activities in their classrooms ($n = 105$). The remainder ($n = 13$) were served in a model that included a combination of individual within-class and individual pull-out sessions. In addition, 22 of the children received private SLP services. The duration of children's intervention or participation in special education services prior to the investigation varied; some children had matriculated from the IDEA Part C system and others had been identified at age three as eligible for IDEA Part B services.

2.2. The TELL curriculum package

Teachers assigned to the *TELL* classes were provided with the curriculum package, which included a scope and sequence of instruction, all materials (e.g., books, letters, props, etc.), suggested lesson plans, and professional development to implement the curriculum with high fidelity. The content and implementation, associated *TELL* teaching practices, and professional development procedures are described in the following sections. Electronic supplemental material is also available.

Content and implementation. *TELL* was designed to target six skill sets, including four code-focused skill areas and two oral language skill areas (see Table 3). Code-focused skill sets included phonological awareness, alphabet knowledge, print concepts, and writing. Oral language skills included vocabulary and complex language (i.e., sentence length and complexity). As noted in the introduction, each of these skill sets corresponds to preschool oral language and emergent literacy skills that have been documented as predictors of children's conventional literacy success. The curriculum was designed for preschool classes that vary in frequency (e.g., 4–5 times weekly) and duration (e.g., half day, full day). The classes in the present investigation meet four times weekly with 150 min of instruction scheduled each day.

The *TELL* curriculum is organized as 12 biweekly themes with reviews occurring every fifth week. The review weeks are a key component of *TELL* and permit time for differentiated and extra instruction for children in skill areas identified by progress mea-

Table 2
Child and family demographic variables by group (*TELL* curriculum versus contrast): means, standard deviations (*SD*), and percent.

Variable	*TELL* ($n = 80$)		Contrast ($n = 38$)	
	Mean (*SD*)	%	*Mean* (*SD*)	%
Child chronological age	53.63 (3.45)		53.55 (3.60)	
Kaufman Assessment Battery for Children (KABC)—2nd Edition	94.42 (14.87)		89.97 (13.79)	
Number of children in the family	2.87 (1.64)		2.43 (1.24)	
Child gender				
Male		80.0		65.8
Female		20.0		34.2
Child ethnicity				
White, not Hispanic		66.3		78.9
Hispanic		7.5		5.3
Asian		1.3		–
American Indian		1.3		–
Multiracial/other		17.5		13.2
Missing/response not given		6.3		2.6
Annual household income				
Less than 16,000		–		5.3
16,000–30,000		5.0		23.7
31,000–50,000		22.5		18.4
51,000–75,000		16.3		18.4
75,000–100,000		17.5		10.5
Greater than 100,000		28.8		13.2
Missing/response not given		10.1		10.5
Marital status				
Single		7.5		13.2
Married		76.3		76.3
Divorced		10.0		7.9
Missing/response not given		6.3		2.6
Maternal education				
Less than high school education		5.0		5.3
High school or GED		27.5		50.0
Associate's degree		18.8		15.8
Bachelor's degree		32.5		13.2
Master's degree		8.8		7.9
Ph.D.		1.3		2.6
Missing/response not given		6.3		5.2

Table 3
Curriculum components × learning blocks × targeted skill sets.

Required daily curriculum component	Learning block	Targeted skill set					
		Phonological awareness	Print concepts	Alphabet knowledge	Writing	Vocabulary	Sentence length and complexity
1. [a]ABC warm-up (letter names) followed by a phonological awareness activity	Teacher-Led (small group) Story time (small group) Transition (large group)	X		X			
2. Focus book reading	Story time (small group)		X			X	X
3. Focus book sequence	Story time (small group)						
Picture walk						X	X
Read			X			X	X
Read it again			X			X	X
Story re-tell						X	X
4. Vocabulary sequence (say the word, explain the meaning, give an example, repeat the word)	Circle (large group) *Options*[b]: dramatic play, science, math, art					X	X
5. Table tent cards (script on back)	Snack			X		X	X
6. [c]Fact cards (expository language, theme related)	Circle, story time, snack *Options*: dramatic play, science, math, art						X
7. [c]Social story cards	Circle						X
8. ABC action cards (letter chants)	Circle	X	X	X			
9. Music and movement	Circle	X					X
10. Three meaningful transitions	Variable: moving from one activity to another	X	X	X			X
11. Writing/dictation	Variable		X	X		X	
12. Phonological awareness warm-up (patterns or sounds)	Circle	X					

[a] Required once per week per child, could be implemented daily for different groups of children or once per week with different groups rotating through while the rest of the children were engaged in another activity.
[b] Options for activity blocks varied across teachers, allowing customization of the curriculum to meet their preferences.
[c] Required twice weekly.

sures that were developed to accompany the curriculum. These brief measures, completed in less than 20 min, are criterion-referenced classroom assessments that inform teachers about children's progress in skill areas targeted in *TELL*.

The scope and sequence of *TELL* goals are based on language and early literacy acquisition research (for reviews see NELP, 2008; Neuman & Dickinson, 2002; Stone, Silliman, Ehren, & Apel, 2004) and are consistent with typical state early childhood standards. The *TELL* thematic units promote language and cognitive development that occurs when concepts, vocabulary, and experiences are linked by meaning and context. *TELL* teaching objectives are achieved through use of 12 required components that are structured to promote children's growth in targeted language and early literacy skill areas. The components include a combination of materials (e.g., fact cards, ABC action cards, focus books, table tent cards, and social stories) and structured activities (e.g., focus book sequence, alphabet games, phonological awareness games, writing, meaningful transitions, music and movement). The components are implemented within five required learning blocks representative of typical preschool classes including circle time, story time, snack time, integrated writing, and teacher-led activities. The *TELL* instructional day is organized by the required learning blocks. Table 3 provides a matrix illustrating the relationship between the targeted oral language and early literacy skill sets, the 12 curriculum components, and the primary learning blocks in which the components are implemented. A more detailed description of the curricular components and the learning blocks is included the supplemental electronic material for this article, as Supplement A.

In addition to the required learning blocks described above, teachers had the option of integrating the 12 curriculum components into dramatic play, science, math, art, or outside play activities. To provide a sampling of the scope and sequence of the curriculum during the school year, supplemental electronic material (Supplement B) includes "themes at a glance" covering two weeks of instruction from the beginning of the school year, two weeks in the middle, and two weeks at the end. A sample lesson plan for one of the themes is also included.

Classroom-based teaching practices. As noted in the introduction, research indicates that preschool teachers vary in their use of teaching practices that support and enable children's growth in oral language and early literacy skills. Further, consistent with social constructivist and transactional learning theory, teachers' use of evidence-based oral language and literacy teaching practices are implemented within the context of supportive interactions with their students. To promote the use of effective teaching practices with *TELL*, we identified evidence-based teaching practices, including those known to *support* early literacy and oral language development and those identified as *enabling* acquisition of new skills. Research supporting the efficacy of *TELL* teaching practices includes reports of meta analyses (e.g., NELP, 2008), other evidence-based syntheses in texts and/or articles (e.g., Dunst, Trivette, & Hamby, 2007; Fey, 1986; Fey, Catts, & Larrivee, 1995; Leonard, 1998; Paul, 2007; Schuele & Boudreau, 2008; Warren & Kaiser, 1986), and individual empirical reports that used experimental methods to determine efficacy of interventions and/or teaching practices for specific code-focused or oral language skills, (e.g., Justice, Kaderavek, Fan, Sofka, & Hunt, 2009; Lonigan & Whitehurst, 1998; Treutlein, Zoeller, Roos, & Scholer, 2008; Whitehurst et al., 1988; Wilcox et al., 1991; Wilcox & Murphy, 2003).

