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Preschool Instruction in Letter Names and Sounds: Does Contextualized or Decontextualized Instruction Matter?

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Abstract

This study investigated the influence of teaching letter names and sounds in isolation or in the context of storybook reading on preschool children's early literacy learning and engagement during instruction. Alphabet instruction incorporated paired associate learning of correspondences between letter names and sounds. In Decontextualized treatment activities, children practiced saying the letter names and sounds that matched printed single letters presented on cards and in letter books, and speeded recognition of taught letters. In Contextualized treatment activities, letter names and sounds were taught and practiced during oral reading of storybooks, recognizing letters in children's printed names, and speeded recognition of taught letters in words. Subjects were 127 preschool children in five public schools with low-income eligibility thresholds, including 48 dual language learners (DLLs). Children were randomly assigned within classroom to small groups randomly assigned to one of the two treatments. Research assistants provided 10 weeks of instruction, 12-15 minutes/day, and four days/week. Both groups made significant growth from pretest to posttest on measures of alphabet learning and phoneme awareness. Children in the Decontextualized treatment small groups had significantly higher gains than children in the Contextualized treatment small groups on taught letter sounds and phonemic awareness measured by identification of initial sounds in spoken words. There were no treatment differences between DLL and non-DLL children. Children's engagement during instruction was significantly higher in the Decontextualized treatment. Findings support explicit decontextualized alphabet instruction emphasizing the relationship between verbal letter labels and letter forms that enlists PAL processes.

Keywords: alphabet, letter names and letter sounds, storybook reading, contextualized instruction, preschool, dual language learner, English language learner

There is persuasive evidence that reading can be parsimoniously represented as a function of linguistic comprehension and decoding (Hoover & Gough, 1990; Kim, 2017). The letters of the alphabet are a human invention to represent the sounds of speech in writing and are a critical foundation for decoding. Assembled in words and stories, letters allow sharing of meaning through reading and writing. Teaching children letter names and letter sounds allows them to learn to decode words and to write, with eventual storing of whole word spellings into long-term memory. With accurate and well-practiced access to these words through reading, word recognition becomes increasingly automatic and efficient increasing the cognitive resources available for acquiring and constructing meaning. Alphabet knowledge as early as preschool predicts reading achievement (Adams, 1990; Foulin, 2005; Catts, Fey, Zhang, & Tomblin, 2001; Lonigan, Schatschneider & Westberg, 2008). Learning how to read words requires both letter sound knowledge and phonemic awareness (PA) (Hulme, Bowyer-Crane, Carroll, Duff, & Snowling, 2012), and both accuracy and speed is needed (Roberts, Christo, & Shefelbine, 2010). Alphabet knowledge and phonemic awareness are highly correlated in early stages of learning to read (Bowey, 1994; Caravalos, Hulme, & Snowling, 2001) with each skill contributing to growth in the other (Burgess & Lonigan, 1998; Ehri & Wilce, 1980; Hohn & Ehri, 1983; Foy & Mann, 2006; Lerner & Lonigan, 2016). They are widely recognized as the two best predictors of beginning reading.

In spite of the clear importance of alphabet knowledge for learning how to read, there is relatively little scientific evidence on the most effective methods for teaching it. In many U.S. preschool classrooms, practices for teaching alphabet knowledge remain craft-based rather than empirically validated (Justice, Pence, Bowles, & Wiggins, 2006), with more serious consequences for at-risk children entering preschool with more limited alphabet knowledge, less exposure to English, and from families with limited financial resources (West, Denton, & Geronimo-Hausken, 2000; Zill & Resnick, 2006). Learning letter names and sounds may appear to be simple, but is in fact a difficult task for young children (Ehri & Roberts, 2006; Froyen, Bonte, van Atteveldt, & Bloomert, 2008; Kilpatrick, 2015; Piasta & Wagner, 2010a; Seidenberg, 2013). This difficulty is indicated in the limited alphabet learning outcomes reported for widely used preschool curricula (Jackson et al., 2007; Preschool Curriculum Evaluation Research Consortium, 2008). Greenwood, Carta, Atwater, Goldstein, Kaminski, and McConnell (2013) reported that "Only in the case of print knowledge did Tier 2 and 3 Head Start children make very little growth Fall to Spring" (p. 54). Head Start is a child development program, funded by the U.S. Department of Health and Human Services, established in 1965, for low-income children and their families, offering preschool programs for three- and four-year olds. A meager standard score gain of .01 was reported for one year of preschool participation. Tier 2 and Tier 3 children were those most at-risk for reading difficulties. The Head Start Impact Study (Puma et al., 2010), a randomized study of a nationally representative sample of Head Start programs, found that Head Start 3- and 4-year old children lagged behind other children in letter identification: at the end of kindergarten, 56 and 55 percent of Head Start 3- and 4-year old cohorts were able to recognize all letters compared to 95 percent of children in the nationally representative ECLS-K sample (U.S. Department of Education, 2002). Disappointing learning rates of letter names or sounds have been reported in earlier studies of alphabet instruction (Diamond, Gerde, & Powell, 2008; Molfese et al., 2006; Piasta & Wagner, 2010b). The importance of alphabet skills for later literacy and school outcomes requires that we identify the best methods for alphabet instruction.

There has been debate and uncertainty about important aspects of alphabet instruction, including the best alphabet content–names or sounds–to teach, and the most effective sequencing of letter names and sounds instruction to secure children's learning. A second area of discussion and uncertainty is the nature of the most effective instructional routines that account for the underlying cognitive processes involved in alphabet learning. A third area of contention is whether to teach letters in the meaningful context of written words and stories, or whether to teach letters in their isolated, decontextualized forms. The present study is the third in a series of instructional studies (Roberts, Vadasy, & Sanders, 2018, 2019b) in which we addressed these questions. In this study in which we compare contextualized and decontextualized alphabet instruction, we teach names and sounds together after having examined the benefits of teaching names only, sounds only, or both in an earlier study (Roberts, Vadasy, & Sanders, 2018) and similar evidence from other researchers (Farver, Lonigan, & Eppe, 2009; Nelson, Sanders, & Gonzalez, 2010; Piasta, Purpura, & Wagner, 2010). We base instruction on practices to emphasize paired associate learning (PAL) after having compared PAL-based instruction to instruction that included (a) less PAL + reference to speech articulation and (b) less PAL + reference to features of letter forms, and (c) typical instruction (Roberts et al, 2019). PAL refers to forming a relationship between two items and storing it into long-term memory such that presentation of one item leads to accurate retrieval from memory of the other. Our previous studies extended the findings of an independent relationship between individual differences in PAL and reading acquisition (Ehri & Wright, 2007; Hulme, Goetz, Gooch, Adams, & Snowling, 2007; Warmington & Hulme, 2012; Windfuhr & Snowling, 2001) to include replicated evidence of increased alphabet learning when instruction robustly included more PAL activity.

Instructional Contexts for Alphabet Learning

Approaches to teaching early literacy skills are often dichotomized as either contextualized or decontextualized. Wide variation in the elements identifying each type of instruction have been proposed. Elements that have been suggested as indicating differences between contextualized and decontextualized learning and instruction of early literacy foundations include: presence of hands-on experiences; extent of child-directed learning; variation in children's engagement in alphabet instruction; variation of activities and instruction based on children's learning or interests; the integration of reading, writing and spelling; and, the degree to which instruction is embedded within meaningful oral or written language at the discourse or word level (Ehri & Roberts, 2006; Copple & Bredekamp, 2009; Craig, 2006; Martin-Chang, 2017; Neuman, Copple, & Bredekamp, 2000; Wigfield & Eccles, 2000).

Decontextualized teaching approaches in which target knowledge or skills are disembedded from complex contexts via presenting letters or words individually have had positive outcomes for young children's initial word reading acquisition, and reduce later reading difficulties (Bus & van IJzdendoorn, 1999; National Reading Panel, 2000). However, the appropriateness of decontextualized teacher-directed approaches found effective for learning literacy skills like word reading and vocabulary has been broadly questioned for use with preschool children, with specific concerns regarding potential negative effects on both learning and engagement (Brown, 2014; Brown & Lan, 2013), and amidst teachers' endorsement of contextualized practices (Lee & Ginsberg, 2007). In this study, we investigate how contextualization, defined as the extent to which letter instruction is embedded within meaningful discourse and words, affects learning and engagement during alphabet instruction of DLL and non-DLL preschool children. We compare learning of the same letter name and sound content in contextualized and decontextualized instruction matched for many teacher references to print, instructional time, and with children randomly assigned to contextualized (storybooks, whole words, children's names) or decontextualized (isolated letters) treatments.

Contextualized Approaches to Alphabet Learning

Contextualized approaches situate alphabet learning within meaning-focused activities, such as storybook or alphabet book reading, children's personal names, and children's emergent expressive writing. Previous studies reveal mixed results for alphabet learning in contextualized approaches with the strongest evidence for its utility in studies that combine storybook reading and explicit references to text (Justice, Pullen, & Pence, 2008; Justice, Kaderavek, Fan, Sofka, & Hunt, 2009). Advocates of contextualized approaches for teaching preschoolers' alphabet knowledge claim that contextualization responds to children's developmental stage of learning. It has the potential to increase letter learning through the engagement, meaningfulness, authentic print experiences, and individualization afforded by storybook reading and encountering letters within whole words, with a special niche ascribed to the value of children's names for this purpose (Burts et al., 1993; Craig, 2006; Culatta, Hall, Kovarsky, & Theadore, 2007; Culatta, Kovarsky, Theadore, Franklin, & Timler, 2003; Justice et al., 2009; Neuman, et al., 2000; Welsch, Sullivan, & Justice, 2003). Another potential benefit of contextualized alphabet instruction is that it may promote both print knowledge and language development. Language proficiency, or linguistic comprehension, is important in its own right and is crucial for literacy acquisition (Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003; Hoover & Gough, 1990; Kim, 2017). Alphabet instruction that also promotes English language development may be particularly beneficial to young DLLs with limited English proficiency who often enter kindergarten with more limited English early literacy experience.

Storybook reading is a strongly endorsed preschool practice for early language learning. Storybooks are also believed to be an important context for alphabet instruction because they make the meaningful and real-life "utility" of letters readily apparent to children (Strickland & Schickendanz, 2009). Mol, Bus, and de Jong, (2009) conducted a meta-analysis of the potential of shared storybook reading to benefit both oral language and print knowledge. Their overall conclusion was that storybook reading had the potential to benefit oral language and alphabet knowledge, with an overall effect size (*ES*) = 0.39 for alphabet knowledge. However storybook reading had no significant effect on the alphabet knowledge of preschool children. Importantly, child language status was not analyzed or reported.

An important reason for the apparent limitations of alphabet knowledge gain while reading storybooks is that there is minimal and usually implicit interaction with print, with little talk or attention directed to the print in the storybooks (Ezell & Justice, 2000; Hammett, van Kleeck, & Huberty, 2003; Yaden, Smolkin, & MacGillivray, 1993). For example, eye movement analyses of preschoolers' visual attention to print when looking at storybooks confirm minimal child attention to print for both print-salient storybooks and picture-salient storybooks (Evans & Saint-Aubin, 2005; Justice, Skibbe, Canning, & Lankford, 2005). Adult mediation directing attention to print either verbally (e.g., "The first letter in 'Dad' is D") or nonverbally (e.g., adult tracking finger along with the print) can increase the amount of time preschoolers look at print (Justice et al., 2008), a behavior that seems on logical grounds to be essential for learning alphabet letters. These findings have led researchers to investigate how explicit references to print during book reading may improve letter learning.

