Early Childhood Research Quarterly xxx (2013) xxx–xxx

Contents lists available at ScienceDirect

Early Childhood Research Quarterly

Enhancing preschool children's vocabulary: Effects of teacher talk before, during and after shared reading☆

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ARTICLE INFO

Article history:
Received 5 July 2012
Received in revised form 30 October 2013
Accepted 4 November 2013

Keywords:
Vocabulary
Shared Reading
Observation
Questioning
Preschool

ABSTRACT

This observational study analyzed patterns of teacher extratextual talk as it occurs before, during, and after reading books to children, and the frequency and duration of teacher questioning by type (label, define, associate) on preschoolers' receptive and expressive vocabulary knowledge. Over the course of 18 weeks, 13 teachers and 100 children participated in ninety 20-min small-group sessions of teacher-guided shared reading instruction. Teachers' reading instruction was examined through videotaped observations using the Multi-Option Observation System for Experimental Studies (MOOSES™; Tapp, Wehby, & Ellis, 1995). Two findings, in particular, yielded relevant educational and theoretical implications. First, time spent after reading was significantly related to expressive vocabulary. However, question timing did not seem to matter in terms of receptive vocabulary outcomes. Second, duration of teacher association questioning was significantly related to receptive vocabulary outcomes while both frequency and duration of teacher vocabulary-related association-level questioning were related to expressive vocabulary. For receptive vocabulary, both vocabulary- and comprehension-related association-level questioning mattered. These findings complement the body of work demonstrating that engaging children in interactive shared reading that elicits their active participation is related to meaningful gains in children's language and literacy growth. Limitations of the study and directions for future research are discussed.

1. Introduction

Reading books to children is one of the most popular and enduring methods adults use to foster young children's language and literacy development (Bus, van Ijzendoorn, & Pellegrini, 1995; Dickinson & Tabors, 2001; Scarborough & Dobrich, 1994). From its prominence in *Becoming a Nation of Readers* (Anderson, Hiebert, Scott, & Wilkinson, 1985) to its identification as a developmentally appropriate practice by the National Association for the Education of Young Children (Copple & Bredekamp, 2008), the practice of adults reading to children is considered one of the most important activities to foster emergent literacy for a diverse range of children (National Early Literacy Panel [NELP], 2008). In addition, shared-book reading ranks high among instructional activities used by "frontline" early childhood educators (Teale, 2003). Sometimes referred to as *interactive reading, shared reading, joint book reading, reading aloud*, or *dialogic reading*, the process of adults reading to and interacting with children around books has been the focus of considerable research over the past two decades (NELP, 2008).

1.1. Shared-book reading

Shared-book reading, generally defined as an interaction that occurs between an adult and a child when reading or looking at a book, is among the most robust ways of exposing young children to new words in meaningful contexts (Hindman, Wasik, & Erhart, 2012). Designed to encourage language and literacy development, shared-book reading has been the focus of more than 25 research studies over the past decade alone (De Temple & Snow, 2003; Ezell & Justice, 2005; Wasik & Bond, 2001; Whitehurst & Lonigan, 1998). The NELP synthesis (2008) revealed that shared reading had a moderate effect on oral language skills ($d = 0.57$) with a greater impact on vocabulary than on broader language skills, was equally effective for children regardless of risk status, and appropriate for a diverse set of children. Swanson et al. (2011) recent synthesis of read-aloud

☆ *Author Note*: Preparation of this article was supported in part by Project WORLD, Grant No. R305G050121 Reading Comprehension and Reading Scale-Up Research, Institute of Education Science (IES), U.S. Department of Education. This material does not necessarily represent the policy of the U.S. Department of Education, nor is the material necessarily endorsed by the federal government.

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0885-2006/$ – see front matter © 2013 Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.ecresq.2013.11.001

effects revealed positive effects on the early literacy skills of at-risk preschool through third-grade children, including vocabulary and comprehension.

Despite consensus that participation in shared reading provides a valuable means of fostering children's language and literacy, vocabulary in particular, few studies have attempted to determine whether the value of shared reading resides in the mere frequency of exposure or in deliberate adult behaviors aimed at advancing language and literacy (Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013). Nevertheless, while overall findings suggest the potential of shared-book reading on future literacy, it is now widely acknowledged that "it is not merely the presence or frequency of reading aloud that is important, but the 'what' and 'how' of that practice" (Teale, 2003, p. 122). Thus, recent research suggests that the "what" and "how" of more effective shared-book reading for young children may include integration of extratextual talk and instruction that facilitates vocabulary depth.

1.1.1. Extratextual talk

An emerging theme from this body of research is that the impact of shared-book reading is influenced by the extratextual conversations that occur about, around, and beyond the text (Reese, Cox, Harte, & McAnally, 2003). In particular, extratextual conversations focusing on higher cognitive tasks may be the linchpin in realizing the full benefits of shared-book reading (Blewitt, Rump, Shealy, & Cook, 2009). For example, research syntheses have shown that opportunities for more cognitively demanding, higher-level discussions are associated with larger effects on vocabulary growth (Elleman, Lindo, Morphy, & Compton, 2009). Shared-book reading is a pedagogical process that provides frequent opportunities for cognitively demanding extratextual conversations through contextualized (i.e., immediate, concrete) or decontextualized (i.e., abstract) talk in ways that allow children to interact with vocabulary beyond the text (Wasik, Bond, & Hindman, 2006). As such, extratextual conversations that decontextualize language provide children with exposure to words that they can use to explore basic and abstract vocabulary and concepts (Ezell & Justice, 2005).

1.1.2. Deeper word learning

The type of instruction that surrounds shared-book reading also matters. Specifically, providing explicit instruction across multiple exposures to words and in multiple ways can have a significant effect on word learning and increases the likelihood that words will be understood and retained (Biemiller & Boote, 2006; Coyne, McCoach, & Kapp, 2007; Coyne, McCoach, Loftus, Zipoli, & Kapp, 2009; National Reading Panel, 2000; Silverman, 2007). However, explicit repetition and multiple exposures alone, often in the form of brief in-context word definitions (Coyne et al., 2009), may not be sufficient to bring about deeper word learning, especially for young learners from high-poverty backgrounds, who may require vocabulary depth in the form of extended vocabulary instruction with more nuanced, refined, and deeper processing of words beyond simple memorization (Coyne et al., 2009).

Deeper processing of words can take the form of enhanced vocabulary instruction that not only relates words to children's personal experiences but also encourages children to use words across new contexts outside their own experiences (Silverman, 2007). Teaching for depth of vocabulary through extended instruction can facilitate word consciousness or metalinguistic awareness, which supports comprehension across varied contexts (Coyne et al., 2009; Hindman et al., 2012; Nagy, 2007; Wasik & Bond, 2001). Controlling for word identification and vocabulary breadth, (Proctor, Silverman, Harring, and Montecillo 2012), for example, found that vocabulary depth, defined in terms of the metalinguistic skills of morphological, syntactic, and semantic awareness, made important contributions to reading comprehension.

The value of deep vocabulary learning and instruction through extended exposure to words is underscored by research showing a strong relationship between vocabulary and comprehension (Elleman et al., 2009; Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003). For preschoolers, comprehension of text usually involves understanding stories read aloud by others (van Kleeck, 2008) and depends on children's oral vocabulary knowledge, a cognitive skill whose development precedes numerous other skills and is a strong determinant of comprehension development (Biemiller, 2003; Farkas & Beron, 2004).

The instructional implication of research showing the value of deeper word learning is that instruction must accelerate children's vocabulary by focusing on words within the larger context of associated concepts. The knowledge hypothesis, a model of relation between developing vocabulary and reading comprehension, supports the importance of this instructional approach, positing that words are part of larger knowledge units and that it is these structures, not the vocabulary per se, that impact comprehension (Wagner, Muse, & Tannenbaum, 2007). In a variation of the knowledge hypothesis, Nagy (2007) argued that vocabulary and comprehension are empirically related because they share a common set of metalinguistic awareness roots.