Table 4 includes the list of the *TELL* teaching practices. We expected teachers to use supportive practices because they are necessary to establish a high-quality learning context. However, we did not expect the teachers to use practices in the other categories during every classroom session. Indeed, some of the teaching practices were specifically targeted toward later emerging skills and were not expected until the middle of the school year. However, we

Table 4
TELL teaching practices.

General supporting practices (general practices to support language, maximize opportunities for talk, and encourage peer interaction around talk)
1. Slow rate of speech to facilitate processing and comprehension
2. Use gestures/signs, with accompanying speech, to facilitate comprehension
3. Rephrase questions/comments to simplify when not understood by child
4. Engage child prior to proving instructions
5. Interact at the eye level of the child
6. Provide children with a sufficient amount of time to respond to questions and directives (at least 5 s)
7. Provide opportunities for children to direct peers or teachers in an activity
8. Wait for a child to request materials or turns
9. Provide child with verbal options when he/she is not able to answer a direct question
10. Engineer the environment: select or structure activities that require peer interaction
11. Encourage peers to "read" to each other
12. Peer redirect: when child requests adult assistance direct them to ask a peer for help

Explicit language teaching practices (vocabulary and complex language)
1. Use labels for immediately perceptible objects/events
2. Use words to express relational (prepositions, directional) and categorical concepts
3. Define words verbally
4. Give examples of attributes (adjectives)
5. Demonstrate concepts with appropriate words and props
6. Pre-teach new vocabulary words
7. Tie vocabulary words to children's personal experiences
8. Linguistic mapping: note the child's focus on attention, and provide a sentence (i.e., linguistic map) that provides a label or states the meaning associated with the activity; a response is not required
9. Recasting: verbally recast child utterances to model more complex sentences; preserve child's meaning but model different linguistic structure; Expansions: verbally expand child utterances using same syntactic form as child, but more complex
10. Model with explicit prompts (i.e., say___)
11. Conversational prompts and cues to assist child in producing a more complex linguistic form
12. Model a story or sequence verbally and nonverbally

Phonological awareness
1. Explain concept of rhyme (i.e., "rhyming words are words that sound alike or sound the same")
2. Identify rhyming words in context
3. Ask children question about rhyming words (i.e., "Which words rhyme?" "What word rhymes with ___?")
4. Ask children to identify words/objects beginning with an initial sound or letter (i.e., "which one starts with /s/ or 's'"?)
5. Clap syllables in words
6. Segment words by sounds (i.e., "c-a-t, what word is that?")
7. Count syllables in words
8. Ask children to count syllables in words

Print concepts and alphabet knowledge
1. Point to letters/words while reading books
2. Ask children to find letters on page or in the environment
3. Ask children to find words on page or in the environment
4. Ask children where to begin reading on a page
5. Discuss parts of book (cover, spine, author, illustrator)
6. Track print with finger while reading
7. Point out print in the environment
8. Say letter name
9. Say letter sound
10. Ask children letter name
11. Ask children letter sound

Writing
1. Model writing
2. Model letter formation
3. Ask children to form letters on paper, chalkboard, etc.
4. Take dictation during activity
5. Ask children to write names during activities

did expect teachers to master and use at least half of the teaching practices in each group with increasing frequency over the school year.

Professional development. Comprehensive professional development was implemented for teachers assigned to the *TELL* condition to ensure that they could establish and maintain a language and literacy-rich classroom environment and implement the curriculum and key teaching practices with high fidelity. The methods for professional development followed those identified as effective in recent research about professional development (e.g., Domitrovich et al., 2009; Neuman & Cunningham, 2009) and included a combination of 22 h of formal instruction and weekly in-class support provided by mentors. In addition, all teachers met individually with their mentors each week for 30-min outside of class time. The formal training was distributed across the school year as an initial 4-h workshop in May of the school year prior to teachers' participation and nine, 2-h follow-up sessions during the participation year (August through May). In the May session, prior to participation, teachers received the *TELL* curriculum so that they had time over the summer to familiarize themselves with the materials, scope and sequence, and suggested lesson plans. Formal trainings employed both didactic and participatory methods to facilitate learning (e.g., video clips to illustrate specific skills, small group problem-solving, and role-playing to practice new skills). The content sequence of professional development activities was as follows:

1. The learning environment and strategies to establish or enhance a quality oral language and early literacy environment
2. Implementation of the 12 curriculum components
3. Shared book-reading strategies and procedures
4. The *TELL* supportive and enabling teaching practices
5. Review of videotapes and group coaching (continued throughout the school year)

A detailed overview of the professional development sessions is included as electronic supplemental material (Supplement C).

Each teacher was paired with a mentor from the research project staff. There were a total of six mentors; three were teachers with a master's degree in early childhood special education and three were certified SLPs. All mentors had a minimum of five years of experience in direct service delivery to preschool children with disabilities. Mentors were randomly assigned (via lottery) across the classes, but stratified to ensure that each mentor provided support and coaching to teachers in more than one of the participating school districts. Each mentor provided in vivo support to three to four *TELL* teachers.

The mentoring procedures included modeling, observation, and discussion that were directly linked to the topics covered in the formal training sessions. Mentoring was also informed by results of the ongoing fidelity checks (described in a subsequent section) conducted by the mentors. Modeling was used to introduce teachers to *TELL* practices and to illustrate how they were integrated with the required curriculum components and learning blocks. Teachers were observed as they implemented practices and components. Subsequent to each observation, mentors met with their assigned teachers for reflective discussion during a weekly scheduled individual meeting. These discussions provided an opportunity for (a) the teachers to engage in reflection and evaluation of the observed practices, (b) the mentors to provide feedback about their observations, and (c) for the teachers and mentors to discuss needed changes for future implementation.

Mentors visited teachers' classes weekly throughout the school year, initially alternating between demonstrating/modeling newly introduced components or practices one week and observing the teachers the next week. As the school year progressed and teachers mastered the curriculum and teaching practices, the mentors spent more time in observation, assisted in the development of lesson plans, and engaged in targeted discussions with a focus on components and teaching practices that were more challenging for individual teachers as indicated by ongoing fidelity checks.

2.3. Contrast group

Teachers in the contrast classes continued "business as usual" in terms of curriculum and teaching content. *TELL* materials were not provided to the contrast teachers. All contrast teachers received professional development through their respective school districts. No additional professional development or support was provided through the present research. Contrast teachers reported using components of the *Creative Curriculum*, *High Scope*, or an "informal language curriculum." None of the contrast classes had formally adopted a language and/or literacy curriculum. This was confirmed through ongoing observations of the contrast classes. Contrast classes were required to address state-approved learning standards that include a scope of instruction and oral language and early literacy benchmarks similar to those in *TELL*. Contrast classes were observed on a monthly basis to document language and early literacy teaching activities.

2.4. Fidelity of implementation

We had two fidelity measures: one for procedural fidelity and another for quality of the curriculum delivery. The teachers' procedural fidelity was monitored by scoring their use of the 12 curriculum components. Quality of curriculum delivery was monitored by rating teachers' use of the evidence-based *TELL* teaching practices (see Table 4). To allow teachers time to understand and implement the new curriculum package, fidelity measurement began two months after classes started in August.