A number of studies in which print was explicitly referenced during storybook reading have reported significant letter gains when adults explicitly refer to print, including referring to individual letters during shared book reading (Gettinger & Stoiber, 2014; Justice, McGinty, Piasta, Kaderavek & Fan, 2010; McGinty, Breit-Smith, Fan, Justice, & Kaderavek, 2011; Zucker, Ward, & Justice, 2009). A series of studies by Justice and colleagues examined the benefits of explicit print referencing during read alouds (Justice & Ezell, 2000, 2002, 2004). Justice et al. (2009) and Justice et al. (2010) examined the effect of teacher use of print referencing during preschool storybook reading sessions over 30 weeks. Teachers were trained to use a set of specific probes (print organization, print meaning, letters, and words) over the course of an academic year. Children in the print referencing condition showed larger gains in alphabet knowledge (*ES* = 0.56) compared to a business as usual (BAU) treatment (Justice et al., 2009), and greater print learning (*ES* = 0.21) compared to a control condition in which teachers were provided and instructed to read the same books in the same order as in the print-referencing condition (Justice et al., 2010). Other studies report less positive results. Culatta et al. (2007) implemented letter and rhyme instruction contextualized within storybook reading, thematic play centers, mealtimes, free play, and art projects with 28 children in Head Start. Twelve letters were taught over 14 weeks. Teachers explicitly named and drew attention to letters. Letter name identification increased by 1 to 1.5 letters, a non-significant gain. The reviewed studies included predominantly or exclusively children whose first language was English, precluding analysis of the effects of storybook-contextualized alphabet instruction for children whose first language is other than English. Letter names rather than the more difficult letter sounds were typically both the referencing target and the outcome measured (e.g., Gettinger & Stoiber, 2014; McGinty et al., 2011; Mol et al., 2009).

The potential mechanisms that have been suggested for how references to print may improve letter learning are diverse. Print referencing is globally based on a social constructivist perspective suggesting that children gain knowledge about print through mediated interactions with adults (Justice & Ezell, 2002). More specific proposed cognitive mechanisms for how print referencing may increase print learning include children's increased attention to and time spent processing and talking about print forms (Justice et al., 2008; Piasta, Justice, McGinty, & Kaderavek, 2012), and the benefits to initial learning and long-term memory that may occur when adults provide explicit references to print (Piasta et al., 2012). Other research on how children visually process printed words reveals a word superiority effect for nonreaders who accurately remember whole words faster than the letters in the words (Berninger, 1987). Potential gains in English vocabulary knowledge from using storybooks to teach letters may lead to more phonological detail in word representations (Metsala & Walley, 1998), and therefore establish a stronger foundation for alphabet learning that may be particularly valuable for DLLs whose knowledge of English phonemes is emerging.

Children's names have also been suggested as a valuable context for alphabet learning. The proposed means by which children's names are believed to be valuable for learning letters is that personal names are highly salient, emotionally charged, and motivating for learning to recognize and write letters of the alphabet (Aram & Biron, 2004; Bloodgood, 1999; Levin, Both-de Vries, Aram & Bus, 2005; Welsch et al., 2003). Letters in children's names are amongst those they can first identify, and there are correlations between name writing and other measures of early literacy (Bloodgood, 1999; Huang, Tortorelli, & Invernizzi, 2014; Welsch et al., 2003). One of the first letters that children write in their invented spellings is the first letter of their name (Aram & Levin, 2001; Both-de Vries & Bus, 2008, 2010; Treiman, Kessler, & Bourassa, 2001). Based on this evidence and related beliefs about the potential of children's names to support alphabet learning, children's names were used as a second form of contextualization in the present study.

Decontextualized Approaches to Alphabet Learning

Within decontextualized alphabet instruction children's attention is directed to individual letters presented, for example, on cards, letter tiles, and letter puzzles, and the name or sound it represents. A predetermined instructional sequence is typically specified, and teachers extensively direct children's attention to letters and their names and sounds. We found nine previous experimental studies in which preschool children received alphabet instruction alone without other components such as phonological awareness instruction. Three randomized control trials included alphabet instruction delivered in a decontextualized format only (Roberts et al., 2018, 2019b; Cardoso-Martins, Mesquita, & Ehri, 2011). In the first two studies, the instructional model was based on providing robust PAL with specific routines to strengthen learning of the letter form and the letter label (name or sound). Comparison instruction was matched for time, small group context, taught letters, and other features. In one study (Roberts et al., 2018), decontextualized instruction was statistically significantly better for letter name (ES = 1.02) and letter sound identification accuracy (ES = 0.83), and letter naming speed (ES = 1.02) compared to alphabet instruction typically used by teachers. DLLs' overall growth on letter sounds (but not letter names), was less than that of non-DLLs. Engagement during instruction of both DLLs and non-DLLs was similarly high. In the second study (Roberts et al., 2019b) three types of decontextualized instruction were compared. Decontextualized instruction that provided more PAL learning compared to 1) instruction with less PAL combined with more instruction on correct articulation of names and sounds or 2) instruction with less PAL combined with more instruction on writing letter forms was statistically significantly better for letter name ID accuracy (*ES* = 0.43), letter sound ID accuracy (*ES* = 0.66), and letter sound ID speed (*ES* = 0.52). There were no differences between DLLs and non-DLLs in letter learning. In the Cardoso-Martins et al. (2011) study, letter sound ID was significantly better when letter name instruction preceded decontextualized letter sound instruction (*ES* = 0.71). These findings lead us to anticipate that for both DLLs and non-DLLs, alphabet learning and engagement will be promoted by decontextualized instruction.

In the additional six studies, decontextualized and contextualized activities were combined precluding examination of the independent effect of contextualization, and engagement during instruction was not measured. Children typically participated in some explicit instruction in which individual alphabet letters were shown, named, and discriminated, combined with alphabet books, children's names, pictures that began with target letter sounds, or book reading (Castles et al., 2009; Culatta et al., 2003; Lonigan, Purpura, Wilson, Walker, & Clancy-Menchetti, 2013; Murray, Stahl, & Ivey, 1996; Piasta et al., 2010c; Woodrome & Johnson, 2009). Comparison groups included business as usual, no letter instruction such as numbers, pictures or social contact (Castles et al., 2009; Piasta et al., 2010c, 2010; Woodrome & Johnson, 2009), or book reading (Lonigan et al., 2013; Murray et al., 1996). Outcomes in these studies varied markedly ranging from *ES* = 0.00 to 0.70. All but one (Lonigan et al., 2013) included predominantly non-DLL children or results were not disaggregated by DLL status.

We suggest that there are three primary reasons for expecting that decontextualized alphabet instruction may be more effective for letter name and letter sound learning than contextualized instruction, and perhaps particularly so for DLLs. The first is that decontextualized instruction can more easily facilitate the conditions for effective PAL that is a powerful learning mechanism for learning letter name and letter sound identification (Roberts et al., 2018, 2019b). These conditions include the contiguous, clear, and repeated pairing of the letter form and associated letter label by both teachers and children.

A second reason is that decontextualized instruction creates a clear, consistent, and unitary focus on letter learning. Preschool-age children's attention to task-relevant features of learning situations is fragile and neurobiologically mediated (Diamond, 1991). They have difficulty (a) ignoring task-irrelevant stimuli and keeping it from intruding into working memory (Harnishfeger & Bjorklund, 1994), and (b) deploying and maintaining efficient cognitive strategies (Siegler, 1996). Switching attention from discourse and word meaning to letters, and deploying selective attention to features of print when instructed to do so during meaning-focused activities taxes cognitive resources, increasing the difficulty in establishing letter form and letter label associations into long term memory (Kirschner, Sweller, & Clark, 2006; Sweller, 2016a,b). Children's predominant and natural orientation to meaning and communication may also make it difficult for them to suppress linguistic comprehension and expression during meaning-focused activities in order to focus on letters (Davidson, Amso, Anderson, & Diamond, 2006; Levin & Tolchinsky-Landsmann, 1989; Tomasello, 2009; Wells, 1986). In addition, the presumed benefit of meaningfulness of storybooks and whole words is likely to be attenuated and to increase cognitive load for preschoolers who are just beginning to learn English.

Finally, decontextualized instruction may be more effective because the accuracy and quality of the representations for the more ephemeral and difficult letter sounds may be clearer and more consistent (Elbro, 1998; Foy & Mann, 2006). Allophonic variation and interleaving of phonemes--the coarticulation that occurs when phonemes are encountered in whole words--may also make alphabet learning more difficult when alphabet instruction is contextualized within whole words. Allophonic variation can be illustrated by comparing the pronunciation of the phoneme /t/ in *cat, water* and *winter.* The effect of coarticulation can be appreciated in comparing the pronunciation of /n/ in *snake* compared to when it is spoken in isolation as /n/. Thus, the increased clarity, quality, and consistency of spoken alphabet letters and sounds may be another reason that decontextualized instruction would benefit DLLs.

Within the contextualized mode, letter names and sounds were taught during oral reading of storybooks, children's exploration of letters in personal names, reading of small alphabet books that presented one familiar word beginning with the target letter on each page, and rapid naming of target letters occurring as the first letter in words drawn from storybooks. Within the decontextualized mode of instruction, individual letters were introduced, children explored individual letters in games, in small alphabet books that presented one individual letter per page, and in rapid naming of target letters in isolation. Within each mode of instruction, equal numbers of explicit and repeated letter references and calls for child responding were embedded in each activity. We measured accuracy and speed of letter name and letter sound identification in both a contextualized and decontextualized format to equate learning assessment with instructional emphasis for both treatments. We measured overall language competence to determine if contextualized instruction may provide the benefit of language gain. We measured phonemic awareness as a measure of generalization of alphabet learning to the second most predictive early literacy foundation for learning to read, and in light of evidence of the reciprocal relationship between the two. We extended previous findings by directly comparing contextualized and decontextualized instruction for both DLL and non-DLL preschoolers.

To address the limitations, gaps, and questions raised in the previous alphabet research summarized above, we investigate the following research questions:

1. What is the influence of contextualized versus decontextualized instruction on alphabet knowledge and phonemic awareness?
2. How does contextualization influence children's engagement in instruction?
3. Do treatment effects differ for DLL and non-DLL children?

Method

Site Recruitment

The research sites were five elementary schools in a suburban district near a western U.S. city. Each school had one full-day and two half-day (one am and pm) preschool classes and typical of public-funded preschool in the US, enrollment was determined by low-income eligibility thresholds. All classrooms were English only settings. Participating preschool teachers, under a memorandum of understanding with the school district, agreed to delay their whole-class or small-group alphabet instruction on alphabet letters until after the intervention. The regular preschool program set aside during the intervention included a district-specified sequence for alphabet instruction for the school year and a set of alphabet materials from a commercial preschool literacy program that teachers were expected to use.