However, the research in this area is not equivocal. The complicated relationship between vocabulary and comprehension was reflected in Elleman et al.'s findings (2009) showing an overall positive effect of vocabulary training for custom comprehension measures but a negligible effect for standardized measures, suggesting that the effects of vocabulary training may not generalize beyond taught target words.

1.2. Features of shared-book reading

Teacher talk that is thought provoking and encourages children's use of higher cognitive questions and comments can lead to deeper, sustained, and more complex thinking about words and concepts (Dickinson, Darrow, Ngo, & D'Souza, 2009). For example, the sophistication of children's vocabulary is enhanced when adult talk requires children to reflect upon or analyze words in ways that create challenges and opportunities for growth (van Kleeck, 2008). Specifically, shared-book reading can be a significant stimulus for vocabulary development, especially through exposure to rare, sophisticated words embedded in semantically rich contexts (De Temple & Snow, 2003; Ezell & Justice, 2005; Hargrave & Sénéchal, 2000; Justice, Meier, & Walpole, 2005; Mol, Bus, de Jong, & Smeets, 2008; Sénéchal, Thomas, & Monker, 1995; van Kleeck, 2008; Wasik et al., 2006; Whitehurst & Lonigan, 1998).

Books provide a rich source of vocabulary growth, and shared reading provides the context for discussions about words (Dickinson & Porche, 2011). However, children make the greatest gains when adults use cognitively demanding reading styles that stimulate deep processing of information (e.g., adult/child conversations that move beyond labeling, identifying to more analytical skills) in conjunction with discussions that scaffold children's learning, focus children's attention, and encourage children to think about the content and construct meaning from what they hear (Blewitt et al., 2009; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Reese et al., 2003; van Kleeck, 2008; Wasik & Sparling, 2012).

Adult/child conversations around shared-book reading can include explicit use of declarative statements or general talk in which teachers label/identify information (teacher points to picture in a book, *This is a liquid*), define/explain (*The basement is the part of a building that is underground*), clarify associations between words and concepts (*A roof is on the outside of a house, and a ceiling is on the inside of a house. Look at this picture, is this a roof or a ceiling?*), and relate a book to children's experiences (*Tell me about a garden you have seen*). Such comments and statements allow teachers to draw

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children into sustained conversations that stretch their linguistic and conceptual abilities through topic discussions (Dickinson et al., 2009). Challenging talk around a topic may encourage children to access existing grammatical and lexical knowledge to expand on their language abilities creating opportunities for teacher scaffolding (Dickinson & Porche, 2011).

Given that teacher extratextual talk may be the key to unlocking the full benefits of shared reading, identifying the features of extratextual talk that most effectively promote language and literacy is an important educational goal (Blewitt et al., 2009). As noted, results of studies with preschool and primary-grade children show that engaging children in decontextualized conversations predicts stronger vocabulary and comprehension skills than without such conversations (Dickinson & Porche, 2011; Dickinson & Smith, 1994).

Adult use of comments and questioning while engaging in decontextualized talk, in particular, has received attention as a strategic way of involving children in cognitively demanding talk, especially inferential language (van Kleeck, 2008). However, previous shared reading research has provided mixed guidance on how comments and questions influence conversations or how they impact children's language development (Zucker, Justice, Piasta, & Kaderavek, 2010). Although the issue is not fully understood, research suggests that attempting to generate an answer to a question likely increases a child's consciousness and heightens effort, which in turn increases memory (Miller & Pressley, 1989) and facilitates retrieval of related information, prompting readers to infer associations between queried and answered material (Matute, Lipp, Vadillo, & Humphreys, 2011; Broek, Tzeng, Risden, Trabasso, & Basche, 2001). Thus, as the cognitive demands of questions increase, requiring children to think analytically about concepts, it is hypothesized that attempting to answer such questions (e.g., why?) activates more links in an associative network of related concepts, thus providing more routes to retrieval (Miller & Pressley, 1989) and, ultimately, deeper processing.

A small but growing body of research has investigated the use of questioning in shared reading in attempts to untangle the relationship of questioning to child outcomes. For example, Zucker et al. (2010) found that higher abstraction levels of teacher questioning were positively and consistently related to children's responses by showing a sequential association between inferential teacher questioning and inferential child responses. Nevertheless, the frequency and proportion of teacher inferential questioning was found to be unrelated to children's vocabulary growth. In a related study, Zucker et al. (2013) found that teachers' use of demanding extratextual talk, including questioning before, during, and after reading, not only fostered short-term child language and literacy skills but also had a positive impact on the long-term development of these skills.

Sheer frequency of shared reading has also been shown to be a powerful predictor of children's vocabulary growth. Thus, in their study of the effects of questioning style on novel vocabulary acquisition of preschoolers, Walsh and Blewitt (2006) found that children's active engagement, regardless of the whether questions were vocabulary eliciting or noneliciting, was the key to unlocking the full potential of shared reading on vocabulary growth. Vocabulary-eliciting questions, a task that required children to recall and use novel vocabulary, did not confer an advantage over noneliciting questions on novel word learning. In other words, the questioning cognitive demand level did not appear to matter in terms of children's word learning.

In related experiments, Blewitt et al. (2009) explored the impact of questioning cognitive demand level, placement (i.e., before, during, or after), and a scaffolding-like procedure on children's vocabulary growth. Results of the first experiment showed that neither demand level nor placement of questioning differentially impacted children's novel target vocabulary growth regardless of children's vocabulary knowledge. However, mere repetition of words through generalized use of extratextual questions resulted in more target word learning over a control condition without such questioning.

In the second experiment, only a scaffolding-like procedure was found to be related to word definitional knowledge in a manner that was not evident through the use of low- and high-demand questions alone. In both studies, greater vocabulary knowledge was associated with higher posttest performance on target words, evidence of the Mathew Effect. Blewitt et al.'s findings (2009) did not, however, support earlier works by Reese and Cox (1999) showing that children's initial vocabulary levels interacted with adult reading styles such that low teacher demand input facilitated word learning for children with less advanced vocabularies whereas high-demand input benefited children with more advanced vocabularies.

The results accumulated thus far portray a complex picture of teacher questioning cognitive complexity and placement around shared-book reading. Thus, Hindman et al. (2012) noted that the contributions of teacher talk, whether contextualized or decontextualized, on children's vocabulary may not be one-size-fits-all. In support of this hypothesis, Reese and Cox (1999), for example, found that children with higher initial vocabularies made greater gains when instruction was more cognitively complex whereas children with lower initial vocabulary skills made greater gains when instruction during shared reading was more concrete (e.g., describing pictures). Further, Hindman et al. (2012) noted that compared to their more skilled peers, children with the lowest initial receptive vocabularies made stronger gains under the contextualized instructional condition. In contrast, all children made receptive vocabulary gains regardless of their initial vocabulary skills under a decontextualized shared-reading instructional condition. On the other hand, Silverman and Crandell (2010) in their observational study of five vocabulary practices during read-aloud and non-read-aloud time found that the relationship between the various practices (i.e., acting out and illustrating words, semantic analysis, applying words in new contexts, word definitions, and word study) depended in large part on children's initial level of vocabulary knowledge.

While there is empirical support for the importance of cognitively challenging adult/child conversations around shared-book reading in supporting stronger vocabulary skills among children, several researchers have recognized the existence of a variety of adult- and child-level variables that may moderate the effects of shared-book reading on vocabulary outcomes. Thus, as noted above, although results are mixed, there is some evidence that a child's ability to profit from shared-book reading is moderated by initial levels of vocabulary, such that children with more initial language benefit more from more challenging talk whereas those with less initial language skills profit most from more literal styles (Hindman, Connor, Jewkes, & Morrison, 2008; Zucker et al., 2013).