Implementation of curriculum components. The mentors conducted procedural fidelity observations during their weekly visits and scored (used/not used) the 12 curriculum components (see Table 3). All mentors were initially trained to a reliable scoring level (>90% agreement) through observation of videotapes of two classrooms and comparison of their scores with a master score. To schedule curriculum component fidelity checks, the mentors consulted teachers' lesson plans to ensure that all components could be observed on the day of their visit. Over the school year, a total of 19 curriculum component fidelity checks were conducted for each of the 19 *TELL* teachers. Recall that the mentoring protocol alternated weeks between modeling and observation. Fidelity checks were all conducted during observation weeks. They could be scored quickly, leaving ample time for the mentors to observe teachers in targeted activities for the purpose of providing feedback.

To assess ongoing reliability for mentors' scoring of curriculum components, another mentor conducted an independent check during a scheduled fidelity check. This occurred twice for each mentor during the school year. Percentage of exact agreement was calculated between the classroom mentor and the mentor conducting the independent observation of the 12 curriculum components. Overall percentage of agreement was 98% (range 91–100%), indicating acceptable levels of agreement between mentors for measuring curriculum content/implementation fidelity.

Implementation of the TELL teaching practices. Over the school year a total of ten biweekly observations were conducted to monitor teachers' use of the *TELL* teaching practices. As with the curriculum component fidelity checks, observations were conducted during a scheduled mentor observation week. As shown in Table 4, there were a total of six instructional practice groups including general supporting, explicit language teaching, writing, print concepts and alphabet knowledge, and phonological awareness. Mentors observed the classroom activities, scoring "+" for observed practices within each of the practice groups. We assessed fidelity by assigning scores to each group of practices that ranged from 0 to 3. A score of 0 was assigned if none of the practices in a given group were observed. A score of 1 (i.e., "emerging use") was assigned if less than three teaching practices were observed within a practice group, but restricted to just one learning block (e.g., circle, dramatic play, story time, etc.). A score of 2 (i.e., "often/frequent use") was assigned when at least half of the practices in a group were observed in two learning blocks. A score of 3 (i.e., "established practice") was assigned if half or more of the teaching practices within a group were observed across three or more learning blocks. All mentors were initially trained to a reliable scoring level (>90% agreement) on the rating scale through observation of videotapes of three different classrooms and comparison of their scores with a master score.

To assess inter-rater reliability for mentors' scoring of teaching practices, another mentor conducted an independent check during a scheduled fidelity check such that all mentors were checked for scoring reliability two times over the school year. Percentage of exact agreement on the score (0–3) for the practice blocks was calculated between the classroom mentor and the mentor conducting the independent observation of the teaching practices. The percentage of agreement for each mentor was 89%, indicating acceptable levels of agreement between mentors for fidelity checks of teaching practices.

2.5. The oral language and literacy environment

We used the first edition of the *ELLCO* (Smith, Dickenson, Sangeorge, & Anastasopoulos, 2002) to gain information regarding classroom supports for early literacy and language. The project mentors administered the *ELLCO* at the beginning and end of the school year for both the *TELL* and contrast classes. This instrument provides descriptive information about classrooms and contains three sections, including a literacy environment checklist, a classroom observation, and a literacy activities rating scale. The literacy environment checklist focuses on the book area in the classroom, book selection, book use, writing materials, and writing around the room. The classroom observation focuses on several parameters of the classroom environment and teaching including organization and contents, the presence and use of technology, opportunities for children to initiate and make choices, teacher management strategies, the classroom climate, oral language facilitation, the presence of books, approaches to book reading, approaches to children's writing, approaches to curriculum integration, acknowledgment of diversity, facilitating home support for literacy, and approaches to assessment. The third section is the literacy activities rating scale that assesses book reading and writing activities.

2.6. Child measures

Assessment of children's progress was conducted with standard measures and a receptive and expressive vocabulary test (VOCAB) we developed to assess vocabulary targeted in *TELL*. Standard measures, administered at the beginning and end of the school year, included the *Phonological Awareness Literacy Screening for Preschool* (*PALS-PreK*; Invernizzi, Sullivan, Meier, & Swank, 2004), the *CELF-P2* (Wiig et al., 2004), and the *Renfrew Bus Story: Language Screening by Narrative Recall* (*BUS*, Glasgow & Cowley, 1994). The *PALS-PreK* assesses several code-focused skills and, based on several studies with previous version of the instrument, also provides spring benchmark data for expected developmental ranges of four-year-olds. The *CELF-P2* includes a subtest for phonological awareness that yields a raw score, and also provides standard language composite scores (i.e., scores that reflect a performance on a combined set of language tests) for core language, receptive language, expressive language, language content, and language structure. The *BUS*, which is a story re-telling task, provides scores for the mean length of the five longest utterances, information included in the re-telling, and use of subordinate clauses. All standard tests were administered by trained research assistants (who were blind to condition).

All *BUS* testing was audio recorded and scored by the same group of research assistants.

Separate fall and spring *VOCAB* tests were developed to evaluate children's knowledge of vocabulary taught in the *TELL* curriculum. The vocabulary taught during the first half of the school year (August–December) was different from that taught during the second half (January–May); therefore, we devised a separate vocabulary test for each term. The fall/winter pre/post testing was conducted in August and December and the winter/spring pre/post testing was completed in January and May. We did not administer a cumulative vocabulary test for the entire school year. The *TELL* vocabulary words were not unique to *TELL* (i.e., they overlapped with vocabulary targeted in many preschool classrooms); therefore, we also administered *VOCAB* to children in the contrast classes. Due to restricted availability of our research assistants, who were graduate students, half of the vocabulary tests were administered by the research assistants blind to condition, and the other half were administered by the project mentors.

Because we developed the vocabulary measure specifically for this investigation, we examined its concurrent validity with other standard measures of child language. Zero-order correlations were calculated to determine the relation between our developed vocabulary measures and the other standardized child language measures administered during the present investigation including the *CELF-P2* and *BUS*. For Fall/Winter 2007 vocabulary and each of the *CELF-P2* subtests correlation coefficients ranged from .31 to .47 for receptive vocabulary and .50 to .57 for expressive vocabulary (all $ps < .0001$). The magnitude of correlations was similar for the spring 2008 measures. Results indicated significant correlations between spring 2008 vocabulary and *CELF-P2* subtest pre-test measures. Correlation coefficients ranged from .26 to .43 for receptive vocabulary and .43 to .61 for expressive vocabulary (all $ps < .0001$).

2.7. Measurement reliability

Scoring reliability was assessed for two of the measurement tools including the *ELLCO* and the *BUS*. For the *ELLCO*, 20% of observations were double-scored (i.e., two observers scored the same class at the same time) to calculate inter-rater agreement for classroom observations. Five of the 29 classes were selected randomly and scored at pre-test and post-test, for a total of ten *ELLLCO*s checked for reliability. Agreements were calculated as an exact score match, and percentage of agreement was calculated as the total number of agreements/agreements plus disagreements. Results indicated an overall *ELLCO* agreement of 90% (range of 89–98%). For the *BUS*, the narratives of 20% of the sample of children at pre- and another 20% at post-testing were selected for scoring by a trained independent observer. Inter-rater agreement was calculated as an exact score match for each child with the overall agreement at 90% (range 89–97%).