Sample and Random Assignment

After students were screened eligible based on pretest low letter knowledge, 132 children were randomized within classrooms into small groups of three to four. Small groups were then randomly assigned within each classroom to one of the two treatments. Age at pretest was M = 4.11 years (SD = 0.45). At study onset 48 children were 3-years-old and 84 children were 4-years-old. There were 74 females, and 48 DLL children. The standard score average for the sample on the PPVT was M = 73.91 (SD = 19.76) and on the pre-IPT was M = 59.22 (SD = 28.43), corresponding to the 15^{th} and 16^{th} percentile ranks, respectively. For DLLs, the mean rank on both assessments was 6th percentile whereas non-DLLs were in the 20th and 22nd percentiles. Information on whether or not the child was English only (non-DLL) or dual language learner (DLL) was reported by parents at enrollment and confirmed by classroom teachers. Almost all of the DLL children spoke Spanish as their first language. One hundred twenty-three children enrolled into the study knew the names of four or fewer of the 10 letters targeted for instruction, and four children knew five or six letter names. The final sample of 127 students in 34 small groups included 64 children in Decontextualized and 63 children in Contextualized instruction. Attrition included 3 students in the Decontextualized condition, and 2 students in the Contextualized condition.

Training

Testers and research assistant (RA) instructors included graduate students and retired teachers. Testers and instructors each received a one-day, 8-hour training presented by the first author in the administration of measures (testers) and the implementation of each of the conditions (instructors). Training for both groups stressed the importance of eliciting accurate responses from children and providing explicit models of precisely articulated letter names and letter sounds, and providing correct responses with child repetition on errors. Prior to instruction, all of the RAs (instructors and assessors) visited the preschool classrooms in which they were assigned to teach or assess, met the children, and introduced procedures for transitioning into small groups and participating in activities.

Alphabet Content

Ten letters that represent features of the alphabet that affect ease of learning were selected for instruction: A, B, D, F, H, I, K, M, S, and T. Consonants were chosen to balance letter features: acrophonic (B, D, K, T), nonacrophonic (F, H, M, S); position in the alphabet: A, B, D, F, beginning; H, I, K, M, middle; S, T, end; more widely/easily (A, B, T) and less well known (F, I, S) by young children; and, ease of articulation (e.g., not V, Z, J, L, R). All letters were presented in upper case, and letter names and letter sounds were taught in both treatments. Letters were selected to include a balance of letter names and sounds that have been found easier and more difficult to learn (Evans et al., 2006; McBride-Chang, 1999; Phillips, Piasta, Anthony, Lonigan, & Francis, 2012; Treiman, 1994). One new letter was taught each week over 4 days for 10 weeks. The sequence of letter instruction was: T, A, D, M, S, H, B, I, F, K and was designed to take into account these features.

The Contextualized and Decontextualized treatments were matched carefully for teacher letter references, calls for children to respond, and time (12-15 min lessons). Children were prompted by the instructor to say the target letter name and letter sound 16 times in each lesson, plus additional repeats during daily review and little book reading. The instructor mixed up the order of the letter labels (asking for name or sound first) throughout each lesson. If a child could not provide the name or sound label, the instructor provided it and had the child repeat it.

Decontextualized Alphabet Instruction

Daily review. The instructor presented 5 in. x 8 in. cards, one letter printed per card, to review all letters taught to date. The instructor then told the name and the sound for each letter and children chorally repeated. The instructor changed the order each day for asking for names or sounds first.

Introduce the new letter as letter card. The instructor slowly drew the new 5.5 in. x 4 in. letter card from a large envelop, then held up the letter card saying: “This is letter name ___, letter sound ___. Say letter sound ___, letter name ___. Look at letter name ___, letter sound ___ and pointed to the letter. Say letter name___. Say letter sound ___.” Children responded chorally to repeat the new letter name and sound three times.

Find the new letter. The instructor presented four cards for: the new letter, two previously taught letters, and one untaught letter (adjustment was made for the first two letters taught). After handing one card to each child the instructor asked, “Who has the letter name ___, letter sound ___?” The child with the new letter card showed it to the group and children chorally repeated the name and sound. This procedure was performed four times.

The animal game. Each child was given three 1 in. x 1in. letter cards (for the new letter, last taught letter, and next letter to be taught), and a picture of an animal whose name began with the new target letter (e.g., a bear picture for letter B). The instructor directed the children to “Close your eyes. Mix up the letters. Feed the (animal) letter sound/name ____and say letter sound/name ____.” Each child played the game four times.

Little letter book cumulative review. Each child was given a small 4 in. x 5 in. spiral bound book depicting the ten letters taught, one letter to a page. Children were prompted to “think” and “look” at each letter. Children were guided as they pointed to and chorally read the first two letters taught, and then children read the rest of the book aloud on their own.

Speed practice. Each child was given a sheet of twelve 1 in. letters comprised of three letters (weeks 1-6) or six 1 in. letters (weeks 7-10) randomly ordered and a small inked stamper. The instructor directed children to “Get ready to find letter name ____. Find all the letter names. Say the letter name and stamp it. Go fast. Ready, set, go.” Children were given 10 sec to say and stamp the letters in an array of 12 letters (four letters repeated three times). Children then used another array of 12 letters to quickly stamp and say the sound.

Decontextualized review day. Day four of each week provided review and practice in speeded name and sound retrieval of all taught letters. The instructor provided each child with a sheet of the randomly displayed taught letters (12 letters, with three letters repeated four times in the array for weeks 1-6; or with 16 letters, with four letters repeated four times in the array for weeks 7-12). The instructor directed children to touch one of the taught letters, varying whether asking for the name or sound first. Once all children found the letter, the instructor touched the letter and said the name and sound (or sound and name), asking “Can you find another letter name/sound, or sound/name?” This was repeated for each of the letters taught to date. Next children sang a song about letters having a name and a sound. Finally, children chorally read the little alphabet letter books.

Contextualized Alphabet Instruction

Daily review. The instructor presented 5 in. x 8 in. cards to review all letters taught to date. These were the cards used for the bear game in the decontextualized condition with the word for the animal printed below the picture (e.g., B, Bear). The instructor presented each card, pointed to the initial letter being reviewed, spoke the name and the sound for each letter, and prompted children to respond chorally with the name and sound for each letter card.

Introduce the new letter as story reading. One storybook was selected for teaching each of the 10 letters (e.g., *Kangaroo, Kangaroo Where Are You*?). Each storybook featured the target letter in upper case for an average of 18 letter appearances in the story. The instructor told children: “I will read you a story. The title is ____________.” The instructor then displayed on a small tabletop easel a 5.5 in. x 4 in. picture of a character from the book whose name began with the target capital letter (e.g., Kangaroo) with the name written on the card. The instructor introduced the picture card: “This is letter name ___, letter sound ___. Say letter sound ____, letter name ___ (pointed to letter). We will see lots of letter sound ___, letter name ____ in this story." The instructor read the story aloud, pointing to the pictures that matched the words or demonstrating the meaning with gestures and action. Each book was marked for 10 print-referencing points where the instructor stopped reading the story to call attention to a word that featured the target upper-case letter. The instructor used a set of 10 prompt cards on a ring: six prompts called attention to the target letter name and letter sound, two prompts called attention to letter name only, and two prompts called attention to letter sound only. The instructor read one of the prompts at each stopping point to draw children's attention to the target letter (e.g., "Look at this word. It is ___. It begins with letter ___ name /sound."; "What is this letter in the word ___? Let's say it together: ___ name/sound."). The order of the prompts was randomized each day. Children responded chorally to the prompts (repeating letter name, sound, or both).

Find the new letter in children's name cards. For each group the instructor placed children's name cards on the table, saying "Let's look for letter name ___, letter sound ___ in our names. Yes, there is the letter name/sound in _____'s name. Say ____ (letter name). Say ____ (letter sound). If the new letter did not appear in any of the children's names, the instructor presented the animal word card used to introduce that new letter. "Look. _____ (animal name) has letter name ____, letter sound___ in their name!"

Little word book cumulative review. The little word book review was identical to that for the Decontextualized treatment except that the books contained whole words that began with the target letters rather than 10 letters appearing in isolation.

Speed practice. The speed practice was identical to that for the Decontextualized treatment except that children stamped target letters appearing as the first letter in whole words taken from the storybooks.

Contextualized review day. The day four review lesson was identical to that for Decontextualized treatment except that the worksheet contained randomly displayed words that began with the taught letters, drawn from the stories. Table 1 summarizes the instructional routines for each treatment.

Review Week

During week 11 after the Thanksgiving weeklong break, in each treatment five letters were reviewed for two days followed by review of the remaining five letters for two days. The review activities were similar to the review day (day 4) instruction for each condition described above. Each lesson ended with children singing a short song about every letter having a name and a sound.

Measures

Two standardized measures of language and 10 experimenter measures were administered at pretest and posttest. Standardized measures were adapted for administration with young children by simplifying instructions and demonstrating how to indicate responses. For all tasks, two practice items and two success items were provided at the beginning and end of each test. All measures were administered individually, in a randomized order. There were four families of variables: alphabet in isolation accuracy, alphabet in isolation fluency, alphabet in word contexts, and distal outcomes. This latter family included two standardized language measures (the Peabody Picture Vocabulary test, and the pre-IPT, a measure of overall broader English language proficiency); and measures of phonological awareness, memory for printed words, dynamic decoding, and letter and name writing.[1] Sample item-level reliabilities (Cronbach's alpha) are

[1] Due to poor measurement characteristics, measures of memory for printed words, dynamic decoding, and letter writing are not reported.

reported for each measure (Table 2). Observations of each child's attention, participation, and affect during lessons were collected at approximately the 3^{rd}, 6^{th}, and 9^{th} week of instruction.

Alphabet Knowledge in Isolation

Letter name and letter sound identification (accuracy). Taught and untaught letter name and sound knowledge was tested separately at pretest and posttest. Individual letter cards of uppercase letters were separated into a deck of the taught letters and another deck of the untaught letters. The tester shuffled each deck prior to each administration. The tester presented a card and asked "What letter name?" or "What letter sound?" If the child responded with the name for the sound test or with the sound for the name test), the tester prompted by asking for the correct form (e.g., "Yes, that is the letter *sound*. What is the letter *name*?"). The score for taught letters was 10, and for untaught letters was 16. Order of assessing taught and not taught letters was counterbalanced. Reliabilities for taught letter names were 0.68 at pretest and 0.88 at posttest, with a pretest-posttest correlation of $r = 0.50$. Reliabilities for taught letter sounds were 0.63 at pretest and 0.88 at posttest, with a pretest-posttest correlation of $r = 0.31$.

Rapid letter name and letter sound naming (fluency). Children were tested separately on naming the ten taught letter names and sounds at pretest and posttest. For each test children were presented an 8" x 11" card with 32 upper-case letters randomly arranged in rows (with different arrangements for the names and sounds tests). Each of the taught letters appeared four times. The tester first presented a set of four practice (untaught) letters, modeling how to point and say each letter name or sound. Assessors provided the correct name or sound as needed. The tester then instructed the child to touch each letter and say its name or sound, allowing 3 sec for each item. The score for each measure was the total number of letter names or sounds correct in 30 sec, with a maximum score of 32. Item-level reliabilities for rapid letter name naming were

0.78 at pretest and 0.89 at posttest, with a pretest-posttest correlation of $r = 0.45$; reliabilities for rapid letter sound naming were 0.70 at pretest and 0.84 at posttest, with a pretest-posttest correlation of $r = 0.22$.

