NURTURING WORD LEARNERS: CHILDREN'S OPPORTUNITIES FOR VOCABULARY LEARNING IN HEAD START CLASSROOMS

By

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To Jonah, without whom this never would have been possible.

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TABLE OF CONTENTS

LIST OF TABLES

Table Page

CHAPTER I

INTRODUCTION

Preschool classrooms are important contexts for supporting the vocabulary development of preschool-aged children. Examining the word-learning opportunities afforded to children in these classrooms is an important step in designing optimal environments for enhancing children's language learning, particularly for children at risk for future academic difficulties. Many young children spend the majority of their waking hours in early childhood classrooms during a critical period in their language development; therefore preschool programs need to offer children quality word-learning opportunities.

Research is needed to determine the frequency with which children in preschool classrooms are exposed to new words that expand their lexicon and the prevalence with which these words are embedded in interactions that help children understand the meanings of words. For this research to be productive, scholars in language development and early childhood education need to refine the tools they use to study vocabulary learning and the expectations for the words children should learn during the preschool period. There is also a need to examine the relationship between these word-learning opportunities and growth in children's vocabulary knowledge. From this research, better designs for preschool environments and experiences may emerge to guide program design and professional development.

Overview of the Problem

Children's vocabulary in early childhood is important for two reasons: vocabulary knowledge grows at a steady rate from preschool through high school, and vocabulary relates to later reading abilities. First, the size of children's vocabularies in early childhood predicts the size of their vocabulary in later schooling. Vocabulary growth rates from early to later childhood have been investigated in two large studies, one with a heterogeneous sample (NICHD Early Child Care Research Network [NECCRN], 2002) and one with children from low-income families (Storch & Whitehurst, 2002). Both studies report the same finding: children's preschool vocabularies correlated highly with their vocabularies up to five years later. There is clear evidence that rates of vocabulary growth are remarkably stable over children's school years.

Second, early vocabulary is important because the size of children's vocabularies measured as early as preschool relates to their later literacy skills. A recent synthesis of research concluded that both preschool and kindergarten vocabulary independently predicted later decoding, comprehension, and spelling skills (National Early Literacy Panel [NELP], 2008). Preschool vocabulary has been correlated with early literacy skills and later reading achievement from kindergarten through fourth grade (Biemiller, 2006; Kendeou, van den Broek, White, & Lynch, 2009; NECCRN, 2002; Scarborough, 2001; Storch & Whitehurst, 2002). Vocabulary skills at kindergarten entry strongly predict math and reading achievement in first through fifth grade (Kurdek & Sinclair, 2000). There is additional evidence that early vocabulary has indirect effects on later reading comprehension through phonological awareness and decoding (Dickinson & Porche, 2011; Sénéchal, Ouellette, & Rodney, 2006; Storch & Whitehurst, 2002). The powerful

connection between early childhood vocabulary and later academic achievement demonstrates the importance of enhancing young children's vocabulary early in their education.

An important construct in understanding these relationships is the academic register, a distinct form of language that is encountered in schools. The academic register takes the dialectal form of Standard Academic English, and includes formal syntax and a lexicon of sophisticated words that relate to learning and content area knowledge (Nagy & Townsend, 2012). The academic register is closely linked to literacy as it is used in most pieces of literature and content areas texts. The words that compose the academic register are the vocabulary most closely tied to academic success (Schleppegrell, 2012). Depending on their experiences from birth through age three, some children first encounter the academic register when they enter formal schooling for the first time. Children in preschool may face a steep learning curve to add the academic words to their lexicon, as these words will likely relate to their school success for years to come.

Importance of Word-Learning Opportunities for Preschool Children From Low-Income Families

There are well-documented differences in language skills among children entering preschool from different socioeconomic groups (Beck, McKeown, & Kucan, 2002). The most commonly cited evidence of these differences is Hart and Risley's (1995; Walker, Greenwood, Hart & Carta, 1994) landmark study of the vocabularies of 42 children from three groups: on welfare, from working-class families, and from professional families. Observers visited families in their homes to audiotape their interactions monthly from when children were 7 to 36 months. Hart and Risley found that by age three, the

productive vocabularies of children from the professional families were more than twice the size of the children from the families on welfare. Children from working- and middle-class households also had smaller vocabularies than those from professional families. The children's productive vocabularies were largely composed of the words that their parents used at home. The low-income households scored significantly lower on standardized measures of receptive vocabularies at age three than both groups of children from families with higher incomes. These differences were associated with children's vocabulary, spelling, and reading achievement through the end of third grade controlling for school quality (Walker et al., 1994). Notably, these data come from a very small number of children and families, and this small sample limits the generalizability of Hart and Risley's findings. Other issues have been raised with Hart & Risley's study, including the possibility of observer bias influencing the findings (Dudley-Marling & Lucas, 2007).