3. Results

We conducted a series of analyses to determine whether *TELL* was effective in promoting improvements in early literacy and oral language skills for the children with DSLI. First, preliminary analyses are presented which assessed whether there were any pre-test differences between groups. Second, the analytic approach for examining group differences is described. Finally, results related to classroom level analyses (i.e., fidelity and quality of implementation and group differences in the classroom environment), and child outcomes (i.e., code-focused and oral language skills) are presented.

3.1. Analysis of pre-test differences for classes and children

Prior to conducting analyses to evaluate the curriculum effect, we examined income and maternal education variables, as well as pre-test scores on the outcome measures, to determine whether there were any significant differences between the *TELL* and contrast classrooms. Crosstabs analysis revealed that there was no significant relation between classroom conditions and level of maternal education, $\chi^2(5) = 7.83$, $p = .17$. There was a significant relation, however, between classroom conditions and family income levels, $\chi^2(5) = 16.14$, $p = .01$. There was a greater proportion of children with higher family income levels in the *TELL* condition than in the contrast condition. Given this significant relation, family income was controlled in subsequent child-level analyses.

Group differences on pre-test scores of outcome measures were also examined. Results of a one-way ANOVA indicated significant differences between classroom conditions on the PALS-*PreK* Nursery Rhyme Awareness subtest and the spring expressive and receptive *VOCAB* measure, $Fs(1, 115, 101, 101) = 4.58, 8.29$, and 5.08, $ps = .03, .01$, and $.03$, respectively. Specifically, children with DSLI in the *TELL* condition scored higher on these measures than children with DSLI in the contrast condition. The *ELLCO* Total scores were also significantly higher in the *TELL* versus contrast classrooms at pre-test, $F(1, 29) = 6.18$, $p = .02$. Given these findings, pre-test scores were included as covariates in subsequent models.

3.2. Analysis approach

Our analytic approach for classroom environment and child outcome variables included a mixed model procedure with a multivariate analysis of covariance (MANCOVA). This approach enables an estimation of both fixed and random effects and allows for the test of the nested, or hierarchical, structure of the data (e.g., groups of children with DSLI belonging to the same classrooms, groups of classrooms nested under *TELL* and contrast conditions). Because classrooms, and not individual children, were randomly assigned to *TELL* and contrast conditions, systematic differences across conditions may have biased intervention effects. As a result, it was necessary to control for pre-test differences on outcome measures, as well as the nesting of classrooms within curriculum conditions. The nesting of classrooms within conditions was accounted for in the MODEL line using PROC MIXED in SAS Version 9.1 (SAS Institute & Inc., 2008). In addition, within the RANDOM line of the procedure, a random effect for classroom was included in the model, which adds a clustering effect for children in the same classroom.

The mixed model MANCOVAs included classroom as a random effect, condition (*TELL*, contrast) and test as fixed main effects, the participant-level covariates of income and pretest scores for each respective subtest measure, and the posttest scores on each subtest measure as outcome variables. The Fai and Cornelius (1996) method using Satterthwaite's estimation for degrees of freedom was used to adjust the denominator degrees of freedom of the mixed models (Satterthwaite, 1946). Satterthwaite's adjustment for the denominator degrees of freedom allows for a more accurate *F*-test given unbalanced designs. We used it because we expected differences in the underlying population variances given that random effects were included in the models.

Given the sample size, to preserve power to detect effects of the curriculum, analyses were completed separately for each measure (e.g., *PALS-PreK*, *CELF-P2*, *BUS*, *VOCAB*). To assess pretest–posttest designs, the use of an analysis of covariance design with pretest scores as a covariate is the preferred method over the use of a repeated measures analysis (Dimitrov & Rumrill, 2003). In addition, as suggested by Maxwell and Delaney (2004) the multivariate approach, with post-test scores as dependent measures and pre-test scores as covariates, was used in lieu of gain scores given our design, which included random assignment to treatment groups, and because the use of a multivariate analysis of covariance can afford greater power than analysis of gain scores.

Table 5
Pre- and posttest means (income adjusted) and standard deviations (*SD*) for children's performance on outcome measures.

Variable	*TELL*				Contrast			
	Pre		Post		Pre		Post	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
CELF P2								
Core language	84.04	15.41	91.50	15.78	80.19	16.76	81.55	16.94
Receptive language	83.31	16.27	90.90	15.49	81.89	16.15	83.99	17.99
Expressive language	82.33	15.00	88.70	15.86	77.81	16.27	79.87	16.39
Language content	84.98	15.29	92.29	15.87	80.94	16.36	84.40	18.70
Language structure	80.52	16.04	87.17	15.96	78.40	15.89	79.43	17.07
Phonological awareness	9.24	5.38	15.87	5.23	9.39	4.76	10.40	7.08
Renfrew Bus Story								
Information score	5.53	4.75	6.45	4.79	5.43	5.13	3.94	3.43
Subordinate clauses	0.11	0.40	0.61	1.00	0.01	0.24	0.59	1.15
MLU-5	3.47	2.75	6.20	2.14	3.20	3.46	3.61	2.93
PALS-PreK								
Upper-case letters	10.32	9.74	19.25	7.97	12.85	10.01	18.73	8.46
Lower-case letters	7.62	8.83	14.93	8.61	9.13	9.01	15.77	8.50
Letter sounds	3.57	6.52	12.16	8.12	3.74	5.88	7.47	8.09
Beginning sound awareness	4.18	3.87	7.95	2.90	3.52	3.76	5.27	4.20
Print and word awareness	4.78	2.68	7.52	1.98	4.30	2.69	6.68	2.68
Rhyme awareness	4.87	2.49	7.05	2.42	4.25	2.13	5.08	2.70
Nursery rhyme awareness	4.05	2.03	5.09	2.28	2.86	2.44	3.98	2.40
Name writing	3.70	2.32	5.90	1.57	3.87	2.22	5.57	2.03
VOCAB								
Fall expressive vocabulary	13.06	5.12	18.66	5.73	10.83	5.64	13.40	5.96
Fall receptive vocabulary	29.21	6.40	33.81	6.87	27.59	6.17	29.23	5.88
Spring expressive vocabulary	13.48	5.46	23.05	8.10	9.93	6.11	12.02	5.44
Spring receptive vocabulary	29.11	6.55	35.73	5.49	25.46	8.55	28.06	5.74

To assess group effects for the mixed models likelihood ratio, difference tests were conducted to compare two models, one in which condition was a factor and one in which condition was not included as a factor. The G^2 difference statistics comparing the two models are reported for the multivariate null hypothesis of no difference between *TELL* and contrast classes (Sokal & Rohlf, 1994; Wright, 1998). The G^2 difference statistic was used because it is a routine method of comparing nested models for the mixed procedure where the G^2 difference is computed as a likelihood chi-squared difference between restricted and unrestricted models using the −2 times the maximized log-likelihood value of each model (Wright, 1998). When condition was significant we used a univariate mixed

Table 6
Intraclass correlations, effect sizes (Cohen's *d*), success percentage, significance, and Benjamini–Hochman (B–H) critical value for mixed model analyses adjusting for income and pre-test scores.