Alphabet Knowledge in Word Contexts

Taught letter name and letter sound identification in word context. In the Contextualized approach, target letters were featured in the initial position of the words. For testing knowledge of taught letter names and sounds, we tested identification of these letters in medial positions, expecting that testing in the initial or final position would be more similar to the test of identifying letters in isolation and potentially fail to capture any letter ID advantage for the contextualized group who learned letters in the context of whole words. Ten 4-four-letter pseudoword items featuring one of the taught letters in an interior (not initial or final) position (e.g., CL**A**P, C**H**OV) with this letter underlined served as stimuli. The tester shuffled the cards for each child, showed each word card, pointed to the underlined letter and asked the child to identify either the name or the sound of the underlined letter. One pass through this set of cards was tested on separate occasions for letter names and letter sounds. The total possible score was 10. Reliabilities for taught letter names in word context were 0.76 at pretest and 0.87 at posttest, with a pretest-posttest correlation of $r = 0.40$. Reliabilities for taught letter sounds in word context were 0.55 at pretest and 0.87 at posttest, with a pretest-posttest correlation of $r = 0.30$.

Distal Outcomes

Receptive vocabulary was measured at pretest and posttest with the norm-referenced *Peabody Picture Vocabulary Test-IIIA* (PPVT-IIIA; Dunn, & Dunn, 2006). The test was designed for ages 2.5 through 90 years. Students select a picture that best illustrates the meaning of an orally presented stimulus word. Testing is discontinued after the student misses eight out of a set of 12 items. For children ages 3-6, alpha coefficients reported in the manual range from 0.92 to 0.98, and test-retest reliability is reported to range from 0.92 to 0.94; validity, based on average correlations with measures of verbal ability are 0.91 (WISC-III VIQ), 0.87 (KAIT Crystallized IQ), and .82 (K-BIT Vocabulary). Sample reliability was 0.97 at pretest and 0.97 at posttest, with a pretest-posttest correlation of $r = 0.57$.

English language oral proficiency was measured at pretest and posttest with the IDEA Pre-IPT Oral Language Proficiency test (pre-IPT; Stevens, 2010), an age-appropriate assessment for children ages 3-5. It present a story line about a day in a park with opportunities for oral interaction between tester and child. Test materials include a large storyboard and story props. The tester uses the props to ask the child questions that require pointing, action, or verbal responses. Four domains of oral English are assessed: vocabulary, grammar, comprehension, and verbal expression. Raw scores range from 0-40. Test- retest reliability of 0.77 is reported in the technical manual. Sample reliability was 0.97 at pretest and 0.98 at posttest, with a pretest-posttest correlation of $r = 0.70$.

Phoneme awareness was measured with a test of initial phoneme isolation. A set of 10 words were chosen that had one of the each of the 10 target letters in the initial position and that could be pictured and recognized by children. After practice with three items teaching children to identify initial sounds by showing a picture, instructor repeating the initial sound, "/d/, /d/, /d/, duck," and child repeating the initial sound and its exemplar word, the tester presented one of the picture cards and said, "This is a ___. First sound?" The test items were: apple, ball, tail, moon, fish, kite, igloo, sun, dog, and hat. The total score was 10. The importance of PA for learning to read, and the close relationship between letter knowledge and PA led us to determine if letter knowledge gained through instruction might generalize to a phoneme-level skill necessary for learning to read words. Sample reliability was 0.81 at pretest and 0.89 at posttest, with a pretest-posttest correlation of $r = 0.45$.

Child engagement. Children's behavior and engagement (attention, participation, affect) in learning was rated during observations of the instruction at approximately the 3rd, 6th and 9th week of instruction. For each observation, each child present in the group was observed three times, beginning with a randomly selected child. Each child was observed for 10 sec followed by scoring their engagement behavior with a 3-point rating (1= high, 2 = medium, 3 = low). Anchors were provided for each behavior. Child attention was rated as high and on-task (looks at teacher, looks at learning task, looks at peer), medium on-task (sometime looks at teacher, task, or peer), or low on-task (ignores teacher or task, looks away, fidgets). Child participation was rated as high following (listens to teacher, repeats or speaks, follows, task diligence), medium following (sometimes listens, repeats, or follows), or low following (limited listens, repeats, or follows). Child affect was rated as mostly positive (smiles, body in sync with teacher, voice lilt, body upright, laughing, states verbal pleasure), mostly neutral (passive, quiet, not positive or negative), or mostly negative (sighing, frowning, blank stare, jumpy, looks down, states verbal displeasure). Observers recorded the specific condition (Contextualized or Decontextualized) and the specific letter treatment activity the instructor was implementing when a child was observed.

Child engagement observations were conducted by one research assistant with whom interrater reliability was established with the first author. During the first week of the study, 10 of the 34 small groups (approximately 30 percent) were selected for establishing interrater reliability (six from Contextualized and four from Decontextualized). Children in each group were observed simultaneously by two raters (first author and research assistant). Reliability estimates for the three engagement category totals of ranked items (high, medium, low) as well as the grand total were ≥ 0.95 ($p < .001$) using Pearson's correlation, and ≥ 0.91 ($p < .001$) using Kendall's tau. By the end of the study, engagement data available for analyses included 99 children (48 DLLs) across all 34 small groups (further described in Results). Cronbach's alpha reliability among the three engagement measure category totals (attention, affect, and participation) at the group level (aggregating across students within a group, with 34 groups), was .85.

Treatment integrity was determined by direct onsite observations of each RA instructor implementing each of the two conditions, coding yes = 1 or no = 0 to indicate whether treatment activities were correctly implemented. For the Decontextualized instruction, the observer coded the following eight items: correct treatment, get ready, daily review with large letter cards, introduce new letter with letter card, find who has new letter, little book with letters review, speed practice with letters, and close lesson. For the Contextualized instruction, the following eight items were coded: correct treatment, get ready, daily review with personal names, introduce new letter with book reading, find letters in animal cards with printed words, little book with words review, speed practice with words, and close lesson. The observer also rated instructional delivery level, scored on a 3-point rating scale (1 = low, to 3 = high). These six items were rated for both conditions: materials organized, models letters correctly, insures all children are responding, engages and redirects as needed, warm and enthusiastic, and pacing maintains child focus.

The same 10 small groups as used for engagement described above were observed simultaneously by two raters (first author and research assistant). Interrater agreement (percent of agreement among observers for simultaneous paired observations) was 100 percent for both lesson activity and instructional delivery ratings. By the end of the study, we conducted 77 fidelity observations (33 Contextualized, 34 Decontextualized). For Contextualized, instructional delivery averaged $M = 2.96$ ($SD = 0.13$) for Decontextualized instructional delivery averaged $M = 2.97$ ($SD = 0.08$).

Treatment intensity. The instructors reported student attendance weekly. Lesson attendance averaged 40 days/sessions. This represents a total of 30 minutes instruction for each of the ten taught letters, or approximately 9 hours total of instruction.

Results

Data Analysis Approach

A multilevel modeling approach was adopted since the appropriate primary unit of analysis is small group, rather than child, given that the two experimental conditions were implemented in small groups of size 2-4 children per group, averaging $M = 3.74$ children ($SD = 0.51$). Further, the multilevel approach accounts for the magnitude of the nesting (non-independence) of students ($N = 127$) within small groups ($N = 34$), as well as small group variation within preschools ($N = 5$). Classroom was omitted as a level since (a) we are not testing classroom-level predictors and (b) between-classroom variance is absorbed in the other levels of the model. Note also that each of the research assistants (RAs) served only at one school, so the preschool level also represents RA membership. All models were estimated in *HLM 7*.

Effect sizes. We computed an *approximate* effect size (*ES*) as the predicted difference between conditions or DLL status in standard deviations, determined by dividing the model-estimated mean difference (double the coefficient) by the approximate predicted pooled standard deviation. For the interaction term, we computed the *ES* as just the coefficient divided by the approximate predicted pooled standard deviation. The predicted pooled standard deviation was computed as the square root of the sum of the model variance component estimates (see Cohen, 1988; Vadasy, Sanders, & Herrera Logan, 2015; Vadasy, Sanders, & Nelson, 2015).

Type I error control. To avoid inflating Type I error from multiple analyses of the same sample, we employed a Dunn-Sidak *p*-value adjustment. For the gain score models, our per-outcome (familywise) *p*-value threshold for significance was .025 rather than .05 for each of our four families of variables: alphabet in isolation accuracy, alphabet in isolation fluency, alphabet in word contexts, and distal outcomes. For the engagement models, familywise *p*-value threshold for significance was .017 instead of .05 (three outcomes).

Preliminary analyses. Intercept-only models were specified to estimate intraclass correlations. Results showed that children's small group membership explained from 0 percent to 37 percent of variation in pretests and posttests, and 0 percent to 12 percent in pretest-posttest gains. Children's preschool membership explained from 0 percent to 15 percent in pretests and posttests, and 0 percent to 18 percent in pretest-posttest gains. On average, 8 percent of variation in pretests, and 9 percent of variation in posttests and pre-post gains was explained by small group and preschool combined. Preliminary analyses also included testing for pre-existing differences among instructional conditions and DLL status. Across measures, only one pretest difference between conditions was detected, and this was on Rapid Letter Naming, with the Decontextualized condition averaging approximately one-half point higher than Contextualized (*Coeff* = 0.25, *t*-test *p* = .044, *ES* = 0.37) (this finding does not take into account multiple analyses; when the alpha is adjusted the difference would not be significant; we also note that adding Rapid Letter Naming to these models does not change the substantive results for treatment effects). DLL children were significantly lower than their non-DLL peers on pretest language skills (Pre-IPT and PPVT, as well as their language composite z-score average; all coefficient *t*-test *p*s < .05). There were no significant differences found for condition or DLL status on any other pretest (*p*s > .05).

Contextualized versus decontextualized instruction effects. Outcome models were specified to test for experimental condition effects at the small-group level, controlling for pretest letter name knowledge at the child level (for the language outcome a pretest language composite combining PPVT and IPT pretests was used), on pretest-posttest gains. These models also tested the effects of DLL status (at the child level), and one cross-level Condition-by-DLL status interaction. For ease of results interpretation, categorical predictors were effect coded and continuous predictors standardized (experimental condition was coded +1 = Decontextualized instruction and –1 = Contextualized instruction; DLL status was coded +1 = DLL and –1 = Non-DLL). Pretest alphabet knowledge (total letters correctly named) was standardized in *z*-scores and was used as a covariate in all models except for the distal Language outcome (for this latter measure we used the composite average of *z*-scores of pretest PPVT and *z*-scores of the pretest Pre-IPT). Our general mixed model for each of our outcomes was as follows.

$$
\begin{aligned}
\textit{Pre-Post Gain}_{\mathrm{ijk}} = \quad & \gamma_{000} + \gamma_{100} * \textit{ZPretest}_{\mathrm{ijk}} + \gamma_{200} * \textit{DLLeffect}_{\mathrm{ijk}} \\
& + \gamma_{010} * \textit{Conditioneffect}_{\mathrm{jk}} \\
& + \gamma_{210} * \textit{Cond}_{\mathrm{jk}} * \textit{DLL}_{\mathrm{ijk}} \\
& + U_{00\mathrm{k}} + U_{0\mathrm{jk}} + r_{\mathrm{ijk}}.
\end{aligned}
$$

In the model above, the pretest-posttest gain for the *i*th child in the *j*th small group in the *k*th preschool/RA is estimated as the sum of: the conditional mean gain between pretest and posttest (γ_{000}); the child-level effect of pretest (either pretest total letter names or pretest language) on gains (γ_{100}), in standard deviations; the child-level effect of DLL status on gains, compared to average (γ_{200}); the small-group level effect of experimental condition (γ_{010}) on gains, compared to average (γ_{200}, double the coefficient to obtain the mean difference between Decontextualized and Contextualized treatments, all else held constant), the cross-level interaction between DLL status and experimental condition on gains (γ_{210}), and the residual errors among preschools/RAs, small groups, and children, respectively (U_{00k}, U_{0jk}, and r_{ijk}). Tables 2 and 3 show descriptive statistics for the full sample and disaggregated by DLL status. Table 4 shows zero-order correlations amongst variables used in analyses. Descriptive statistics and correlations are not adjusted for dependencies in the data.