One feature of shared-book reading that has received relatively little research attention is the effect of frequency of exposure to shared reading on children's language development. Zucker et al. (2013) noted that most efforts to understand the role of frequency of shared reading have focused primarily on the home environment or simply controlled for duration of reading sessions. In an unpublished empirical synthesis of 27 studies of shared reading main effects and moderators of preschool and kindergarten children's language development spanning the period 1990–2006 (Gonzalez et al., 2009), multilevel techniques demonstrated that neither number of shared reading sessions per week ($N = 916$, $k = 14$, $b = -.068$, $p = .18$) nor total number of shared-reading sessions ($N = 1581$, $k = 12$, $b = .008$, $p = .90$) was related to vocabulary outcomes. More recently, Zucker et al. (2013) found a positive and significant

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association between frequency of teacher-reported shared reading and children's vocabulary development regardless of children's initial language skills. In contrast to previous works that operationalized frequency as a count of shared reading sessions, in the present study, we define frequency to mean a count of types of teacher talk.

Even more elusive is research on the effect of the duration of shared-book reading, more specifically, duration of talk targeted at vocabulary and comprehension-related teacher input. As noted by Zucker et al. (2013), most studies simply control for duration. Our interest in duration of extratextual teacher input stems from research by Coyne and colleagues (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Coyne et al., 2009) and others who found that not only multiple and frequent exposures to words but also extended conversations in terms of duration (i.e., seconds, minutes) around words targeting deeper processing of words or depth of vocabulary are important.

Finally, investigations showing that the benefits conferred through interactive talk around shared reading may have differential effects depending on the outcome variable measured. For example, works by Whitehurst and Lonigan (1998) suggest that the use of labeling questions that require children to imitate by reproducing words heard in a narrative may be a powerful type of shared-reading talk for the acquisition of expressive vocabulary. In support, Sénéchal (1997) found that asking children labeling questions that required them to reproduce novel words was a strong predictor of gains in expressive vocabulary and less so for receptive. On the other hand, as noted by Sénéchal (1997), receptive vocabulary may be more sensitive to such features as frequency of language use (i.e., repeated readings) because of the added opportunities to associate and store novel words or information.

In summary, the extant research highlights the need for greater understanding of the features of shared-book reading that promote language and literacy (Price, van Kleeck, & Huberty, 2009). We know that children's learning is optimized when adults adjust their input to children's existing abilities with some degree of scaffolding to stretch beyond that ability. We also know that shared reading provides a fertile context for such scaffolding by engaging children in extratextual conversations prompted by adult talk, especially when the talk emphasizes inferential learning. However, previous shared reading research, with some notable exceptions, provides limited guidance to help fully untangle the nuances of teacher talk as it relates to children's conversational abilities or language outcomes (Zucker et al., 2010).

In an effort to fill this void in the literature, the present study examined patterns of teacher talk around shared-book reading and the association of these patterns with child vocabulary outcomes. The first aim was to evaluate the relationship between teacher talk as it occurs before, during, and after reading books and children's vocabulary outcomes. Because of the cognitively demanding nature of talk that emphasizes associative knowledge and preschool children's limited linguistic abilities and basic comprehension skills, we hypothesized that teacher talk that targets vocabulary and comprehension input after reading would benefit at-risk children's word learning more than during-reading when it might be too difficult to both understand the story, deeply process new information, and make word and concept connections.

The second aim of the study was to evaluate the relationship between frequency and duration (i.e., minutes, seconds) of types of teacher talk (e.g., labeling, defining, and making associations) and children's vocabulary gains. We hypothesized that extended teacher-child vocabulary-focused talk would provide children more opportunities to reflect on and deeply process word meanings, and thereby word learning.

The specific research questions were as follows:

1. How does placement of teacher talk before, during, and after shared-book reading relate to preschoolers' vocabulary gains on standardized measures of receptive and expressive vocabulary?
2. How does duration and/or frequency of types of teacher talk relate to preschoolers' vocabulary gains on standardized measures of receptive and expressive vocabulary?
3. Is there an interaction between duration and/or frequency of types of teacher talk and students' beginning-of-year receptive and expressive vocabulary scores and students' end-of-year scores on the same measures?

2. Method

2.1. Earlier study

This study was part of a randomized clinical investigation examining the effects of a theme-based shared-reading intervention designed to develop and accelerate preschool students' background knowledge (e.g., science and social studies) and content-related vocabulary in children from high poverty schools. The pedagogical approach integrated empirically based shared-book reading strategies (e.g., explicit vocabulary instruction, interactive dialogs, conceptual clustering of words) and structures (repeated reading, instruction distributed before, during, and after reading books) to develop and accelerate students' background knowledge and content-related vocabulary.

The intervention (a) targeted a range of higher-level cognitive tasks (describing, associating, predicting, making connections between concepts, analyzing); (b) gave teachers scripted talking points about content-related words (e.g., *liquid, solid*) at the point of use and open-ended questions with feedback before, during, and after reading; and (c) provided children with opportunities to reflect on and deeply process new content-related concepts. In addition to selecting highly important vocabulary, the intervention offered teachers intensive and intentional scripted opportunities to integrate new information and vocabulary with existing knowledge so that new information would be understood at a deeper level. Fidelity of implementation was 85% ($SD = 12\%$).

Results showed that preschool children in 17 small intervention groups, largely from low-income households, who received 20-min daily sessions of content-focused shared-book reading and vocabulary instruction in 5-day instructional cycles over 18 weeks outperformed their business-as-usual peers on vocabulary outcome measures. In particular, significant effects were found on the standardized measure of receptive vocabulary and both researcher-developed measures of receptive and expressive social and science vocabulary. Specifically, effect sizes for the intervention ranged from $\delta_T = 0.93$ (in terms of Hedges' [2007] δ_T) for general receptive vocabulary to $\delta_T = 1.41$ for intervention-specific receptive vocabulary (Gonzalez et al., 2011). Our findings were corroborated by previous studies showing that more intensive and cognitively complex shared-book reading interventions can positively impact children's receptive language (Wasik & Bond, 2001; Wasik et al., 2006). The present study used the same data to take a deeper approach at looking at the complex conversational interactions, especially the cognitive complexity of teacher talk, that occur around shared book reading to support children's acquisition of vocabulary. We were especially interested in placement (i.e., before, during, after) as well as the frequency and duration of questions around shared reading and their relationship to vocabulary gains.

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2.2. Participants

Participants were preschool-aged children from intervention classrooms in nine schools located in two ethnically diverse school districts in South Central Texas. Twenty-one teachers were randomly assigned to either the intervention ($n = 13$) or the business-as-usual condition ($n = 8$). Because the purpose of this study was to examine teacher-child interactions by attending to the content and amount of time spent in the shared-book reading activities and the relationship between these activities and vocabulary outcomes, only data from the intervention teachers and children were examined.

Of the 13 intervention teachers, four taught both a morning and an afternoon class, resulting in 17 intervention classes. Seven teachers were from general education prekindergarten classrooms and six were from Head Start prekindergarten classrooms. Of these teachers, 92% ($n = 12$) held a bachelor's degree and 7% ($n = 1$) an associate's degree. Most held elementary (77%, $n = 10$) and/or early childhood certification (92%, $n = 12$), and 54% ($n = 7$) held English as Second Language (ESL) certification. Teachers had a mean of 12.00 ($SD = 7.56$) total years' teaching experience, with a mean of 8.92 ($SD = 6.16$) years teaching prekindergarten/Head Start.

From these classes, students were selected using a two-step screening process, which led to 100 students meeting inclusion criteria. First, all students with parental consent were administered the Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997). Students whose scores most closely approximated the 15th, 30th, and 50th percentiles on the PPVT-III were selected to participate in the study. Two students from each of the target percentile ranks were chosen to form a single group of six students per classroom. Actual group sizes ranged from five to seven (Mdn = six) students per group for a total of 17 small intervention groups.