Using larger samples of children, other researchers have found similar gaps in vocabulary knowledge and rate of acquisition between children from low-income backgrounds and their peers from middle- or high-income backgrounds. A number of studies found that children from low-socioeconomic (SES) families acquire vocabulary at a slower rate than those from middle-SES families (Biemiller & Slonim, 2001; Dollaghan et al., 1999; Farkas & Beron, 2004; Hoff, 2003; Qi, Kaiser, Milan, & Hancock, 2006; Rowe, 2008). African-American children from low-income families have a lower normative distribution of vocabulary size than the national mean on norm-referenced tests of vocabulary knowledge (Champion, Hyter, McCabe, & Bland-Stewart, 2003; Qi, Kaiser, Milan, Yzquierdo, & Hancock, 2003; Washington & Craig, 1999).

Much of the research on SES-related vocabulary differences cited here comes from a norm-referenced measure of receptive vocabulary size, the Peabody Picture Vocabulary Test (PPVT-R; Dunn & Dunn, 1981). This measure operationalizes vocabulary knowledge using a single dimension and test format, and focuses on words typical of the academic register that is aligned with mainstream, middle-class language norms. The PPVT-R was demonstrated to have a bias against low-income African Americans as well as a noun bias that favors middle-class Whites (Washington & Craig, 1992). This finding indicates that similar research on vocabulary knowledge may under represent the size of children's vocabulary due to the selection of words on standardized measures. Many children who are not from White, middle-class backgrounds likely have a lexicon in a register other than the Standard English assessed by the PPVT.

Through an ethnographic study of children's early experiences with language and literacy, Heath (1982) found that children from different backgrounds have varying registers.. She describes the oral and literate traditions of a middle-class community, a working-class White community, and a working-class Black community. She depicts how all three groups of children learned language and literacy practices, but the specific language and developmental pathways looked different. Heath (1982) noted that the two lower income communities demonstrated that the mainstream view of communicative competence is not a universal. Children from these communities learned words from listening and observing, rather than from explicit talk about words typical of higher-income families. Regardless of the pathways, children's experiences before school provides them with ways of using language, including the lexicon they need to participate in family and community traditions. The degree to which children's home register

matches the academic register and linguistic demands of schooling is likely reflected in how children perform on standardized vocabulary tests and related academic measures.

On the other hand, it is important to note that the academic register is the form of language most commonly used in K-12 classrooms in the United States (Hemphill & Tivnan, 2008; Nagy & Townsend, 2012). In many studies the PPVT and similar measures have been found to predict later vocabulary and reading achievement (e.g., Biemiller, 2006; Kendeou et al., 2009; NECCRN, 2002; Scarborough, 2001; Storch & Whitehurst, 2002). Hence, it appears the academic register and associated vocabulary is important for academic success, suggesting that increasing all children's opportunities to learn these words is a worthwhile endeavor beginning in early educational settings.

There is further evidence to suggest that the relationship between SES and vocabulary knowledge is at least partially mediated by children's early experiences with language through their interactions with adults. Huttenlocher and colleagues examined whether the relationship between SES and children's lexical diversity was mediated by parents' child-directed speech (Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). While partial mediation was present in this model, SES still independently predicted children's lexical diversity. Huttenlocher et al.'s study also revealed substantial individual differences in vocabulary size and growth rate within each socioeconomic group. Other studies have likewise demonstrated considerable variability in the vocabulary knowledge of children within a low-SES sample (Dickinson & Tabors, 2001; Pan, Rowe, Singer, & Snow, 2005; Weisleder & Waxman, 2010). These findings suggest that SES alone cannot explain the great variability in young children's vocabulary size.

Children's early experiences with language through interactions with adults also influences their vocabulary development.

The extent of the differences in vocabulary knowledge between children from low-SES families and their peers has been a topic of concern for both researchers and policy makers. A primary goal of early childhood intervention programs for children from low-income backgrounds is to build pre-literacy skills including vocabulary (NECCRN, 2002; US Department of Health and Human Services, 2003; 2010). Thus, it is important to identify the environmental supports in early childhood classrooms that account for variability in children's vocabulary knowledge. The preschool word-learning opportunities afforded to and the vocabulary outcomes of children from low-income families is of particular importance to the field today.