Pretest-posttest outcome gains. Tables 5-9 display the multilevel model results for pretest-posttest gains, controlling for pretest, for each family of comparisons, including: alphabet knowledge in isolation accuracy, alphabet knowledge in isolation fluency, alphabet knowledge in word contexts accuracy, and distal outcomes (phoneme awareness and language). The *p*-values that are statistically significant after Dunn-Sidak adjustment for multiple tests are boldfaced.

Children across both conditions and DLL statuses made statistically significant pretest-posttest gains except for language, all else held constant. In addition, results of pretest effects showed that higher pretest alphabet knowledge (total letter names identified at pretest) was significantly predictive of better gains on taught letter names and sounds (alphabet knowledge in isolation accuracy, Table 5), rapid letter names and sounds (alphabet knowledge in isolation fluency, Table 6), and letter sounds in context (but not letter names in context, Table 7). For distal outcomes, pretest alphabet knowledge was not predictive of phoneme awareness gains, whereas children with higher language composite pretest scores were predicted to have lower pretest-posttest language gains, all else held constant (Table 8).

The results of the models for experimental condition and DLL status showed that children in the Decontextualized condition small groups had statistically significantly greater gains than children in the Contextualized condition small groups on taught letter sounds (alphabet knowledge in isolation accuracy) by an estimated 1.54 points (double the coefficient for effect-coded predictors), *ES* = 0.53 standard deviations, and on phoneme isolation by an estimated 1.20 points, *ES* = 0.45 standard deviations. Importantly, there were no significant differences among DLL and non-DLL children on pretest-posttest gains, nor were there any significant Condition*DLL interactions (all *p*s > .10).

Post hoc analyses. A post hoc analysis comparing children's learning of taught and not-taught letter names and letter sounds was performed to evaluate the extent to which pretest-posttest gain scores on letter name and letter sound identification were due to instruction. We computed and compared arcsine-transformed posttest percentage scores at the small group level for the 10 taught and 16 untaught letter names and letter sounds. Letter name and letter sound gains were statistically significantly higher for the taught than the untaught letters. For letter names, the results were $t(33) = 12.96$, $p < .001$; *M* taught = 0.57 (*SD* = 0.25); *M* untaught = 0.17 (*SD* = 0.12), *ES* = 2.22 For letter sounds, the results were $t(33) = 11.81$, $p < .001$; *M* taught = 0.50 (*SD* = 0.25); *M* untaught = 0.04 (*SD* = 0.07), *ES* = 2.87.

We also performed a post hoc analysis of distributional patterns in the data in the hope of gaining some insight into the characteristics of the children who had a gain of less than three letter names or letter sounds. Chi-square analyses showed that neither DLL children nor three-year-olds were disproportionately represented in the lowest performing group for letter name gains: DLL status χ^2 ($df = 2$, $N = 40$) = 0.48, $p > .05$; age group χ^2 ($df = 2$, $N = 40$) = 0.56, $p > .05$), nor for letter sound gains: DLL χ^2 ($df = 2$, $N = 40$) = 2.71, $p > .05$; age group χ^2 ($df = 2$, $N = 40$) = 1.79, $p > .05$. However, for those children who learned less than 25 percent of the taught letter sounds (but not letter names) the number of lessons attended and PPVT receptive vocabulary were significantly correlated with gains: lessons attended $r(40) = 0.41$, $p = .007$; PPVT $r(40) = 0.31$, $p = .040$.

Children's engagement. Children's engagement during instruction was also estimated using a 3-level model identical to the one described above for gains, except that there was no pretest covariate. There were $N = 99$ children who were present during all three observations; however, all 34 small groups and 5 preschools/RAs are represented (Table 9).

Multilevel model results for engagement during instruction are reported in Table 10. Although not shown in the table, intercept-only models revealed that the small-group intraclass correlations ranged from 22 percent to 38 percent (averaging 31 percent), and that preschool/RA intraclass correlations ranged from 0 percent to 3 percent (averaging 1 percent) across engagement measures, indicating that there was a substantial amount of variation between small groups on engagement. Conditional means (Table 10), show that across conditions and DLL statuses, students averaged relatively high on the engagement scales overall (25.15, 26.10, 26.42 on Attention, Participation, and Affect, respectively, with each ranging from 9 to 27 points). Interestingly, small groups in the Decontextualized experimental condition averaged higher on Attention than the Contextualized condition by 1.30 points when doubling the coefficient for Condition, *ES* = 0.67. On the grand total of engagement formed by summing each child's Attention, Participation, and Affect across the beginning, middle and end of the intervention, the Decontextualized condition averaged 2.58 points higher than the Contextualized condition, *ES* = 0.73. No significant DLL or Condition*DLL interaction effects were evident.

Discussion

Alphabet Learning, Phonemic Awareness, and Language

In both the Contextualized and Decontextualized instruction preschool children showed statistically significant pretest to posttest gain on all alphabet measures, and these gains on letter ID can be attributed to instruction. Furthermore, children in both groups demonstrated notable attainment toward meeting end-of-preschool alphabet knowledge and PA benchmarks supportive of subsequent success in learning to read. Thus, the study suggests that both types of instruction benefitted alphabet learning. There was no pretest to posttest gain on the language composite.

Yet, Decontextualized instruction led to statistically significantly better outcomes on two important early literacy skills. Children in the Decontextualized treatment made reliably and meaningfully greater gains on letter sound ID of letters in isolation. This finding is particularly noteworthy given the evidence that letter sounds are more difficult to learn than letter names (Roberts et al., 2018; Boyer & Ehri, 2011; Treiman & Kessler, 2003). The associated effect size was *ES* = 0.55. We point out that this effect size was obtained when instruction in both treatments contained many and an equal number of explicit references to letter names and letter sounds. Previous studies on storybook contextualization with print referencing report a similar effect size on letter name learning when compared to instruction in which no explicit print referencing was specified (Justice et al., 2009). The obtained effect size is notably larger than the average *ES* = 0.21 reported in favor of print-referencing in which alphabet letters are referred to during storybook reading (Justice et al., 2010) compared to shared reading of storybooks that did not include print-referencing.

A number of procedures were taken to evaluate the educational meaningfulness of the overall gains and treatment differences in gains. We computed the U_3 statistic (Cohen, 1988), based on effect sizes, to compare the percentage of children in the Decontextualized treatment that exceeded the mean gain of children in the Contextualized treatment; referenced the average growth across treatments and between treatments against a range of benchmarks for end-of-preschool letter name and initial phoneme isolation reported in previous studies; and examined the percentages of children at the high and low ends of the distribution at pretest and posttest. The U_3 analysis showed that 66 percent, 70 percent, and 76 percent of the children in the decontextualized group had higher gains than the mean gain of the contextualized group on phoneme isolation, letter sounds in isolation, and engagement, respectively. The obtained posttest scores for letter names would accrue (assuming a stable rate of growth for 35 weeks of preschool) to average end-of-preschool letter name scores of 19.40 and 16.90 for the Decontextualized and Contextualized treatments, respectively. This average score for end of preschool for the Decontextualized treatment exceeds the 18 letter name benchmark recommended by Piasta, Petscher, and Justice (2012) and falls a little short of the benchmark for the Contextualized treatment. Although we were not able to locate empirically established preschool benchmarks for letter sounds, the 19.25 letter sounds projected for the Decontextualized treatment and 13.13 letter sounds projected for the Contextualized group represent meaningful educational attainment toward letter sounds goals suggested by training studies of preschool letter sound learning (for review, see McGee & Dail, 2013). Analysis of posttest frequency distributions for the number of children scoring at the low end (scores of less than 25 percent correct) of the letter name and letter sound distributions revealed that at pretest 87 percent (letters) and 97 percent (sounds) of children were low scorers, while at posttest these percentages had dropped to 31 percent and 34 percent, respectively. The extent of this reduction in low performance across treatments is another indicator of a meaningful educational outcome.

Decontextualized alphabet instruction also led to statistically significantly greater gain on phonemic awareness in comparison to Contextualized instruction with an *ES* = 0.45. This finding provides evidence of generalization of alphabet learning to the second most predictive early literacy foundation of beginning reading success. There was some floor effect on this measure. Invernizzi, Sullivan, Meier, and Swank (2004) identified a score of 5-7 of 10 items on an initial phoneme ID task at the end of preschool as a PA goal for subsequent adequate reading achievement. The PA scores from the present study would project to 5.60 for Contextualized instruction and 10.71 for Decontextualized instruction. Thus, children in the Contextualized group can be seen as on track for benchmarked PA achievement with children in the Decontextualized treatment on track for exceeding this benchmark. An advantage of the Decontextualized instruction for phonemic awareness may have been its isolation of the printed letters in the 16 target letter exposures per lesson. This isolation may have helped children apply this orthographic knowledge in the difficult phonemic awareness test by (a) visualizing the letters for the initial sounds tested, and (b) serving as a memory aid for the initial phonemes (see Castles, Wilson, & Coltheart, 2011). This result is consistent with other reports that development of letter sound knowledge and phonological awareness are mutually facilitating (Burgess & Lonigan, 1998; Foy & Mann, 2006). Both skills support learning to decode and spell words, and orthographic mapping of words into long-term memory. We emphasize that this generalization of Decontextualized instruction was found on a phoneme-level task that mirrors the sensitivity to initial phonemes that children must apply when they first begin to decode words. To address measurement challenges in assessing very young children we developed a phoneme awareness measure with an initial dynamic teaching component in which we modeled, children practiced, and corrective feedback was given on the initial phoneme identification task; tested only phonemes taught during LN + LS instruction; and, accompanied oral presentation of test word items with pictures.

Contextualized instruction was found to be as effective as Decontextualized instruction for easier and instruction-specific letter name learning. Thus, the results for letter naming from the present study are consistent with others indicating some benefit for explicit, contextualized letter name instruction. We emphasize that the benefit to letter name identification in the Contextualized treatment occurred in the presence of extensive PAL embedded within 10 letter-referencing probes during book reading; combined with looking for letters in children's names, reading individual letter books with target letters embedded in common one-syllable words, and speeded practice in recognizing and naming letters in storybook words. Findings from a recent study (Roberts & Sadler, 2019a) identify that a form of contextualized instruction in which a close and extensive meaningful integration of letter forms letter sounds, and narratives is established may be highly effective for letter sound ID and phonemic awareness (identifying initial phonemes in spoken words). Specifically embedding letter forms within pictures of letter characters whose character name contains the target letter sound accompanied by imaginary narratives about the letter character in which many words beginning with target letter sounds are included significantly increased letter sound learning and phonemic awareness compared to other instruction.