The selected students formed a single, small, shared-reading group within the treatment classrooms; the remainder of the students in the classrooms did not participate in the intervention. The decision to use small groups was based on literature examining effective schools, which suggests that (a) the effect of reading instruction on child skill gains is greater in small-group instruction than similar instruction in larger or whole-class groups (Taylor, Pearson, Clark, & Walpole, 2000), (b) preschool instruction provided in small groups shows main effects (Connor, Morrison, & Slominski, 2006), (c) reading in small groups offers as much interaction as one-to-one and may lead to greater comprehension than whole-class or even one-to-one (Morrow & Brittain, 2003), and (d) engagement in book sharing decreases with increasing group size (van Kleeck, 2008). Therefore, the 100 treatment students were nested under the teacher treatment condition.

Students were, on average, 4.58 ($SD = 0.30$) years old, ranging from 4.08 to 5 years at pretest. The sample was 54% female; it was ethnically diverse, with 46% African American, 24% Caucasian, 22% Hispanic or Latino, 5% Asian, and 3% other ethnicity. Most students were English speaking (94%), with over 90% eligible for free or reduced-price lunch. Sixty-nine percent of the families of participating students had an annual income of $24,000 or less. More than three quarters of the students' parents had at least a high school diploma or GED (82% of mothers and 79% of fathers).

2.3. Shared-book reading content and procedures

2.3.1. Eighteen thematic units

The 18-week shared-book reading intervention was organized by two science and two social studies themes with daily 20-min lessons designed for each theme. The two science themes were Nature and Living Things. Within these themes, weekly lesson units were organized around 10 smaller science topics, with each theme including five weekly units (Nature: water, snow, storms, seasons, and light; Living Things: plants, trees, ocean animals, birds and animals). The two social studies themes were Places Where We Live and Go and Earth–Land and Water. Within these themes, weekly lesson units were organized around six smaller topics. For Places Where We Live and Go, the weekly lesson units included cities, homes, school, and stores. For Earth–Land and Water, the weekly units included 2 weeks of overview of land and water, and an ocean unit. Thus, intervention teachers implemented a total of 18 thematic units to accelerate vocabulary knowledge.

2.3.2. Content-related vocabulary words

Researchers selected 59 science- and 35 social studies-related vocabulary words from a total of 36 books (two books introduced per week and connected by theme/topic) and taught within the thematic units so that vocabulary knowledge was organized by lexical sets (e.g., water, liquid, frozen) to assist students in deeply processing words and connected concepts. Vocabulary words were visually represented in the books and important for later learning as words were often identical to science and social studies vocabulary lists developed by state and local school districts for teachers of young children. Additional vocabulary selection criteria included that the words were related to important science and social studies concepts, were likely to appear in a wide variety of texts, and were less likely to be learned through everyday conversations for children from high poverty backgrounds (Beck, McKeown, & Kucan, 2002; Stahl, 1991). Although three words were typically selected from each text for a total of six words taught per week, early lessons introduced only two vocabulary words per book to allow the young children to become acclimated to the shared-book reading process.

2.4. Shared-book reading procedures

A 5-day scope and sequence was implemented in which specific days of the instructional cycle were used to (a) introduce a new book, words, and concepts (Day 1: First book and Day 3: Second book); (b) review previously taught knowledge and reread the book (Day 2: Reread and review words and connected concepts in the first book and Day 4: Reread and review target words and connected concepts in the second book); and (c) integrate new words and science and social studies concepts across the two books connected by theme in a cumulative review (Day 5). All books, teachers' guides, and other materials (theme cards, picture/concept cards) were provided for intervention teachers.

The procedure used for introducing a new book, two to three new words, and connected science/social studies thematic concepts was the following:

1. Before-Reading Discussion to Build Background Knowledge on the Theme and to Preview the Book using Picture Cards and the Book (*Look at this picture. This is winter. Winter is a time of year when it is cold. What things do you like to do when it is cold? On this page you will learn about the word winter. Tell your neighbor what you will learn about winter on this page.*).
2. While-Reading Discussion of Word Meanings and Thematic Concepts Using the Book. The teacher reads the book and briefly stops to introduce new words on the page where they appear. (*Look at this page. This is Earth. The Earth is a place where we live and is made of land and water. What is this everyone? Here we see a big circle made of land and water. Who do you think lives on this land and in the water?*).
3. After-Reading Discussion to Review Words, Book Content, and Thematic Concepts Using Picture Cards and the Book (*This is Earth. What is this everyone? Remember, the Earth is a place where we live that is made of land and water. What is the earth made of? What things can live on the Earth?*). The after-reading review also included a guided discussion with two book-related questions

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for each vocabulary word (*What is a place where we live and is made of land and water? Tell me about things you have seen on the Earth.*), and comprehension questions to informally evaluate if children understood what happened in the book (*What is the big thing that happened in the story? Why was Moonbear afraid of his shadow? What happened to the tree's leaves in the fall?*). To encourage children with limited language abilities to participate in the discussion, teachers could scaffold the discussion by reteaching words/concepts, modeling a response, extending children's oral responses, rephrasing questions, asking additional questions, etc. A similar instructional sequence was implemented on the second reading of the book with a deeper discussion on the book and vocabulary (*What is the difference between an apartment and a house? Why do we have apartments in cities?*).

The shared-book reading lessons were designed using explicit language to ensure consistency across interventionists in the teaching of vocabulary and conceptual knowledge. However, teachers understood the importance of explicit instruction with young children (Lonigan & Shanahan, 2010) and thus, that they were not expected to read verbatim from scripts but were encouraged to "breathe life" into the lessons using their own teaching style. The scripted lessons allowed teachers to know what materials to use (books, picture concept cards, etc.) and provided talking points and possible student responses:

Teacher: Look at the cover of our book, *Changing Seasons.* We will learn about seasons in this book. Look at the pictures to find out what you will learn about *Changing Seasons.* What do you think you will learn in this book (slowly show the book pages to children).

Possible Student Responses:

1. I think I will learn about seasons.
2. I think I will learn about pumpkins.
3. I think I will learn about snowmen.

In this Day 1 activity, the teacher used this script to create a discussion as children looked at pictures in the book and talked about what they thought they would learn. The teacher's role was to extend oral responses, provide feedback, and scaffold to support children's oral language abilities. The teachers, therefore, were not prevented from asking additional questions as long as they did not digress from the topic, the instructional focus (e.g., here it is having a conversation about what children will learn), and appropriate time (e.g., a 3-min activity turning into a 25-min activity).

2.5. Measures

To examine students' vocabulary development at pretest and posttest, a battery of standardized, norm-referenced measures was administered. Both receptive and expressive vocabulary was assessed. Although not an aim of the present study, we concur with Sénéchal's (1997) theorizing that receptive and expressive vocabulary learning may make use of different memory processes, recognition in the former and recall in the latter. These processes, in turn, may cause children to respond differentially to features or task requirements present in shared-reading instruction as opposed to individual or developmental child differences, therefore we chose to measure both (Wagner et al., 2007).

Tests were administered by graduate and undergraduate research assistants and project personnel 2 weeks prior to intervention and 2 weeks postintervention. The observational system allowed for collection and analysis of data obtained from observational processes. All individuals collecting data were trained and had conducted practice examinations until they reached 100% fidelity on all measures prior to testing.

2.5.1. Receptive vocabulary

The PPVT-III (Dunn & Dunn, 1997) was designed to measure receptive vocabulary. Specifically, it is recommended for use in educational and clinical settings to measure receptive vocabulary and to screen for English language ability and general language development. When taking the test, the child is required to point to one of four pictures on a panel that represents an object or action named by the examiner. Reported alpha and split-half reliability coefficients are in the range of 0.86–0.98 for Forms A and B, respectively.