Variable	ICC	Cohen's *d*	U_3	*p*-value[a]	B–H critical
CELF P2					
Core language	0.50	0.39	0.65	.08	.0208
Receptive language	0.47	0.34	0.63	.17	.0125
Expressive language	0.51	0.28	0.61	.22	.0083
Language content	0.41	0.25	0.60	.27	.0042
Language structure	0.51	0.35	0.64	.14	.0167
Phonological awareness	0.33	1.08	0.86	.0001*	.0250
Renfrew Bus Story					
Information score	0.10	0.50	0.69	.02	.0167
Subordinate clauses	0.24	−0.22	0.41	.91	.0083
MLU-5	0.19	0.82	0.79	.0001*	.0250
PALS-PreK					
Upper-case letters	0.44	0.31	0.62	.19	.0157
Lower-case letters	0.46	0.08	0.53	.86	.0031
Letter sounds	0.41	0.76	0.78	.005*	.0188
Beginning sound awareness	0.51	0.53	0.70	.003*	.0219
Print and word awareness	0.42	0.13	0.55	.19	.0125
Rhyme awareness	0.35	0.56	0.71	.002*	.025
Nursery rhyme awareness	0.48	−0.04	0.49	.86	.0063
Name writing	0.52	0.22	0.59	.33	.0094
VOCAB					
Fall expressive vocabulary	0.27	0.57	0.72	.0003*	.0125
Fall receptive vocabulary	0.19	0.47	0.68	.007	.0060
Spring expressive vocabulary	0.41	1.32	0.91	.0001*	.0250
Spring receptive vocabulary	0.35	0.56	0.71	0001*	.0188

Note: U_3 = percentage of individuals within the contrast group with scores that are exceeded by the average score in the *TELL* condition (Cohen, 1988). Intraclass correlations at posttest (ICC) were based on a random effects model with condition as a random factor and income and pretest score included as a covariate.

[a] *P*-values denote significance levels that were derived from mixed model univariate analysis of variance tests which followed significant mixed model multivariate omnibus tests analyzed for each scale (*CELF-P2*, *Bus Story*, *PALS-PreK*, and *VOCAB*).

* $p <$ B–H critical value for the false positive rate correction of the univariate curriculum intervention effect.

model analysis of covariance (ANCOVA) approach to determine which outcome measures resulted in significant effects (Spector, 1977).

To control for type I error for the number of *F*-tests examined, we applied the Benjamini–Hochberg (B–H) correction for multiple comparisons (Benjamini & Hochberg, 1995) to each set of measures separately. The B–H correction adjusts for the false positive rate instead of the family-wise error rate. It is a less conservative method than the Bonferroni adjustment (Bonferroni, 1935; Hancock & Klockars, 1996) and is the suggested method of the WWC.

Effect sizes were calculated using the standardized mean difference statistic (Cohen's *d*; Cohen, 1988) for each model. As suggested by Morris (2008), effect sizes were calculated by subtracting the mean difference in scores from pre- to posttest in the contrast group from the mean difference in the *TELL* group, divided by the pooled pretest standard deviation. We also calculated the U_3 statistic for each effect size as defined by Cohen (1988). The U_3 statistic is expressed in terms of the percentage of individuals within the contrast classes with scores that are exceeded by the average score in the *TELL* classes (see Cooper, 2008 or Cohen, 1988 for a discussion). This statistic allows interpretation based not on a predefined metric, but rather on the value itself. This permits readers to decide if a given U_3 value is meaningful. In the following sections, we provide the U_3 value for all findings. Table 5 includes children's pre- and post-test mean scores for all measures. Table 6 includes the ICC, effect size, U_3, *p*-value and the B–H correction for each measure.

3.3. Implementation fidelity: procedural and quality

Implementation fidelity was measured as adherence to the procedural aspects of the curriculum and use of the *TELL* teaching practices. The measure of procedural fidelity scored teachers' use of the 12 curriculum components and included 19 observations that commenced two months after the start of school (October) and continued until the end of the school year in May. Results were grouped as fall (October–November), winter (December–February), and spring (March–May) observations. We calculated the mean percentage of teachers who demonstrated use of the required components across observations falling within these reference points. Table 7 displays the fidelity results for the 12 curricular components for the teachers as a group. As can be seen, the teachers improved across the school year. Ten of the 12 components had fidelity that exceeded 80%, meaning that 80% or more of the teachers used the components. Two components (teacher led phonological awareness activity and meaningful transitions) were somewhat lower in fidelity, although as with the other areas they improved across the school year.

Table 7
Fidelity of implementation for curricular components: percentage of teachers using each component.

Component	Fall (*n* = 2 observations)	Winter (*n* = 8 observations)	Spring (*n* = 9 observations)
Social story	36	80	80
PA warm up	66	93	95
ABC card	77	96	93
New vocabulary	86	93	96
Story sequence	66	88	88
Focus book	100	97	93
Fact card	55	69	85
Phonological awareness activity	63	79	71
Table tent card	95	92	90
Writing	53	72	93
Music and movement	100	100	98
3 meaningful transitions	53	72	64
Overall mean percentage	71	86	87

Table 8
Fidelity of implementation (Quality): teachers' use of the *TELL* teaching practices across the school year.

(*n* = 2 observations)	Fall (*n* = 4 observations)		Winter (*n* = 4 observations)		Spring	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
General supporting	2.47	.59	2.78	.32	2.93	.16
Explicit language and vocabulary	1.80	.54	2.24	.51	2.64	.38
Phonological awareness	1.55	.71	1.92	.45	2.22	.55
Alphabet knowledge	1.92	.71	2.37	.45	2.76	.36
Writing	1.11	.68	1.42	.58	2.17	.54
Print concepts	1.32	.63	1.98	.45	2.24	.46

Note. Individual scores for each component could range from 0 to 3 with 0 = not observed; 1 = emerging; 2 = often; 3 = most of the time.

The quality of curriculum delivery focused on teachers' use of the *TELL* practices. Means and *SD*s were calculated across all teachers at all 10 time points for each practice block. Table 8 details the results. Teachers used supportive practices most frequently. Use of remaining teaching practices increased at each measurement point such that by spring, nearly all of the teachers demonstrated use of all practice areas at level two, which corresponds to "often/frequently."

3.4. The classroom language and literacy environment

Classroom level language and literacy environmental supports were measured with the *ELLCO* (see Table 9 for means and *SD*s). A mixed-model MANCOVA was conducted on the three *ELLCO* subtests with condition as the between-subjects factor and pre-test scores as the covariates. Results of the omnibus multivariate test were significant ($G^2 = 39.7$, $df = 3$, $p = .0001$), showing a significant difference between conditions for the *ELLCO* subtests. Univariate ANCOVA follow-up difference tests were conducted for each of the *ELLCO* subtests to determine which subtests differed significantly (Spector, 1977). Univariate results showed that scores in *TELL* classrooms were significantly higher at post-test than scores in the contrast classrooms for all subtests: *Literacy Environment Checklist*, $F(1, 26) = 36.09$, $p < .0001$, B–H critical = .017; *Classroom Observation*, $F(1, 26) = 39.07$, $p < .0001$, B–H critical = .025; and *Literacy Activities*, $F(1, 26) = 15.97$, $p = .0005$, B–H critical = .008. Estimates of U_3 statistics were .97, .86, and .89, respectively for the Classroom Observation, Literacy Environment Checklist, and Literacy Activities subtests, suggesting that the majority of contrast classrooms were outscored by the average *TELL* classroom on each of the *ELLCO* subtests.

Table 9
Classroom ELLCO mean scores (M) and standard deviations (*SD*) from pre- to post-testing by group.