We included equivalent pre- and post-tests in which letter knowledge was tested in both a decontextualized and contextualized format in order not to privilege the instruction-measurement linkage for one treatment more than the other. Children receiving Contextualized instruction did not do better than children who received Decontextualized instruction on tasks in which tested alphabet letters were embedded in whole words taken from storybooks or in common one- to two- syllable words likely to be familiar to many preschool children.

Language was tested at pretest and posttest. There was no statistically significant gain overall on the language composite formed of measures of vocabulary and broader language competence. Thus, there was no evidence that either treatment facilitated or compromised language development. We may have detected vocabulary learning differences with a treatment-specific measure in which we tested words drawn from the storybooks, consistent with a great deal of other research documenting that treatment-specific vocabulary gains are often obtained and general vocabulary growth is limited (Marulis & Neuman, 2010).

On five of six alphabet measures, those children who started higher gained more. This finding replicates our earlier findings in which literacy scores at preschool entry were significantly related to alphabet learning. These relationships among literacy competencies when children enter preschool and subsequent learning suggest the potential importance of toddlerhood or home environments for supporting early literacy foundations.

Engagement

Motivation, engagement, and literacy achievement are related as early as preschool and the relationship may be bidirectional (e.g., Dally, 2006; see Morgan & Fuchs, 2007 for review). Concern has been expressed about the potential negative effects of decontextualized instruction on preschooler's engagement in general (e.g., Bredekamp & Copple, 1997; Stipek et al., 1998). A concomitant belief is that contextualized alphabet instruction will be more engaging because it will be delivered within meaningful activities and words, authentic text and language, with engagement mediating learning (Craig, 2006; Culatta et al., 2003; Justice et al., 2009; Neuman, et al., 2000). A previous study on print-referencing during book reading found that print-referencing was particularly supportive for children with less strong attentional skills (McGinty, Justice, Piasta, Kaderavek, & Fan, 2012). In the current study, children in the Decontextualized condition demonstrated statistically significantly more attention and overall engagement, based on individual observations of all children present in lessons at the beginning, middle, and end of the intervention, with a large effect size of *ES* = 0.73. Engagement scores–averaged across the beginning, middle, and end of the intervention–were 27 percent higher in the Decontextualized than in the Contextualized condition. The notable size of this advantage and evidence of the relationship of engagement and reading achievement highlights the educational meaningfulness of this finding. We speculate, consistent with our observations during lessons, that the story portion of the lesson was the most challenging of the lesson routines for children to attend to and may have initially distracted children from focusing on letters. It is plausible that for the novice English learners who began to receive instruction just three weeks after they first started preschool even these very simple storybooks for which instructors were trained to use non-verbal practices such as gestures, actions, and picture-pointing to assist access to meaning were very challenging.

Correlations indicate that engagement was overall modestly and significantly related to proximal outcomes including letter name ID (r = .24), letter naming fluency (r = .27), and letter sounds in words ID (r = .23). Correlations by language status showed that for non-DLLs 7/10 correlations between alphabet learning and attention and 6/10 between alphabet learning and participation were statistically significant. In contrast, for DLLs these same correlations were very small and not significant. This pattern is consistent with the idea that alphabet learning for non-DLLs is more dependent upon engagement than is alphabet learning for DLLs.

Dual Language Learners

There were no differences between DLL and non-DLL children in letter learning, phonemic awareness, or engagement. This is the second study in which we have found that the same basic decontextualized, PAL-based instruction was effective for learning and engagement outcomes for both groups of children (Roberts et al., 2019b). In fact, DLLs' means were higher, although not significantly so, on LN and LS ID than those of their non-DLL counterparts. These results are consistent with those reported for older DLLs in which basic reading processes and the benefits of explicit instruction for acquiring English reading foundations has been demonstrated (August & Shanahan, 2017; Nassaji, 2014), and extend these findings to include levels of engagement during instruction that were not different for DLLs and non-DLLs. Contextualized instruction in which letter sounds and letter names were embedded in whole words may have led to increased difficulty for DLLs because of the allophonic variation and phonetic changes resulting from coarticulation of phonemes in whole words,. We have provided theoretical reasons related to children's development of attention, inhibition, strategy deployment, cognitive load, and the potential challenges for letter learning that may be present in meaning-focused contexts for all children and particularly so for DLLs. We suggest that the decontextualized context provided an instructional accommodation for the learning needs of DLLs such that their learning and engagement was on a par with their non-DLL counterparts.

Limitations

An important limitation is that in spite of evidence of overall gains found on several measures, approximately 30 percent and 34 percent of children learned fewer than 3 letter sounds or letter names. Recently it has been suggested that letter knowledge and other constrained reading skills are easier to learn over a shorter course of learning than less constrained skills such as vocabulary and comprehension (Paris, 2005). Yet PAL, the reliance on phonology when paired associations between letter forms and their verbal labels must be learned, and the dependence of this learning on instruction, has led others to conclude that constrained skills are very difficult to learn for many children, and dependent upon robust and high-quality instruction (Kilpatrick, 2015; Seidenberg, 2013).

Additional limitations include that we had no measures of home language which would have allowed a richer analysis of DLLs' language profiles. We relied upon extrapolated rather than observed end-of-year performance in our discussion of benchmarks. Importantly we have no longitudinal follow-up to actual reading. Coding for engagement behaviors was necessarily not blind to treatment. Even with scripted lessons that were matched for letter exposures and requests for child responses, without audio or videotaping of the sessions, we cannot rule out that small variations in exposures and responses may have occurred. We investigated instruction for only one of the several important components of early literacy, and highlight the finding that neither DLL nor non-DLL at-risk preschoolers made standardized gains in English vocabulary or overall language.

Instructional Implications

Preschool educators can be encouraged to provide the decontextualized PAL-based instruction of letter names and letter sounds utilized in this study with the expectation that it will be particularly beneficial for letter sound learning, phonemic awareness, and engagement of both DLLs and non-DLLs. The evidence of superiority for decontextualized instruction across cognitive and motivation-related domains strengthens the case for selecting decontextualized instruction. Similar to our earlier studies (Roberts et al., 2018, 2019b) few differences in alphabet learning were found between DLLs and non-DLLs. We are heartened by these findings indicating the utility of PAL-based instruction for both groups of children. This study and other recent studies describe a worrisome number of at-risk preschool children who show limited response to instruction, (Carta et al., 2017; Lonigan & Phillips, 2016; Wanzek & Vaughn, 2008).

The preschool children in this study averaged at pretest in the 15th percentile on language skills, and knew an average of two letter names, documenting their at- risk status. The correlation of letter sound learning with number of lessons attended only for the lowest performing children is consistent with the idea that there are children who are especially dependent upon instruction for letter learning (Lonigan & Phillips, 2016). Identification of and additional instructional support for these children in preschool should be considered. Teacher professional development on the value of and best practices for providing decontextualized instruction is likely warranted due to teacher preference for contextualized instruction and previous evidence of the limitations in preschool and elementary teachers' knowledge of the structure of the English language (Cunningham, Etter, Platas, Wheeler, & Campbell, 2015; Moats & Foorman, 2003). It is noteworthy that similar levels of letter sound and letter name learning were achieved in the Decontextualized treatment. This finding is particularly important given that letter sounds are more difficult to learn than letter names. We emphasize that effective decontextualized instruction for teaching alphabet knowledge included many opportunities for PAL, was implemented in a number of participatory activities and games that provided some degree of self-regulation, and robustly utilized techniques to evoke active verbal responding. Decontextualized alphabet instruction can be recommended to help both DLL and non-DLL preschool children acquire the letter sound and phonemic awareness foundations for learning the decoding and orthographic mapping skills necessary for accurate and fast word reading, and these skills are the two strongest predictors for beginning reading success.

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Table 1.

Detailed Lesson Sequence for Contextualized and Decontextualized Treatments

Contextualized Instruction

Daily Review

1. All letters taught to date reviewed on cards with names of storybook characters written below animal picture.
2. Instructor points to target letter and provides letter name and letter sounds.
3. Children chorally repeat letter name and sound.

Introduce Letter

4. Storybook is introduced. A picture of a character from the storybook is shown. The character name that began with the target letter is written below the picture.
5. Instructor points to target and provides the letter sound and letter name.
6. Children chorally repeat (1 time).

Storybook Reading

7. Teacher reads storybook pointing to pictures, using gestures and action to show meaning.
8. Teacher presents 10 randomly ordered prompts to refer to target letter name and letter sound while reading story.
9. Teacher models response to prompts, children chorally repeat (10 times).

Find Target Letter in Children's Names

10. Children in the group names are placed on the table.
11. Children look for and say any target letter sound and letter name found.
12. If there no letters in names, the picture of character + name from the story is used.
13. Teacher models and children chorally repeat name and sound (1-4 times).

Little Letter-Book Reading: One word beginning with target letter per page.

14. Teacher guides children to "think" & "look" at each of first two letters that had been taught.
15. Children repeat each letter name and letter sounds for the first two pages.
16. Children individually read the letter name and letter sound for the rest of the letters that have been taught.
17. Teacher models and corrects as needed.

Speed Practice

18. Children stamp target letters from an array of 12-16 storybook words (3-4 repeats).

Decontextualized Instruction

Daily Review

1. All letters taught to date reviewed using individual letter cards.
2. Instructor points to target letter and provides the letter name and letter sound.
3. Children chorally repeat letter name and sound.

Introduce Letter

4. New letter for the day is introduced. A letter card with a single target letter is shown.
5. Instructor points to target and provides the letter sound and letter name.
6. Children chorally repeat (repeat 4 times).

Find the New Letter Game

7. Teacher passes out four single letter cards, one showing the target letter.
8. The child who has the new letter shows it to the group.
9. Children chorally repeat the letter name and letter sound (repeat 4 times).

Animal Game

10. Children close their eyes, mix up three letters, open their eyes, find the target letter and feed it to an animal whose name begins with the target letter and say the letter sound and letter name (repeat 4 times).

Little Letter-Book Reading: One letter per page.

11. Teacher guides children to "think" and "look" at each of the first two taught letters
12. Children repeat each letter name and letter Sounds for the first two pages.
13. Children individually read the letter name and letter sound for the rest of the letters that have been taught.
14. Teacher models and corrects as needed.

Speed Practice

15. Children stamp the individual target letters from an array of 12-16 letters (3-4 repeats).

Table 2.