2.5.2. Expressive vocabulary

The Expressive One-Word Picture Vocabulary Test (EOWPVT; Brownell, 2000) was designed to estimate expressive English-speaking vocabulary. It requires a child to verbally provide the names of illustrations of common objects, actions, and concepts. Split-half coefficients presented in the manual reflect a median of 0.98.

2.5.3. Observational system

Multi-Option Observation System for Experimental Studies (MOOSES^{TM}; Tapp, Wehby, & Ellis, 1995) is an observational software system run on a compatible laptop or hand-held device that allows for real-time collection and analysis of data obtained from observational processes.

During the observation of instruction and teacher talk, codes for the events are "entered into the data stream as they occur" (Tapp et al., 1995, p. 26). Entering the code for a new event ends the previous event and begins recording the duration of a new event, so that the data collector enters a new code when the instructional context changes. For example, if the teacher is reading *Changing Seasons* and stops to identify the target word *winter* while pointing to a picture, the data collector enters the code for labeling (l: *This is winter*). If the teachers continues to point to the picture and asks children to recall the word associated with the picture (*What is this, everyone?*), the duration of the labeling code (l) continues for as long as this type of instruction occurs. When the teacher begins to describe/define the target word (Teacher: *Winter is a time of year when it is cold*), the code for defining/describing (d) is used. As long as the teacher continues to describe the features associated with winter in the picture (Teacher: *Sometimes there is snow on the ground because it is cold during the winter.*), the duration of this defining/describing instruction is recorded until the teacher changes the instructional focus – "*Can we predict what the girl will wear when she plays outside in the winter?*"

As events are entered into the program, they are coded for event type, duration, and frequency, making postobservation analysis more efficient. Further, a built-in list management system allows several observational sessions to be processed simultaneously, thus making it possible to pool multiple sessions. Observation durations were calculated using code groups such that each code group (e.g., teacher question type) was a mutually exclusive and exhaustive set of values that accounted for the full length of the observation. The output from the pooled observations can be sent to a data file for use with spreadsheets or statistical software. Table 1 outlines the MOOSES^{TM} coding scheme used.

Teacher shared-reading instruction was examined through videotaped observations at the beginning, middle, and end of the 18-week intervention period. As such, all preschool teachers were videotaped at an agreed-upon time and date. As a courtesy, teachers were notified 3 days prior to an observation taking place, and observations were rescheduled if a teacher was not available or requested another time and date. Observations were conducted for the duration of the shared reading block.

Please cite this article in press as: Gonzalez, J. E., et al. Enhancing preschool children's vocabulary: Effects of teacher talk before, during and after shared reading. *Early Childhood Research Quarterly* (2013), http://dx.doi.org/10.1016/j.ecresq.2013.11.001

Table 1
Summary of MOOSES coding scheme.

Time distribution	Code	Instructional emphasis	Code
Before Reading	brr	Interactor	
During Reading	drr	Teacher	t
After Reading	arr		
		Type of teacher talk	
		Label/identify/recall/discriminate	l
		Define/explain/describe	d
		Associate/connect/expand/relate	a
		Instructional focus	
		Vocabulary	v
		Comprehension/concept knowledge	c

Each video clip was coded using MOOSES^{TM} software. MOOSES^{TM} observations were completed on a total of 39 treatment teacher observations (13 teachers × 3 observations per teacher). Coders coded teacher behaviors according to two foci: (a) time distribution and (b) instructional emphasis. Distribution of time codes tracked the instruction across total time as well as placement of teacher talk before, during, and after book reading. Because the curriculum was scripted, before-, during-, and after-reading activities were clearly delineated for teachers, and subsequently for coders.

Instructional emphasis codes documented the presence of the teacher (the teacher is presenting information), the context of teacher talk questioning (e.g., label, associate), and the instructional focus of each event (i.e., target vocabulary word or comprehension/concept knowledge). Basically, there were three types of teacher talk reflecting a range of cognitive complexity and extending previous research by Dickinson and Smith (1994): (a) label/identify/recall/discriminate, (b) define/explain/describe, and (c) associate/connect/expand/relate. Lower cognitive tasks include labeling and identifying questions, whereas association questions require higher thinking skills.

The instructional emphasis codes were based on the types of instructional behaviors that were integrated throughout the shared-book reading lessons. Although the lessons were scripted, the coding was based on what was actually observed. For example, teachers' behaviors might include instructional scaffolding or reteaching of a concept, which would require the teacher to think on her feet and make instructional adjustments based on student needs. Observers coded if the teacher labeled pictures and if she asked children to label the picture. The codes, therefore, reflected exactly what the teacher was doing. In summary, observers coded the instructional behaviors of teachers, whether they asked questions that were prescribed in the intervention lesson or asked additional questions that were not prescribed in the lesson but were essential for scaffolding instruction. (See Table 2 for detailed descriptions of each type of question with corresponding examples from the shared-book reading intervention.)

The instructional focus of each event was the target vocabulary word or comprehension. That is, the teacher explicitly introducing or reviewing the meaning of a word was an example of an event that focuses on a target word (Magic Word Preview: *On this page we will learn about our magic word change.* Ready, Set, Go!: *Name each picture as fast as you can.* [The teacher flashes each picture/concept card and corrects errors.]) Similarly, an example of an event that focuses on comprehension is the teacher asking questions after reading (*What was our story mainly about? During which season did the plants start to grow? Why did Mr. Greg plant the garden?*). Basically, vocabulary required retrieval, labeling, or association of the vocabulary with another word versus comprehension that requiring the application of the word in a larger context (e.g., what happened in the book).

For example, the three-code sequence tlv indicates that the teacher (t) asks a labeling question (l) on a vocabulary concept (v; e.g., "*Look at this picture and tell what you learned about pour.*") Similarly, a tav code would reflect that the teacher (t) is making associations/connections (a) between vocabulary concepts (v; e.g., "*Would there be light outside if there were a storm? Why or why not?*").

MOOSES allows computation of the event frequency and duration of each three-letter code and of the ability to restructure the codes to analyze any of the respective areas of emphasis (e.g., interactor only; Tapp et al., 1995). Duration in the MOOSES^{TM} system is identified as an independent variable. The event or observation (e.g., teacher labeling vocabulary) is the time from the earliest start

Table 2
Summary of types of teacher questions.

Description	Curriculum Examples
Label/identify/recall/discriminate	
(1) To name; to identify or designate with a label.	• (T): "*Look at this picture. This is a shadow.*"
(2) A recall of a previous day's information.	• (T): "*What new word did we learn yesterday?*"
	• (T): "*Do you think this is a story or an information book?*"
	• (T): "*Look at this picture,*" (shows picture of puddle). "*Here we see a little boy splashing in a puddle of water.'*
	• (T): "*Who is the character in the story?*"
	• (T): "*The title of our book is* The Rainy Day. *Anne Milbourne is the author.*"
	• (T): "*What is all over the ground where Peter is walking?*"
Define/explain/describe	
(1) A statement or explanation that communicates the critical attributes or meaning of the target vocabulary word.	• (T): "*A liquid is something wet, like water or juice.*"
	• (T): "*Who can tell me what frozen means?*" (T): "*It is something hard and cold.*"
	• (T): "*What do you think will melt on this page and why?*"
(2) A definition or explanation that communicates understanding of the term.	• (T): "*What word have we learned that is a type of storm? Yes, a tornado is a type of storm with lots of strong wind that spins around.*"
	• (T): "*What was the big thing that happened to Moonbear in the story?*"
	• (T): "*Yes, Moonbear wanted to get away from his shadow and tried lots of ways to make his shadow go away.*"
Associate/connect/expand/relate	
(1) Make a logical connection of the new word with other words.	• (T): "*Could we be in the shade if we felt the hot sun? Why or why not?*"
	• (T): "*What is the difference between standing in the shade and standing in the sun?*"
(2) Compare words and connected concepts with other words and concepts, to extend knowledge.	• (T):"*Are there schools and apartments on the earth?*"
	• (T): "*Where have you seen lightening? What was it like?*"
(3) Connect concepts discussed in the story with life experiences.	• (T): "*Let's pretend we are sitting outside in the dark. Since you can't see anything in the dark, tell me about what you hear?*"

Note. T = Teacher. Underlined words are vocabulary specified within the treatment curriculum.