Group	*ELLCO* subscale	School beginning	School end
		M (*SD*)	*M* (*SD*)
TELL classes (*n* = 19)	Literacy environment checklist	23.95 (5.19)	31.68 (3.46)
	Literacy activities	8.42 (2.52)	10.74 (1.37)
	Classroom observation	42.05 (5.08)	56.63 (4.40)
Contrast classes (*n* = 10)	Literacy environment checklist	20.60 (5.25)	22.70 (3.71)
	Literacy activities	8.00 (2.40)	7.30 (3.16)
	Classroom observation	41.00 (5.03)	46.10 (3.98)

Note. Maximum score for the literacy environment checklist = 41; literacy activities = 13; classroom observation = 70.

Table 10
Benchmark range, percent (%) of children reaching PALS-Pre-K spring benchmarks, and chi-square test of significant differences between *TELL* curriculum and contrast groups.

PALS-Pre-K subtest	Benchmark range	*TELL M* pretest	Contrast *M* pretest	% of children who met spring benchmark		
				TELL	Contrast	χ^2 (df = 1)
Upper case letter recognition	12–21	10.32	12.85	73.4	26.6	0.38
Lower case letter recognition	9–17	7.62	9.13	71.8	28.2	0.00
Letter sounds	4–8	3.57	3.74	79.4	20.6	5.79*
Beginning sound awareness	5–8	4.18	3.52	78.9	21.1	7.58**
Print and word awareness	7–9	4.78	4.30	70.8	29.2	0.14
Rhyme awareness	5–7	4.87	4.25	81.3	18.7	12.96***
Nursery rhyme awareness	6–10	4.05	2.86	78.9	21.1	1.47
Name writing	5–7	3.70	3.87	72.4	27.6	0.02

* $p < .05$.
** $p < .01$.
*** $p < .001$.

3.5. Oral language and code-focused skills of children with DSLI

In preparation for analysis of the curriculum effect on children's outcomes, intraclass correlations (ICC) were calculated for each measure to assess the degree of intragroup dependency of classrooms nested within curriculum conditions. The ICC was calculated for each measure using estimated variance components from a mixed model, with teacher as a random effect and pretest scores as covariates. ICC values ranged from .19 to .52, which indicates that there was some dependence of observations at the onset of the study. Cohen, Cohen, West, and Aiken (2003) suggest that even small ICC values (i.e., .01) can cause alpha inflation. Based on this assessment, our results indicated that the similarity among classrooms within conditions could influence scores on outcome measures; therefore, the effect of nesting was accounted for in subsequent analyses using a mixed model approach. In addition, the effect of children clustered within classrooms was also accounted for, where classroom was considered a random effect in each mixed model analysis.

Oral language skills. Oral language skills for the children with DSLI were assessed with the *CELF-P2*, *BUS*, and *VOCAB*. No differences between the children in the *TELL* and contrast classes were observed for any of the *CELF-P2* oral language scores. For *BUS*, children in the *TELL* classes scored significantly higher than their peers in the contrast classes. Based on the mixed model MANCOVA omnibus results, there was a significant multivariate effect of the *TELL* curriculum, $G^2 = 26.4$, $df = 3$, $p < .0001$. Results of the follow-up univariate ANCOVAs revealed that mean scores on the *BUS* MLU-5 subtest were significantly higher for children in the *TELL* classes than for children in the contrast classes after accounting for pretest scores and family income, $F(1, 84) = 25.63$, $p = .0001$, B–H critical = .025. There were no significant differences between children in the *TELL* and contrast classes on the *BUS* information score or the subordinate clauses subtest. For the MLU-5 subtest, U_3 statistics suggest that 79% of children in the contrast classes had lower scores than the average child in the *TELL* classes.

Children in the *TELL* classes scored higher at the fall and spring posttest on *VOCAB* than children in the contrast classes. Recall that we had separate *VOCAB* measures for the fall and the spring but no cumulative vocabulary measure for the school year. Results of the mixed model MANCOVA indicated that there was a significant omnibus intervention effect, $G^2 = 49.2$, $df = 4$, $p < .0001$. Further, there were significant univariate effects for the outcome measures of expressive *VOCAB* at the end of the fall and spring semesters, Fs(1, 97 and 33.1) = 14.21 and 25.14, ps = .0003 and .0001, B–H critical = .0125 and .025, as well as for receptive *VOCAB* at the end of the spring semester, $F(1, 34.4) = 22.79$, $p < .0001$, B–H critical = .0188, with children in the *TELL* classes scoring significantly higher than children in the contrast classes on each measure. For fall and spring expressive *VOCAB* and spring receptive *VOCAB* U_3 statistics were 72%, 91%, and 71%, respectively.

Code-focused skills. Two instruments assessed code-focused skills for the children with DSLI: the *PALS-PreK* and the *Phonological Awareness subtest of the CELF-P*. Examination of the *PALS-PreK* focused on the changes in raw scores for each subtest and the percentage of children who achieved spring benchmarks. Examination of mean differences on the *PALS-PreK* subtests indicated that children in the *TELL* classes performed better than children in the contrast classes. Results from the omnibus MANCOVA revealed a significant difference between conditions on posttest scores of the *PALS-PreK* subtests, $G^2 = 27.4$, $df = 8$, $p = .006$. Children in the *TELL* classes scored higher on the *PALS-PreK* than children in the contrast classes. Follow-up univariate ANCOVAs indicated that children in the *TELL* classes had significantly higher posttest scores on the letter sounds, beginning sounds, and rhyme awareness subtests compared to children in the contrast classes as measured by the mixed model ANCOVA, Fs(1, 29.2, 26.2, and 26.8) = 9.08, 10.74, and 11.57, ps = .005, .003, and .002, B–H critical = .0188, .0219, and .025, respectively. The associated U_3 values for the letter sounds, beginning sounds, and rhyme awareness subtests were .78, .70, and .71, respectively, indicating that 78%, 70%, and 71% of children in the contrast classes had lower scores on these subtests than the average child in the *TELL* classes.

A chi-square analysis was used to compare the proportion of children who attained spring benchmarks on the *PALS-PreK* in the *TELL* and contrast classes. The benchmarks are included in the *PALS-PreK* manual and represent the minimum level of age-appropriate performance. A two-way contingency table was created with condition (*TELL*, contrast) and spring benchmark using two levels (1 = reached benchmark, 0 = did not reach benchmark). Results indicated that a significantly greater proportion of children in the *TELL* condition met benchmarks on the code-focused skills of letter sounds, beginning sound awareness, and rhyme awareness than did children in the contrast group. Table 10 includes the benchmark range, the percentages of children who met benchmarks in each subtest, and the chi-square statistics for each subtest. Also included in Table 10 are the pretest mean scores for the *TELL* and the contrast children. The majority of children in each of the groups were at the low end or below spring benchmarks when they were tested at the beginning of their fall term.

In terms of the *CELF-P2 Phonological Awareness* subtest, a significant curriculum effect was found for the omnibus mixed model MANCOVA $G^2 = 22.0$, $df = 6$, $p = .001$ with children in the *TELL* classes outscoring children in the contrast classes. Follow-up univariate ANCOVA tests of significance for each subtest showed that children's mean scores on the Phonological Awareness subtest were higher for the *TELL* classes than the contrast classes after controlling for pretest scores, $F(1, 32) = 20.79$, $p = .0001$, B–H critical = .025. This finding indicates that 86% of children (i.e., $U_3 = .86$) in the con-

trast classes were outperformed by the average child in the *TELL* classes.