Descriptive Statistics of Outcome Measures for Full Sample

Measure	*Items*	Pretest α	Pretest *N*	Pretest *Min*	Pretest *Max*	Pretest *M*	Pretest *(SD)*	Posttest α	Posttest *N*	Posttest *Min*	Posttest *Max*	Posttest *M*	Posttest *(SD)*	*Pre-Post r*
Alphabet in Isolation Acc														
Total Letter Names ID (Pre)	26	.87	127	0	15	2.39	(3.54)	--	--	--	--	--	--	--
Taught Letter Names ID	10	.68	127	0	6	0.91	(1.40)	.88	127	0	10	5.25	(3.42)	.50
Taught Letter Sounds ID	10	.63	127	0	4	0.20	(0.68)	.88	127	0	10	4.65	(3.39)	.31
Alphabet in Isolation Fluency														
Rapid Letter Names	40	.78	127	0	7	0.47	(1.36)	.89	126	0	24	6.09	(5.46)	.45
Rapid Letter Sounds	40	.70	127	0	7	0.22	(0.83)	.84	127	0	16	3.72	(3.92)	.22
Alphabet in Word Contexts														
Taught Letter Names ID	10	.76	127	0	7	0.91	(1.61)	.87	126	0	10	4.93	(3.37)	.40
Taught Letter Sounds ID	10	.55	127	0	4	0.45	(0.91)	.87	126	0	10	3.95	(3.32)	.30
Distal Outcomes														
Phoneme Awareness	10	.81	127	0	10	1.28	(2.03)	.89	126	0	10	2.37	(2.97)	.45
Language PPVT	96	.97	127	0	75	26.98	(18.04)	.97	126	3	82	36.24	(18.95)	.57
Language Pre-IPT	40	.97	127	0	49	12.57	(12.05)	.98	126	0	40	17.47	(13.44)	.70
Language Composite (Z)	--	--	127	-1	2	0.00	(0.90)	--	126	-1	2	-0.01	(0.91)	.84

Note. N = 127 children in 34 small groups, 5 schools (1 RA per school); one DLL child missing data on several posttest measures; all measures in raw scores; α = sample-based internal consistency computed as Cronbach's alpha; Pre-Post r = correlation between pretest and posttest score; Language Composite = mean of z-scored PPVT and z-scored Pre-IPT scores.

Table 3.

Disaggregated Descriptive Statistics for Outcome Measures by Experimental Condition and DLL Status

Measure	Decontextualized Instruction Condition (*n* = 64)						Contextualized Instruction Condition (*n* = 63)					
	Pretest		Posttest		Pre-Post Gain		Pretest		Posttest		Pre-Post Gain	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
All Children												
Alphabet in Isolation Acc												
Total Letter Names ID (Pre)	2.52	(3.55)	--	--	--	--	2.25	(3.56)	--	--	--	--
Taught Letter Names ID	0.88	(1.45)	5.67	(3.16)	4.80	(2.75)	0.94	(1.35)	4.83	(3.63)	3.89	(3.17)
Taught Letter Sounds ID	0.27	(0.82)	5.55	(3.08)	5.28	(2.96)	0.13	(0.49)	3.75	(3.46)	3.62	(3.35)
Alphabet in Isolation Fluency												
Rapid Letter Names	0.72	(1.74)	6.83	(5.81)	6.11	(5.13)	0.22	(0.75)	5.32	(5.00)	5.10	(4.80)
Rapid Letter Sounds	0.28	(1.06)	4.44	(4.13)	4.16	(4.12)	0.16	(0.51)	3.00	(3.57)	2.84	(3.41)
Alphabet in Word Contexts												
Taught Letter Names ID	0.97	(1.65)	5.36	(3.13)	4.39	(2.75)	0.86	(1.57)	4.48	(3.57)	3.61	(3.42)
Taught Letter Sounds ID	0.39	(0.92)	4.45	(3.32)	4.06	(3.16)	0.51	(0.91)	3.44	(3.26)	2.94	(3.13)
Distal Outcomes												
Phoneme Awareness	1.48	(2.03)	3.06	(3.32)	1.58	(3.01)	1.08	(2.02)	1.65	(2.36)	0.55	(2.34)
Language PPVT	26.14	(19.30)	36.89	(19.95)	10.75	(13.10)	27.84	(16.77)	35.56	(17.99)	7.82	(11.36)
Language Pre-IPT	14.56	(13.47)	18.63	(13.49)	4.06	(8.47)	10.56	(10.12)	16.27	(13.38)	5.66	(10.86)
Language Composite (Z)	0.06	(1.01)	0.06	(0.96)	0.00	(0.50)	-0.06	(0.78)	-0.07	(0.86)	-0.01	(0.53)

Note. *N* = 126 or 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; one DLL child in Contextualized condition missing several posttest measures; all measures in raw scores; Language Composite = mean of z-scored PPVT and z-scored Pre-IPT scores.

Table 3. (Continued)

Measure	Decontextualized Instruction Condition (*n* = 64)						Contextualized Instruction Condition (*n* = 63)					
	Pretest		Posttest		Pre-Post Gain		Pretest		Posttest		Pre-Post Gain	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Dual Language Learners (DLLs)												
Alphabet in Isolation Acc												
Total Letter Names ID (Pre)	1.50	(3.08)	--	--	--	--	2.77	(3.62)	--	--	--	--
Taught Letter Names ID	0.42	(1.24)	5.19	(3.11)	4.77	(2.86)	1.32	(1.43)	5.59	(3.58)	4.27	(3.15)
Taught Letter Sounds ID	0.19	(0.63)	5.62	(3.14)	5.42	(3.02)	0.27	(0.77)	4.45	(3.43)	4.18	(3.26)
Alphabet in Isolation Fluency												
Rapid Letter Names	0.31	(1.23)	6.04	(4.97)	5.73	(4.38)	0.36	(1.14)	6.57	(5.41)	6.19	(4.93)
Rapid Letter Sounds	0.31	(1.38)	3.92	(4.20)	3.62	(4.42)	0.23	(0.75)	3.09	(3.22)	2.86	(2.90)
Alphabet in Word Contexts												
Taught Letter Names ID	0.46	(1.10)	4.58	(3.31)	4.12	(3.01)	1.23	(1.97)	5.36	(3.44)	4.14	(2.98)
Taught Letter Sounds ID	0.42	(0.86)	4.12	(3.35)	3.69	(3.26)	0.50	(0.86)	3.76	(3.39)	3.29	(3.08)
Distal Outcomes												
Phoneme Awareness	1.19	(1.65)	2.96	(3.36)	1.77	(3.09)	1.50	(2.61)	1.45	(2.52)	-0.05	(2.57)
Language PPVT	14.27	(13.32)	24.08	(13.89)	9.81	(10.40)	17.82	(15.61)	26.48	(19.52)	9.43	(10.60)
Language Pre-IPT	5.54	(7.12)	10.46	(9.00)	4.92	(4.54)	6.64	(8.78)	11.68	(12.27)	5.05	(8.03)
Language Composite (Z)	-0.64	(0.64)	-0.58	(0.63)	0.06	(0.33)	-0.50	(0.70)	-0.49	(0.93)	0.01	(0.40)

Note. *N* = 126 or 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; one DLL child in Contextualized condition missing several posttest measures. all measures in raw scores; Language Composite = mean of z-scored PPVT and z-scored Pre-IPT scores.

Table 3. (Continued)

Measure	Decontextualized Instruction Condition (*n* = 64)						Contextualized Instruction Condition (*n* = 63)					
	Pretest		Posttest		Pre-Post Gain		Pretest		Posttest		Pre-Post Gain	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Non-DLLs												
Alphabet in Isolation Acc												
Total Letter Names ID (Pre)	3.21	(3.73)	--	--	--	--	1.98	(3.53)	--	--	--	--
Taught Letter Names ID	1.18	(1.52)	6.00	(3.19)	4.82	(2.71)	0.73	(1.28)	4.41	(3.64)	3.68	(3.20)
Taught Letter Sounds ID	0.32	(0.93)	5.50	(3.08)	5.18	(2.96)	0.05	(0.22)	3.37	(3.46)	3.32	(3.40)
Alphabet in Isolation Fluency												
Rapid Letter Names	1.00	(1.99)	7.37	(6.33)	6.37	(5.63)	0.15	(0.42)	4.68	(4.71)	4.54	(4.70)
Rapid Letter Sounds	0.26	(0.79)	4.79	(4.10)	4.53	(3.92)	0.12	(0.33)	2.95	(3.79)	2.83	(3.69)
Alphabet in Word Contexts												
Taught Letter Names ID	1.32	(1.88)	5.89	(2.93)	4.58	(2.59)	0.66	(1.30)	4.00	(3.58)	3.33	(3.65)
Taught Letter Sounds ID	0.37	(0.97)	4.68	(3.32)	4.32	(3.10)	0.51	(0.95)	3.27	(3.23)	2.76	(3.17)
Distal Outcomes												
Phoneme Awareness	1.68	(2.26)	3.13	(3.34)	1.45	(2.99)	0.85	(1.61)	1.75	(2.30)	0.88	(2.17)
Language PPVT	34.26	(18.65)	45.66	(18.80)	11.39	(14.77)	33.22	(14.93)	40.22	(15.41)	7.00	(11.78)
Language Pre-IPT	20.74	(13.36)	24.21	(13.28)	3.47	(10.36)	12.66	(10.26)	18.80	(13.44)	6.00	(12.23)
Language Composite (Z)	0.54	(0.94)	0.50	(0.91)	-0.04	(0.59)	0.18	(0.72)	0.15	(0.74)	-0.02	(0.60)

Note. *N* = 126 or 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; one DLL child in Contextualized condition missing several posttest measures; all measures in raw scores; Language Composite = mean of z-scored PPVT and z-scored Pre-IPT scores.

Table 4.

Zero-Order Correlations among Variables used in Analyses

Measure	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Predictors												
1. Condition (1 = Decontext)	--											
2. DLL Status (1 = yes)	.06	--										
3. Pretest Letter Names Total	.04	-.07	--									
4. Pretest Language Composite (Z)	.07	**-.50**	**.43**	--								
Outcomes												
5. Total Engagement	**.33**	.08	.18	.16	--							
6. Taught Letter Name ID	.15	.05	**.22**	.17	**.24**	--						
7. Taught Letter Sound ID	**.26**	.10	**.36**	**.21**	.13	**.59**	--					
8. Letter Name Fluency	.10	.05	**.43**	**.25**	**.27**	**.66**	**.53**	--				
9. Letter Sound Fluency	.17	-.05	**.30**	**.25**	.16	**.39**	**.62**	**.51**	--			
10.Taught LN ID in Context	.13	.03	**.20**	**.19**	.17	**.73**	**.50**	**.57**	**.35**	--		
11.Taught LS ID in Context	**.18**	.00	**.37**	**.21**	**.23**	**.45**	**.63**	**.48**	**.61**	**.41**	--	
12. Phoneme Awareness	**.19**	-.04	.12	.04	.02	.16	**.29**	**.26**	.13	.14	**.18**	--
13. Language Composite (Z)	.01	.07	.04	**-.27**	.17	.13	.01	.14	-.02	.00	.01	**.24**

Note. *N* = 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 Dual Language Learners (DLLs) in Decontextualized; *n* = 22 DLLs in Contextualized; one DLL child in the Contextualized condition missing data on all posttest measures except Taught Letter ID and Rapid Letter Sounds; missing data for 28 children on Total Engagement; all measures in raw scores; Language Composite = mean of z-scored PPVT and z-scored Pre-IPT scores; Pearson's *r* reported; correlations with *p*-values < .05 are boldfaced.

Table 5.