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Table 3
Intraclass correlation coefficients for raters using the MOOSES Codes.

Duration codes		Frequency codes	
MOOSES Code	ICC	MOOSES Code	ICC
Before reading time	1.000	–	–
During reading time	0.992	–	–
After reading time	0.984	–	–
Teacher labeling vocabulary	0.877	Teacher labeling vocabulary	1.000
Teacher defining vocabulary	0.597	Teacher defining vocabulary	0.917
Teacher associating vocabulary	0.870	Teacher associating vocabulary	0.508
Teacher labeling comprehension	0.832	Teacher labeling comprehension	0.967
Teacher defining comprehension	–[a]	Teacher defining comprehension	0.954
Teacher associating comprehension	–[a]	Teacher associating comprehension	0.860

Note. Intraclass correlations were calculated with raters treated as random and items (codes) treated as fixed.
[a]One rater had zero variance on this code in the subset of video clips coded by both raters, so ICC could not be calculated.

of an event to the latest stop of the event. Finally, frequency is the total number of times the selected event (e.g., teacher labeling vocabulary) occurs in the observation.

For this study, we were particularly interested in how the instruction and interaction opportunities were distributed according to the cognitive complexity of vocabulary tasks. Specifically, we were interested in determining whether tasks that requested students to label or define a vocabulary word (i.e., tasks at the lower end of cognitive complexity) would differentially influence vocabulary development less than tasks focused on higher-order tasks, such as associating new vocabulary with previously taught words and/or contrasting examples.

Classroom video observations were coded by two trained graduate assistants. The videotaped observations were approximately equally distributed across teacher implementation of all 5 days of the instructional cycle according to intervention's scope and sequence. The interrater reliability of the coders was estimated by having them both code five video observations prior to formal coding and calculating the intraclass correlation coefficient (ICC) for all codes. (The ICC estimates the proportion of the variance in codes that is attributable to differences in the teachers' behavior vs. differences between the coders.) The median ICC was .832 for duration codes and .936 for frequency codes. All ICC values are shown in Table 3. The zero variance for one of the coders on two of the codes is a concern, and we have suggested in the limitations section that more instructional periods be coded if the instrument is used in the future in order to increase coders' means and variances for duration codes. As the MOOSES codes were used as predictors, though, the shape of their distribution is not a concern. Multilevel modeling makes no assumption about the distribution of predictors. They may be normally distributed but they may also be skewed or categorical without violating the assumptions of the model.

3. Results

Multilevel models were estimated separately for the two outcome measures of interest – the PPVT and the EOWPVT. Standard scores of both measures were used in all analyses. For each outcome variable, a random intercept model with no predictors (i.e., a random effects ANOVA) was first estimated to determine how much of the variance in the outcome was associated with the teachers. For PPVT, $\tau_{00} = 6.09$ and $\sigma^2 = 70.36$, resulting in ICC = .08. For EOWPVT, $\tau_{00} = 12.10$ and $\sigma^2 = 79.66$, resulting in ICC = .13. For both outcome measures, the variance of the random intercepts (τ_{00}) was not significantly different from zero, but given that the sample size was small, resulting in low power for these tests, and the fact that the ICC values were substantial, multilevel models were still used for the main analyses.

In the main analyses, all models included baseline score on the same measure (PPVT or EOWPVT) as a covariate. As these analyses were based on nonexperimental data (i.e., only students and teachers in the intervention condition were analyzed), we included as covariates student characteristics (students' age, gender, English Language Learner (ELL) status, special education eligibility, ethnicity, and school district) measured at baseline in order to rule out these characteristics as potential alternative explanations of results. All models were random intercept models (see Appendix A for equations). When random slopes were added to the models, none of the slopes were found to have significant variance, so the random intercept models are reported for purposes of parsimony. Because there were only 13 teachers into which students' scores were clustered and, therefore, few degrees of freedom for testing teacher-level effects, it was not possible to include all MOOSES^{TM} codes in a single model. As a result, codes for each of the two outcome measures were entered in five separate models for each outcome measure, with related codes being entered into the same model.

The first model included measures of how time was spent throughout the lesson (i.e., before, during, and after reading). The second model included the number of times (frequency) teachers labeled, defined, and associated target vocabulary. The third model included how much time (duration) teachers spent labeling, defining, and associating target vocabulary. Finally, the fourth and fifth models mirrored the second and third, except that they included codes for duration and frequency of comprehension rather than target vocabulary. All covariates were entered in all five models for each outcome measure.

The first two research questions were answered using multilevel models that included only main effects of the MOOSES^{TM} codes. The third question required the inclusion of interaction terms between beginning-of-year PPVT and EOWPVT scores and MOOSES^{TM} codes. Because of the limited number of teachers, the interaction terms were entered in separate models with their corresponding main effects as with the main effects models.

In addition to significance tests for coefficients in the models, effect sizes are often reported for multilevel models. As the predictors of interest in the models were at level 2 (the MOOSES^{TM} codes for teacher talk), the appropriate effect size is a proportion reduction in variance at level 2 (Raudenbush & Bryk, 2002). This is calculated as the reduction in variance in the random intercepts realized by the addition of one or more level 2 predictors to the model. Unfortunately, likely as a result of the small sample size, these estimates were unstable, frequently yielding either negative or misleadingly large positive values. Therefore, we do not report these proportion reductions in variance values.

3.1. PPVT scores

Results for models of PPVT scores are shown in Table 5. As illustrated, posttest PPVT scores were not predicted by duration

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Table 4
Descriptive Statistics for MOOSES Codes.

MOOSES code	Duration codes (s)				Frequency codes (counts)			
	M	*SD*	Min	Max	*M*	*SD*	Min	Max
Before reading time	433	191	244	932				
During reading time	287	117	0	515				
After reading time	357	146	0	617				
Teacher labeling vocab	117	31	63	167	34	11	21	59
Teacher defining vocab	65	22	33	104	11	3	6	15
Teacher associating vocab	109	40	53	185	30	9	19	46
Teacher labeling comp	27	12	8	43	4	2	2	7
Teacher defining comp	7	10	0	31	2	3	0	11
Teacher associating comp	7	11	0	36	3	3	0	8

Note. All values are based on three observations per teacher of approximately 18 min each.

before, during, and after reading, or by any of the vocabulary or comprehension frequency variables. Duration allocated by teachers to vocabulary association questioning, on the other hand, significantly predicted posttest PPVT scores ($\gamma = 0.058$, $p = .044$). Thus, a 1-second increase in duration of teacher-associating vocabulary was predictive of a .058-point increase in posttest PPVT scores (MOOSES^{TM} duration codes are in seconds). The duration of teachers' comprehension-association questioning was also a significant positive predictor ($\gamma = 0.339$, $p = .046$). Thus, a 1-s increase in the duration of comprehension-association activities was predictive of a .339-point increase in posttest PPVT score. Although this effect is large, it should be kept in mind that the average teacher spent only 7 s in this activity (see Table 4), the modal teacher spent 0 s, and only two teachers spent as long as 20 s. Therefore, this finding cannot be extrapolated beyond the very limited range of the scores.