4. Discussion

The purpose of this investigation was to test the efficacy of the *TELL* curriculum for preschool children with DSLI as evidenced by children's improvements in targeted oral language and early literacy skills compared to children in business as usual contrast classes. Our research design included a small RCT, thereby allowing us to test for a causal effect. Results indicated significantly greater improvement in the oral language and early literacy skills of children in the *TELL* classes compared to children in the contrast classes. Because children's classroom learning environments impact curriculum effectiveness, professional development was provided to the *TELL* teachers to support their (a) creation of high quality language and literacy environments and (b) implementation of the *TELL* curriculum components and teaching practices with high fidelity. It should be noted that *TELL* was delivered as a package that included professional development to support fidelity of implementation and quality of the curriculum delivery and as such, we cannot parse out the effects of the curriculum from the professional development associated with our efforts to support the learning environment and teaching practice.

4.1. Children's improvements in oral language skills

Results indicated that by the end of the school year, children with DSLI in *TELL* classes demonstrated higher oral language scores in vocabulary and MLU in the *BUS* story retelling task than their peers with DSLI in contrast classes. In *TELL* classes vocabulary was taught in a scripted shared-book reading context, an approach for which effectiveness is well established (e.g., NELP, 2008). Because children in the contrast classes were not systematically exposed to the specific vocabulary targeted by the *TELL* curriculum, it is not surprising that a vocabulary advantage emerged for children in the *TELL* classes; however, words selected for the *TELL* curriculum are found in children's books and are targeted in preschool classrooms serving children with DSLI. Our monthly observations of the contrast classes confirmed that children in those classes were exposed to many of the *TELL* vocabulary words through large group book-readings or theme discussions; however, teachers in contrast classes did not teach vocabulary explicitly and we hypothesize that this contributed to the different vocabulary outcomes in *TELL* and contrast classes.

Children in the *TELL* classes also demonstrated significantly higher MLUs on the *BUS* measure. An increase in MLU by preschool children with DSLI generally occurs because their language has increased in complexity through the acquisition of new grammatical components or the use of additional descriptors in sentences. As these newly learned language skills are incorporated into children's conversations and narratives, sentence length increases. Sentence length and complexity were targeted in several *TELL* curriculum components (e.g., shared book-reading, expository fact cards, table tent cards) and *TELL* practices promoted strategies targeting acquisition of complex language skills. It appears that these strategies and activities were effective for children with DSLI.

We did not see higher scores for *TELL* than contrast children on the *CELF-P2* language composite scores or the *BUS* information or subordinate clause scores. It is worth noting that children in the *TELL* classes demonstrated increases in their standard scores on all *CELF-P2* language composites while scores for children in the contrast classes were relatively stable in comparison (see Table 5). Further, the mean scores for the *TELL* group at post-test were all within one standard deviation of the mean, which many would consider within typical limits on a standardized test. This was not observed with any of the language composite scores for the contrast group. In addition the U_3 values for the *TELL* group for all language composite scores ranged from .60 to .65, indicating that at least 60% of the children in the contrast classes were outscored by the average child in the *TELL* classes. Although we did not observe statistically significant between-group differences on the *CELF-P2* language composite scores, the finding that a large percentage of children in the contrast classes were outperformed their peers in the *TELL* classes suggests practical significance that may be viewed as important by teachers (for a discussion of practical significance see Cooper, 2008).

4.2. Children's improvements in code-focused skills

Children in the *TELL* classes had higher scores than children in contrast classes on the phonological awareness subtest of the *CELF-P2* and the letter sounds, beginning sound awareness, and rhyme awareness subtests of the *PALS-PreK*. In addition, more children in the *TELL* classes achieved spring benchmarks on the *PALS-PreK* than children in the contrast group. Collectively, all of these subtests evaluate phonological awareness skill sets that are developmentally appropriate for children during their pre-kindergarten year. Preschoolers' phonological awareness skills are a strong predictor of subsequent reading success (e.g., NELP, 2008) thus the higher phonological awareness skills of children in *TELL* classes bodes well for their future literacy achievement.

All children (*TELL* and contrast) demonstrated gains in upper case letter recognition and print and word awareness (e.g., recognition of print in the environment, print directionality, understand that print represents sounds of spoken words, ability to distinguish between letters and words) as measured by the *PALS-PreK*. This was a focus of the *TELL* curriculum and based on our monthly observations, a focus in the contrast classes as well. Given this, the lack of significant between-group differences is not surprising. However, when comparing the two groups on achievement of spring benchmarks on the *PALS-PreK*, while they were highly similar in skill areas at the beginning of the school year, a substantially larger percentage of children in the *TELL* classes (70–80%) achieved spring benchmarks on all of the subtests than did children in the contrast classes (20–30%) (see Table 10). This finding suggests that there was an advantage for children who received the *TELL* curriculum.

4.3. The classroom learning environment

A quality preschool classroom learning environment should include multiple opportunities for children to practice targeted skills and also be of sufficient quality to support successful implementation of a language and literacy curriculum. Multiple practice opportunities are of particular importance to promote language learning for young children with DSLI. To ensure this, we provided professional development (formal training, in-class mentoring and support) to enable teachers to establish and maintain a high quality learning environment that included multiple practice opportunities for children, as evidenced by *ELLCO* scores, fidelity of implementation adherence to the *TELL* curricular components (Table 3), and frequent use of the *TELL* teaching practices (Table 4). Our results indicate that we were successful in accomplishing all of our objectives for the classroom environment and *TELL* implementation.

Oral language and literacy supports in the environment. Our *ELLCO* data indicated that that the quality of the learning environment was conducive to children's oral language and early literacy learning. With pretest scores and family income as covariates, posttest scores in *TELL* classes were significantly higher than contrast classes on all *ELLCO* subtests. The magnitude of the between-group effect sizes suggests that targeted mentoring and support made a sub-

stantial difference in the language and early literacy environments of preschool classes serving children with DSLI.

Implementation fidelity. As a measure of the quality of curriculum delivery, we monitored teachers' use of the evidence-based *TELL* teaching practices designed to support children's oral language and early literacy learning and those explicit teaching practices intended to enable children's acquisition of new oral language and early literacy skills. Teachers improved in their use of these practices across the school year. The general supporting practices were implemented the most frequently. Most of the practices in this category are preschool teaching practices that have been recommended for many years to promote quality teacher–student interactions. Explicit language teaching and alphabet teaching practices were also implemented frequently. Practices implemented less frequently for some teachers included phonological awareness activities, especially in teacher-led learning blocks, writing, and print concepts; however, we would expect these practices to be used at a reduced frequency because they were tied to specific curriculum components—in contrast to the more frequently used strategies that were applicable across most of the curriculum components.

Procedural fidelity was defined as teachers' adherence to the curriculum components and improved across the school year. Two curricular components presented some fidelity challenges: use of meaningful transitions and the teacher-led phonological awareness activities. It should be noted, however, that from winter to spring, fidelity checks showed that these components were implemented with a mean of 68% and 75% respectively, which is well above half of the time. Given children's improvements in skills targeted through these activities (i.e., phonological awareness, vocabulary) it would appear that these levels were sufficient to support skill growth. Our mentors reported that teachers who implemented the teacher-led phonological awareness activities early in the year with lower fidelity expressed some discomfort with teaching that was not child-directed. These teachers eventually implemented the teacher-led activities with integrity, but their fidelity was slower to increase than teachers who did not share this concern. It was also apparent that transitions were challenging for teachers whose classes included children with highly diverse learning needs ranging from those with significant and multiple impairments to children with typical development. When teachers were not challenged by managing individual children, the transition activities typically went as planned. As we continue to refine the *TELL* curriculum, we are working on specific adaptations that can be integrated within transitions to address a variety of learners.