Multilevel Model Results for Pre-Post Gains on Alphabet Knowledge in Isolation Accuracy

Fixed Effect	Taught Letter Names ID				Taught Letter Sounds ID			
	Coeff	*(SE)*	*p*	*d*	*Coeff*	*(SE)*	*p*	*d*
Mean Pre-Post Gain	4.34	(0.47)	**.001**		4.52	(0.32)	**<.001**	
Pretest (Z)	0.59	(0.25)	**.020**	.21	1.14	(0.26)	**<.001**	.39
Condition (1 = Decontext)	0.43	(0.25)	.095	.30	0.77	(0.26)	**.007**	.53
DLL Status (1 = yes)	0.15	(0.25)	.564	.10	0.35	(0.27)	.190	.24
Cond*DLL	0.03	(0.26)	.916	.01	0.06	(0.27)	.817	.02
Random Effect (Intercept)	*Variance*		*p*		*Variance*		*p*	
Small Groups	0.00		>.500		0.00		>.500	
Schools/RAs	0.79		**<.001**		0.17		.113	
Residual (Children)	7.42				8.28			

Note. *N* = 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; all measures in raw scores; Pretest = Total Letter Names at pretest in z-scores; Condition and DLL status effect coded; observed *p*-values reported; Dunn-Sidak adjusted *p*-values adjusted for two outcomes for the family in boldface; *ES* for pretest and interaction = coefficient divided by approximate predicted pooled standard deviation; *ES* for Condition and DLL = coefficient*2 divided by approximate predicted pooled standard deviation.

Table 6.

Multilevel Model Results for Pre-Post Gains on Alphabet Knowledge in Isolation Fluency

Fixed Effect	Rapid Letter Names				Rapid Letter Sounds			
	Coeff	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*
Mean Pre-Post Gain	5.69	(0.52)	**.001**		3.47	(0.33)	**.001**	
Pretest (Z)	2.07	(0.39)	<**.001**	.47	1.09	(0.33)	**.001**	.30
Condition (1 = Decontext)	0.35	(0.46)	.447	.16	0.62	(0.33)	.073	.34
DLL Status (1 = yes)	0.38	(0.40)	.348	.17	-0.15	(0.33)	.658	-.08
Cond*DLL	-0.28	(0.40)	.497	-.06	-0.05	(0.33)	.893	-.01
Random Effect (Intercept)	*Variance*		*p*		*Variance*		*p*	
Small Groups	1.97		.052		0.05		.436	
Schools/RAs	0.31		.162		0.00		.403	
Residual (Children)	17.37				12.83			

Note. *N* = 127 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; one DLL child in Contextualized condition missing pre-post gain on Rapid Letter Names; all measures in raw scores; Pretest = Total Letter Names at pretest in z-scores; Condition and DLL status effect coded; observed *p*-values reported; Dunn-Sidak adjusted *p*-values adjusted for two outcomes for the family in boldface; *ES* for pretest and interaction = coefficient divided by approximate predicted pooled standard deviation; *ES* for Condition and DLL = coefficient*2 divided by approximate predicted pooled standard deviation.

Table 7.

Multilevel Model Results for Pre-Post Gains on Alphabet Knowledge in Word Contexts

Fixed Effect	Taught Letter Names ID				Taught Letter Sounds ID			
	Coeff	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*
Mean Pre-Post Gain	3.99	(0.62)	**.003**		3.50	(0.52)	**.002**	
Pretest (Z)	0.50	(0.25)	.047	.17	1.06	(0.25)	**<.001**	.37
Condition (1 = Decontext)	0.36	(0.25)	.170	.24	0.48	(0.25)	.069	.33
DLL Status (1 = yes)	0.13	(0.25)	.612	.09	0.11	(0.25)	.669	.08
Cond*DLL	-0.11	(0.26)	.665	-.04	-0.05	(0.26)	.837	-.02
Random Effect (Intercept)	*Variance*		*p*		*Variance*		*p*	
Small Groups	0.01		>.500		0.01		>.500	
Schools/RAs	1.59		**<.001**		1.01		**<.001**	
Residual (Children)	7.39				7.33			

Note. N = 126 children in 34 small groups, 5 schools (1 RA per school); n = 26 DLLs in Decontextualized; n = 21 DLLs in Contextualized; all measures in raw scores; Pretest = Total Letter Names at pretest in z-scores; Condition and DLL status effect coded; observed *p*-values reported; Dunn-Sidak adjusted *p*-values adjusted for two outcomes for the family in boldface; *ES* for pretest and interaction = coefficient divided by approximate predicted pooled standard deviation; *ES* for Condition and DLL = coefficient*2 divided by approximate predicted pooled standard deviation.

Table 8.

Multilevel Model Results for Pre-Post Gains on Distal Outcomes

Fixed Effect	Phoneme Isolation				Language Composite (Z)			
	Coeff	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*
Mean Pre-Post Gain	1.01	(0.24)	**.014**		-0.02	(0.05)	.756	
Pretest (Z)	0.35	(0.24)	.144	.13	-0.18	(0.06)	**.002**	-.37
Condition (1 = Decontext)	0.60	(0.24)	**.020**	.45	0.02	(0.05)	.706	.08
DLL Status (1 = yes)	-0.13	(0.24)	.607	-.10	-0.05	(0.05)	.320	-.21
Cond*DLL	0.37	(0.25)	.135	.14	-0.01	(0.04)	.895	-.01
Random Effect (Intercept)	*Variance*		*p*		*Variance*		*p*	
Small Groups	0.00		>.500		0.02		.042	
Schools/RAs	0.00		.301		0.00		>.500	
Residual (Children)	6.96				0.22			

Note. *N* = 126 children in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 21 DLLs in Contextualized; all measures in raw scores; Pretest = Language composite from mean of PPVT and IPT z-scores at pretest; Condition and DLL status effect coded; observed *p*-values reported; Dunn-Sidak adjusted *p*-values adjusted for two outcomes for the family in boldface; *ES* for pretest and interaction = coefficient divided by approximate predicted pooled standard deviation; *ES* for Condition and DLL = coefficient*2 divided by approximate predicted pooled standard deviation.

Table 9.

Disaggregated Descriptive Statistics for Engagement Measures by Experimental Condition and DLL Status

	Decontextualized Instruction Condition (*n* = 64)								Contextualized Instruction Condition (*n* = 63)							
Measure	Obs 1		Obs2		Obs3		Across Obs		Obs 1		Obs2		Obs3		Across Obs	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Attention Total	8.65	(0.66)	8.53	(0.82)	8.58	(0.84)	25.76	(1.57)	7.64	(1.42)	8.09	(1.19)	8.33	(1.01)	24.45	(2.40)
Participation Total	8.77	(0.53)	8.83	(0.42)	8.82	(0.56)	26.45	(0.98)	8.14	(1.09)	8.69	(0.61)	8.69	(0.72)	25.77	(1.55)
Affect Total	8.85	(0.44)	8.93	(0.25)	8.87	(0.42)	26.69	(0.69)	8.63	(0.73)	8.74	(0.56)	8.76	(0.58)	26.20	(1.19)
Grand Total	26.27	(1.38)	26.29	(1.10)	26.27	(1.55)	78.91	(2.62)	24.41	(2.79)	25.52	(2.00)	25.78	(1.95)	76.43	(4.50)
Dual Language Learners (DLLs)																
Attention Total	8.72	(0.54)	8.72	(0.61)	8.50	(0.72)	25.96	(1.02)	7.75	(1.12)	8.48	(0.81)	8.37	(0.76)	25.00	(1.41)
Participation Total	8.84	(0.37)	8.84	(0.47)	8.88	(0.45)	26.52	(0.85)	8.10	(0.97)	8.86	(0.36)	8.63	(0.76)	25.89	(1.41)
Affect Total	8.88	(0.33)	8.88	(0.33)	8.83	(0.48)	26.57	(0.84)	8.50	(0.76)	8.81	(0.51)	8.79	(0.54)	26.17	(1.04)
Grand Total	26.44	(0.77)	26.44	(1.00)	26.21	(1.38)	79.04	(2.01)	24.35	(2.28)	26.14	(1.24)	25.79	(1.78)	77.06	(3.28)
Non-DLLs																
Attention Total	8.60	(0.74)	8.38	(0.92)	8.63	(0.91)	25.63	(1.88)	7.58	(1.57)	7.85	(1.33)	8.31	(1.13)	24.08	(2.86)
Participation Total	8.71	(0.62)	8.82	(0.39)	8.79	(0.62)	26.41	(1.07)	8.17	(1.16)	8.58	(0.71)	8.71	(0.71)	25.69	(1.67)
Affect Total	8.83	(0.51)	8.97	(0.17)	8.89	(0.39)	26.78	(0.55)	8.69	(0.71)	8.70	(0.59)	8.74	(0.61)	26.23	(1.31)
Grand Total	26.14	(1.68)	26.18	(1.17)	26.32	(1.66)	78.81	(3.01)	24.44	(3.07)	25.12	(2.29)	25.77	(2.06)	76.00	(5.20)

Note. *N* = 127 children (99 with complete data) in 34 small groups, 5 schools (1 RA per school); *n* = 26 DLLs in Decontextualized; *n* = 22 DLLs in Contextualized; missing observation data from 11 children at Observation 1, 14 children at Observation 2, 11 children at Observation 3, and 28 children Across Observations; Attention, Participation, and Affect Totals range from 3 to 9 points; Grand Total ranges from 9 to 27 points; higher scores = better engagement.

Table 10.

Multilevel Model Results for Engagement Outcomes

Fixed Effect	Attention Total				Participation Total				Affect Total				Engagement Grand Total			
	Coeff	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*	*Coeff*	*(SE)*	*p*	*ES*
Engagement Total Mean	25.15	(0.25)	**<.001**		26.10	(26.10)	**<.001**		26.42	(0.12)	**<.001**		77.67	(0.47)	**<.001**	
Condition (1 = Decontext)	0.65	(0.22)	**.008**	.67	0.35	(0.35)	.021	.56	0.27	(0.12)	.037	.57	1.29	(0.45)	**.008**	.73
DLL Status (1 = yes)	0.28	(0.19)	.153	.29	0.06	(0.06)	.623	.10	-0.08	(0.09)	.375	-.16	0.22	(0.33)	.511	.12
Cond*DLL	-0.06	(0.19)	.735	-.03	0.03	(0.03)	.784	.03	-0.03	(0.09)	.764	-.03	-0.01	(0.33)	.981	.00
Random Effect (Intercept)	*Variance*		*p*		*Variance*		*p*		*Variance*		*p*		*Variance*		*p*	
Small Groups	0.54		.030		0.23		.022		0.28		**<.001**		3.63		**<.001**	
Schools/RAs	0.06		.187		0.07		.075		0.00		>.500		0.08		.265	
Residual (Children)	3.16				1.27				0.61				8.91			

Note. *N* = 99 children (55 in Decontextualized, 44 in Contextualized) in 34 small groups, 5 schools (1 RA per school); *n* = 23 DLLs in Decontextualized; *n* = 18 DLLs in Contextualized; missing observation data from 11 children at Observation 1, 14 children at Observation 2, 11 children at Observation 3, and 28 children Across Observations; Attention, Participation, and Affect Totals range from 3 to 9 points; Grand Total ranges from 9 to 27 points; higher scores = better engagement; Condition and DLL status effect coded; observed *p*-values reported; Dunn-Sidak adjusted *p*-values adjusted for three outcomes for the family in boldface, however Engagement (Total) *p*-values are unadjusted; *ES* for pretest and interaction = coefficient divided by approximate predicted pooled standard deviation; *ES* for Condition and DLL = coefficient*2 divided by approximate predicted pooled standard deviation.