3.2. EOWPVT scores

The results for models of EOWPVT scores are also shown in Table 5. In the model that included the time teachers spent before, during, and after reading, duration dedicated to after-reading interactions was a significant predictor of posttest EOWPVT scores ($\gamma = 0.022$, $p = .032$). Thus, a 1-s increase in time after reading was predictive of a .022-point increase in posttest EOWPVT scores. Frequency of vocabulary-association questioning was also a significant positive predictor ($\gamma = 0.305$, $p = .019$). Each additional instance of a teacher associating vocabulary was predictive of a 0.305-point increase in posttest EOWPVT scores. Finally, duration of vocabulary-association questioning was a significant positive predictor of posttest EOWPVT scores ($\gamma = 0.071$, $p = .041$). That is, a 1-s increase in time spent associating vocabulary was predictive of a .071-point increase in posttest EOWPVT scores. Posttest EOWPVT scores were not predicted by comprehension variables, either frequency or duration.

In the models that included interaction terms, which were used to test whether the effect of type of talk on vocabulary scores depended on students' beginning-of-year vocabulary scores, no interaction terms were found to be significant in any of the models for either PPVT or EOWPVT. Therefore, we do not report any results of these models in tables or discuss them in any further detail.

4. Discussion

In this study, we analyzed the placement of teacher talk before, during, or after, and the frequency and duration of teacher talk (label, define, associate) during shared-book reading on preschoolers' receptive and expressive vocabulary knowledge. Over the course of 18 weeks, 17 small intervention groups of children participated in ninety, 20-min sessions of teacher-guided shared-reading instruction over 5-day instructional cycles that focused on vocabulary and comprehension talk of varying cognitive complexity. We examined placement of teacher talk (before, during, and after) as well as type of teacher talk to understand which were more facilitative of general vocabulary development and, thereby, could be the focus of future efforts to maximize the instructional power of shared-book reading. Two findings had particularly relevant and important educational implications.

First, the hypothesis that teacher talk about vocabulary after reading would benefit children on general measures of vocabulary was supported for expressive vocabulary. Teacher talk placement after reading, when most association talk occurred in the intervention, was significantly related to expressive vocabulary. One possible interpretation of this finding is that for young readers/listeners, after-reading conversations allowed more time for the additional linguistic and cognitive demands on memory associated with understanding, analyzing, and articulating relationships between words/concepts in higher level association questions. During reading, talking tasks were briefer with less time for making connections between the word/concept and life experiences. Because of the linguistic (e.g., correct syntax structure) and cognitive demands of questioning during reading for children with limited verbal abilities, it is possible that the benefits of articulating deep relationships between words and concepts in association questioning were conferred after reading when a child has more time to articulate perceived word/concept connections and associations with prior knowledge than during the brief in-context discussions.

It is also possible that talk after reading when more associative tasks occurred cued the retrieval of mental representations constructed by the young listeners and, in turn, deepened lexical networks, thus enhancing their vocabulary (Matute et al., 2011; van Kleeck, 2008). This finding was consistent with works by Silverman (2007) and others that engaging children in deeper and active analysis of word meanings may be more effective than merely relating words to the context of the story or to personal experiences than in less analytical and context-specific ways. Findings also supported Beck and McKeown showing that word-related teacher talk after reading may provide a rich context from which to build initial vocabulary understandings and allow rich story understandings without interrupting the meaning building (Beck & McKeown, 2007).

We did not find that the placement of teacher talk mattered in terms of child receptive vocabulary outcomes. One explanation for the lack of a relationship stems from research showing that interactive reading benefits children's expressive vocabulary specifically through active verbal involvement on the part of the child because it increases attention to words and provides production practice via child responses (Gonzalez et al., 2011).

Second, our hypothesis that extended teacher vocabulary talk in terms of duration and frequency would benefit both receptive and expressive vocabulary was supported notably for duration of talk. Thus, duration of teacher association talk was significantly related

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Table 5
Results for Multilevel Models Predicting Posttest PPVT and EOWPVT Scores.

Fixed effects results by predictor	PPVT		EOWPVT	
	γ	p-Value	γ	p-Value
Model 1: Reading time				
Before	0.003	.652	0.001	.923
During	−0.014	.219	−0.006	.672
After	0.011	.211	0.022	.032
Model 2: Vocabulary event frequency				
Labeling	−0.059	.544	−0.052	.585
Defining	−0.073	.860	−0.570	.176
Associating	0.089	.464	0.305	.019
Model 3: Vocabulary event duration				
Labeling	−0.045	.197	−0.001	.979
Defining	−0.047	.455	−0.027	.719
Associating	0.058	.044	0.071	.041
Model 4: Comprehension event frequency				
Labeling	−1.063	.120	−0.696	.431
Defining	0.661	.144	0.811	.166
Associating	0.711	.098	0.068	.903
Model 5: Comprehension event duration				
Labeling	0.016	.865	0.068	.578
Defining	−0.129	.497	−0.041	.871
Associating	0.339	.046	0.186	.411
Random effects results	τ_{00}	σ^2	τ_{00}	σ^2
Model 1: Reading time	0.39	56.25	0.00	77.55
Model 2: Vocabulary event frequency	2.70	56.22	0.00	76.63
Model 3: Vocabulary event duration	0.00	55.14	0.00	76.99
Model 4: Comprehension event frequency	0.00	53.02	1.57	79.40
Model 5: Comprehension event duration	0.00	54.38	2.84	79.11

Note. All models control for the following covariates: Baseline score on the dependent variable (PPVT or EOWPVT score), age, gender, ELL status, special education eligibility, ethnicity, and school.

to receptive vocabulary outcomes while both frequency and duration of teacher vocabulary-related association talk was related to expressive vocabulary outcomes.

For receptive vocabulary, both vocabulary- and comprehension-related association-level talk mattered. One possible interpretation of these findings is that making associations may direct a learner's attention to information beyond what is stated in the text to make connections between new and previously taught concepts, thereby activating important prior knowledge related to what is being heard/learned (Martin & Pressley, 1991). Is it also possible that association-level talk may have provided children with additional opportunities to encode, associate, and store novel information (Sénéchal, 1997).

In our study, association-level talk in general may have been related to deeper processing of words learned and thereby growth in receptive vocabulary. In the end, with regard to duration, more time spent on vocabulary-related association talk (e.g., *What is the difference between frozen water and liquid?*) was found to be related to growth in children's general receptive vocabulary. In addition, increased time spent in comprehension-related association talk (e.g., *Can you drink something that is frozen? Why or why not?*) was related to greater gains in generalized receptive vocabulary.

For expressive vocabulary, both duration and frequency of vocabulary-related association-level talk mattered. As stated earlier, one possible interpretation of this finding is that interactive reading benefits children's expressive vocabulary through active verbal involvement because it increases attention to words and provides production practice via child responses. The combination of association-level talk and more opportunities to make connections between words and science and social studies concepts in our intervention may have been associated with greater gains in vocabulary. It is also possible that both the frequency and duration of association-level talk around targeted vocabulary may have provided children with more opportunities to reproduce words heard in the storybook narrative (Sénéchal, 1997).

In sum, our findings expand upon the body of work demonstrating that engaging children in interactive shared reading that elicits their active participation is associated with meaningful gains in children's language and literacy growth (Mol, Bus, & de Jong, 2009; Mol et al., 2008; van Kleeck & Norlander, 2008) by further specifying the types of shared-book reading activities that promote vocabulary growth. More specifically, although results from our study only partially suggest that the benefits of after-reading vocabulary talk might be more beneficial than during-reading vocabulary talk, much more research is warranted in this area. Stopping to discuss concepts during-reading talk might be more challenging for children with low vocabulary knowledge and limited language abilities to utilize multiple linguistic (e.g., appropriate syntax structure, correct word usage) and high cognitive abilities simultaneously in a limited discussion. However, as in Beck and McKeown (2007), after listening to the entire book and engaging in brief in-context conversations on words and concepts, children might be more able to respond to after-reading questions and analyze and articulate relationships between words and concepts. Both comprehension and vocabulary association-level talk was related to vocabulary gains. While correlational, experimental, and longitudinal research has suggested that vocabulary and comprehension are related (Elleman et al., 2009; Neuman, Newman, & Dwyer, 2011), to our knowledge, there is little empirical research showing how comprehension questioning specifically, relates to vocabulary learning.