Fidelity and children's outcomes. Due to observed variation in the teachers' use of the *TELL* teaching practices and their adherence to the curriculum components, we decided to explore a possible relationship between these aspects of fidelity and children's post-test scores. We conducted correlational analyses between teachers' use of *TELL* teaching strategies in each of the six strategy areas) and children's post-test scores (also calculated as an aggregate for each teacher's class). We found preliminary support for a relationship between the *TELL* supporting strategies, and the *TELL* explicit teaching strategies and children's receptive vocabulary scores. No relationships were found for any of the other oral language or code-focused skill areas. Of course, the use of aggregates is not an optimal method for exploring this type of relationship; however, we were encouraged to find a global relationship between teachers' use of supportive and enabling language and literacy teaching practices and children's scores. This positive relationship is consistent with recent curricula implementation research noting that the quality of curriculum delivery is related positively to children's outcomes (e.g., Hamre et al., 2010; Odom et al., 2010).

We repeated the same procedure for each teachers' adherence to the *TELL* curriculum components (i.e., procedural fidelity), deriving an aggregate fidelity score for each teacher to examine in relation to aggregate gains by children in their classes. No relationships were found. We do not interpret this to mean that procedural fidelity is unimportant. However, the possible lack of relationship raises some issues for consideration. First, in the design of the *TELL* curriculum, we integrated each of the six targeted skill sets across multiple required curriculum components and learning blocks. This redundancy was intended to provide multiple opportunities to practice and learn, and also to reduce the likelihood that implementation of one or two components at lower fidelity levels would have a substantial impact on children's outcomes. Hence, a lack of relationship between procedural fidelity and outcomes may be due to the redundancy built into the curriculum.

Another issue to consider when thinking about fidelity and children's outcomes pertains to the notion of "how much is sufficient?" At present, there are no established, data-based standards to determine what constitutes an effective 'dosage' of the active ingredient for achieving specific targeted goals. It seems likely that dosage should vary depending on the desired outcome. As educational researchers continue to explore and document the evidence base for teaching strategies and practices, identification of minimum levels of fidelity (i.e., dose) are worthy of examination in future work.

Finally, it may be that the quality of implementation is more important than procedural fidelity. In other words, while procedural fidelity (i.e., dose) is important, it may not be the largest predictor of children's oral language and early literacy growth. The need to focus on multiple dimensions of implementation has been emphasized in recent literature (e.g., Griffin, 2010; Odom et al., 2010), and in all likelihood, both quality and procedural fidelity are important for efficacy.

4.4. Limitations and directions for future research

We are encouraged by our findings in this RCT: preschool children with DSLI in *TELL* classes demonstrated significantly higher improvement in oral language (e.g., vocabulary, sentence length) and early literacy skills (e.g., phonological awareness) than their peers with DSLI in contrast classes. As with all research, there are some limitations in our work. It would have been desirable to have all staff that administered outcome measures be blind to children's assignment to conditions. Although all standardized data and half of the vocabulary measures were collected with blinded research assistants, the remaining half of the vocabulary measures were collected by the project mentors. Given budgetary constraints we had to use mentors for the vocabulary assessments as well as mentoring, which is a source of potential bias in our results. Another issue is that all of the participating teachers were volunteers and thus may have been more motivated to implement the *TELL* curriculum than teachers who did not volunteer. Third, given that our unit of assignment was the classroom level stratified by school, our sample size was small for a clustered design. Replication of effects with a substantively larger sample will increase confidence in the efficacy of the *TELL* curriculum package and potentially reveal more significant effects from both a practical and statistical perspective.

An additional issue is that our contrast classes were "business as usual." While this is a standard approach to recruitment of contrast groups for educational research, the fact remains that teachers in the *TELL* classes were provided with support and professional development beyond what was available for the contrast teachers through their respective school districts. Some might argue that this extra "attention" for the *TELL* classes was the active ingredient, perhaps more than the curriculum itself. Thus, we do not know if provision of similar levels of mentoring and support without the *TELL* curriculum would have yielded the same results. On a related note, we did not design the study to parse out effects associated

with the *TELL* curriculum itself and the professional development that was necessary for teachers to implement the curriculum. It is possible that any professional development focused on language and early literacy activities and teaching practices may have been effective, with or without the *TELL* curriculum. The specific role of professional development, independent of a curriculum, is an area to consider for future research.

Our final limitation is that children in the *TELL* classes received the services of an SLP in addition to classroom instruction, and this is a factor that may have contributed to observed outcomes in addition to the *TELL* package. SLPs were included in many classroom activities for participating children in the *TELL* classes, and provided intervention services focused on speech and/or language goals as specified on children's IEPs. Often, the *TELL* goals overlapped with the IEPs. This raises the possibility that the SLPs promoted children's language and early literacy gains beyond that which we might expect from the curriculum and teachers. We think this unlikely because the same situation existed in the contrast classes. That is, SLPs in the contrast classes also participated in language and early literacy activities and provided speech and/or language intervention services for participating children in the contrast classes. Given the enhanced acquisition of oral language and early literacy skills by children in the *TELL* classes, we think it plausible that the *TELL* curriculum package contributed to this growth.

Other important areas of focus for future research with *TELL* pertain to examination of effects for children enrolled in inclusive classrooms in addition to those with DSLI. In the present investigation, we examined outcomes for preschoolers with DSLI. The *TELL* teachers' anecdotal reports indicated that they, as well as children's parents, perceived improvements by children with typical development. Because *TELL* is intended to be a universal curriculum, inclusion of both groups of children in future research is important to determine whether *TELL* is effective for all preschool children. Second, some of the preschool classes also included children with multiple disabilities. Mentors engaged in discussion with teachers that focused on adaptations of *TELL* to accommodate these diverse learners as well as strategies for differentiated instruction during review weeks. Future research that examines the efficacy of adaptations and differentiated instruction will be important not only to *TELL*, but to other universal curricula as well.

5. Conclusions

All skill areas targeted through *TELL* correspond to those that have been identified as important for conventional literacy success during early schooling. To our knowledge, the *TELL* curriculum is (a) the first designed to address the oral language and early literacy needs of children with DSLI within ongoing activities in an inclusive classroom and (b) the first to report the results of a randomized controlled trial that examined the efficacy of a comprehensive oral language and literacy curriculum for children with DSLI. The *TELL* oral language and early literacy scope and sequence, activities, and teaching practices were appropriate for the children with DSLI and, according to teachers' anecdotal reports, their peers with typical development as well. Classroom teachers delivered the *TELL* curriculum with fidelity *and* the children with DSLI demonstrated significant improvements in their oral language (i.e., vocabulary, MLU) and early literacy skills (letter knowledge, phonological awareness). Children with DSLI are at-risk for poor conventional literacy outcomes and because our results suggest that their acquisition of important oral language and early literacy skills can be promoted by their early childhood teachers with a curriculum package such as *TELL*, we look forward to testing the effectiveness of *TELL* in a larger study. Although some children with DSLI may require additional, more intensive instruction, the fact that the children were able to benefit from the systematic group instruction within *TELL* suggests that the curriculum is an efficient and cost effective way for early childhood teachers to prepare children with DSLI for subsequent literacy success.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ecresq.2010.12.003.

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