4.1. Limitations

In the present study, we only looked at teacher talk. Our decision in this regard was informed by Dickinson et al.'s (2009) suggestion that "the teacher is the dominant force in shaping these

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conversations, but all interaction is jointly constructed; therefore, it reflects the conversational preference and linguistic skills of both" (p. 404). The results of our study showed that we have no way of knowing whether children's level or type of participation was a factor in vocabulary development. We also know little about how the "flow" of conversation unfolded, thus precluding analysis of child participation in the interactions or how the flow affected the child's ability to learn new words.

A second limitation of the study is that we were not able to answer the question of how much talk during shared-book reading is optimal for word learning or if certain children benefit from less talk. A third limitation is that the sample was drawn from a restricted geographic area – only two school districts. As a result, generalizing the study to broader populations of preschoolers may be difficult. In addition, the sample size was small: 92 students clustered within 13 classrooms. Because of the small sample size, nonsignificant effects should not be over-interpreted. That is, they may not have been detected because of a lack of power. By the same token, we performed a large number of tests given such a small sample and, in order to maintain power, did not adjust the Type I error rate to account for this. Our significant findings should, therefore, also be considered cautiously. Similarly, our inability to calculate proportion reduction in variance effect sizes, also likely as a result of the small sample size, is a further limitation of the study.

A fourth limitation of the study was the low ICC values for teacher defining comprehension (not able to be calculated), teacher associating comprehension (not able to be calculated), and teacher associating vocabulary (0.508). As noted in Table 3, one rater recorded zero variance on teacher defining comprehension and teacher-associating comprehension in the set of video clips coded by both raters, making it impossible to calculate ICC. Regarding teacher-associating vocabulary, one problem with this code was that it was used relatively infrequently, usually 1 min or less (sometimes only a few seconds) for a given observation. Any deviation between the coders would be magnified even if the difference was only a few seconds. For this and other codes with low values and little variance, future use might be facilitated by coding more classroom instruction periods in order to increase the mean levels and variance between coders.

Finally, our findings may not generalize beyond the treatment teachers and children. It is possible, for example, that better teachers demonstrated more fidelity to the intervention, thus asking more association-level questions, subsequently related to higher gain among their students. Similarly, it is possible that some intervention groups of students had strengths, such as self-regulation (not measured in the present study), that both elicited richer teacher instruction and led to greater vocabulary gains. Neither students nor teachers were randomly assigned to differing levels of distribution of time or types of questions, so caution must be used in generalizing beyond our study. Conclusions can only be drawn about teacher talk in the context of a shared book reading intervention but not about teachers in a business-as-usual context.

4.2. Implications

From the findings presented here, we can conclude that making connections between vocabulary and related concepts before and after reading of books is important for fostering generalization of vocabulary. Such insights might be incorporated into teacher professional development as well as coaching. Specifically, teachers can be assisted in understanding that as they engage children in extended conversations, they are not only fostering and nurturing relationships with the children but also promoting their language and literacy skills (Dickinson et al., 2009).

It is important that such professional learning opportunities develop and strengthen teachers' ability to scaffold conversations and assist children in making inferences and associations that highlight word and concept connections. Because some young children enter school with limited access to daily "informal informational lessons" transmitted via adult-child conversations (Neuman, 2006), teachers must be equipped to encourage children to (a) manipulate word sets or networks in which selected vocabulary share semantic attributes (Beck, McKeown, & Omanson, 1987; Beck, Perfetti, & McKeown, 1982; Kame'enui, Dixon, & Carnine, 1987); and (b) ask questions that assist them in discovering where a connection exists between words (Beck, McKeown, & Kucan, 2008). This type of instruction goes far beyond associating words with definitions and produces word and world knowledge that is rich enough to facilitate future comprehension.

For many young children, their vocabulary levels diverge greatly beginning in the preschool years with virtually little done in schools to close this gap. Chances of addressing these word gaps are best in preschool and the early primary years (Biemiller & Boote, 2006; Hirsch, 2006). That is, the earlier children acquire larger vocabularies, the greater their reading comprehension will be later in their schooling (Hirsch, 2006). Unfortunately, studies have documented that preschool teachers engage in low use of cognitively demanding explanations, questioning, and other sophisticated teaching strategies (Dickinson, Darrow, & Tinubu, 2008; van Kleeck, 2008).

In the current study of a shared-reading intervention, teachers went beyond information directly provided in the text before, during, and after shared reading to fill in the knowledge children needed to comprehend the story or extend/scaffold children's oral language and cognitive thinking abilities so that they are to perceive and articulate connections between words and connected knowledge. These higher-level discussions involved explaining, summarizing, associating, and comparing and contrasting, which elicited children's active thinking around words and concepts. The ultimate goal of the intervention was to accelerate vocabulary knowledge by teaching more in less time for children who entered school less prepared to learn due to poverty and other experiential factors.

The report *Becoming a Nation of Readers* (Anderson et al., 1985) concluded "the single most important activity for building the knowledge required for eventual success in reading is reading aloud to children" (p. 23). Yet, as Teale (2003) pointed out, reading aloud is by no means the "holy grail" for addressing the beginning reading dilemma; rather, it is the "what" and "how" of that practice or what actually happens that matters (p. 122). Findings from this study converged with other research demonstrating that interactive adult/child conversations explicitly teach vocabulary in ways that encourage children to process words at deeper levels across various contexts (e.g., before, after), thereby promoting word learning (Beck & McKeown, 2007; Silverman, 2007; Silverman & Crandell, 2010).

Appendix A.

These equations describe the first multilevel model for the PPVT. The remaining models for the PPVT differed only in that they used different codes in the equation for β_{0j} (i.e., associated with γ_{03}, γ_{04}, and γ_{05}). The multilevel models for EOWPVT were identical to the models for PPVT, except that they used posttest EOWPVT as the outcome variable and baseline EOWPVT as a covariate in place of baseline PPVT.

This is the student level part of the model (i indexes student, and j indexes teacher):

$$\begin{aligned}\text{Posttest PPVT}_{ij} &= \beta_{0j} + \beta_{1j}\,\text{Baseline PPVT}_{ij} + \beta_{2j}\,\text{Age}_{ij} \\ &\quad + \beta_{3j}\,\text{Gender}_{ij} + \beta_{4j}\,\text{ELL status}_{ij} \\ &\quad + \beta_{5j}\,\text{Special education eligibility}_{ij}\end{aligned}$$

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$$+ \beta_{6j}\,\text{African American}_{ij} + \beta_{7j}\,Asian_{ij}$$
$$+ \beta_{8j}\,Hispanic_{ij} + \beta_{9j}\,\text{Other ethnicity}_{ij} + e_{ij}$$

These are the teacher level parts of the model (j indexes teacher):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\,\text{District}\,A_j + \gamma_{02}\,\text{District}\,B_j + \gamma_{03}\,\text{Duration before reading}_j + \gamma_{04}\,\text{Duration during reading}_j + \gamma_{05}\,\text{Duration after reading}_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10};\ \beta_{2j} = \gamma_{20};\ \ldots\ \beta_{9j} = \gamma_{90}$$

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Please cite this article in press as: Gonzalez, J. E., et al. Enhancing preschool children's vocabulary: Effects of teacher talk before, during and after shared reading. *Early Childhood Research Quarterly* (2013), http://dx.doi.org/10.1016/j.ecresq.2013.11.001