Variation in Outcomes for Children with Low Initial Language

As explored further in Chapter II, theoretical and empirical literature suggests that the size of children's existing vocabulary is related to how they learn new words. In a number of correlational and intervention studies, certain classroom experiences have been shown to provide better word-learning opportunities for children with higher initial vocabulary scores (Blewitt, Rump, Shealy, & Cook, 2009; Collins, 2005; Mashburn, Justice, Downer, & Pianta, 2009; Robbins & Ehri, 1994; Sénéchal, Thomas, & Monker, 1995). In each of these studies, despite similar experiences, children with lower initial vocabulary scores learned fewer words than their higher-scoring peers. These findings are suggestive of a "Matthew Effect" in vocabulary learning, a term for occasions when children with larger existing vocabulary skills are better able to learn new words from

typical school experiences than their peers with smaller vocabularies (Stanovich, 1986). This effect may widen the vocabulary gap between children with low-language skills and their peers with typical-language skills at preschool entry. Recent research also has identified preschool experiences that appear promising for increasing the vocabulary level of children with initially low-language skills (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004; Reese & Cox, 1999; Silverman & Crandell, 2010). These include intensive small-group instruction and the use of nonverbal semantic information focused on vocabulary, both of which had larger effects on vocabulary growth for children with smaller initial vocabularies. While these supports for low-language children's word learning need to be further explored, they show promise for potentially ameliorating the Matthew Effect.

Preschool Classrooms as Word-Learning Contexts

Preschools are an important context for word learning, particularly for children with low-language skills or children who are encountering the academic register for the first time (Schleppegrell, 2012). Many low-income and at-risk children are enrolled in preschool programs such as Head Start or public prekindergarten, and some spend as much waking time in these settings as they do at home. These groups of children need experiences to expand their vocabulary knowledge during preschool so that they enter kindergarten with the requisite vocabulary for success in school.

Considerable effort has been expended in research to understand how parents support language, but relatively little work has been done examining the everyday teacher-child interactions in preschool classrooms that have the potential to support word

learning. The few studies that have observed teacher-child interactions in preschool classrooms have identified some promising ingredients for vocabulary learning; these are reviewed in Chapter II. Characterizing the word-learning opportunities in preschool classrooms and determining the type of interactions that relate to children's vocabulary gains over the preschool year will further the field's understanding of the role teacher-child interactions play in vocabulary development. This knowledge could have implications for the research on word learning in preschools and the practice of early childhood educators.

Objectives

This study had two primary objectives. First, it was designed to describe the daily word-learning opportunities children experience in Head Start classrooms. Word-learning opportunities for preschoolers were operationalized by creating a list of words that are instructionally valuable for preschool children and would likely expand their vocabulary. This tool was used to search interactions between teachers and children in small group and centers activities for teachers' use of words that were potentially instructional. Interactions that included a word identified using this tool were further examined for the presence of semantic supports that prior research suggests help children understand the word meaning. Three types of support were considered: 1) verbal supports such as defining, 2) nonverbal supports such as gesturing, and 3), and use of words in extended discourse.

Second, this study investigated the relationships between the word-learning opportunities and children's vocabulary growth. Teacher use of instructional words in

adult-to-child speech, as well as the frequency with which these words were embedded in interactions featuring semantic supports, were examined in relation to child vocabulary gains. These relationships were examined for subgroups of children with low initial language skills and children with typical initial language skills to explore whether the relationships differed by existing linguistic knowledge. Word-learning opportunities were examined in two common preschool activity settings: centers/free play and small group instruction. These contexts were both characterized by low teacher-child ratios for interactions, but differed in terms of the formality and degree of instructional focus. Growth in vocabulary knowledge was measured across several dimensions, including receptive and expressive vocabulary and through standardized assessments and naturalistic language sampling.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter reviews the existing literature related to word-learning opportunities in preschool classrooms. First, the contextual factors conducive to word-learning opportunities in classrooms are outlined. Second, word-learning opportunities and related constructs are defined for the purpose of this study. Next, a theoretical framework for vocabulary learning is laid out. Finally, issues related to the study of vocabulary learning in preschool classrooms are considered. Each section presents implications from the reviewed literature for the current study.

Other studies have used correlational evidence to identify the types of adult-child interactions that relate to children's vocabulary learning. Much of this correlational research comes from various reports from one major study of early childhood language and literacy learning, the Home-School Study of Language and Literacy Development (HSS; see Dickinson & Tabors, 2001, for an overview). This study examined the home and school environments of 84 child participants from racially diverse low-income families in Eastern Massachusetts. Observational data were collected about children's language and literacy environments at home and in preschool when they were 3, 4, and 5 years old. Most participants were followed throughout their school years to assess their language and literacy achievement. The corpus of data from the HSS led to various observational reports describing the nature of adult-child input during the preschool years, as well as correlational analyses of the relationship between various types of input

and interactions with children's language and literacy learning. The HSS is particularly relevant to the current study as it is one of few studies that report observational data about children's language experiences in preschool classrooms and link these experiences to vocabulary learning.

Conditions Conducive to Word-Learning Opportunities in Preschool Classrooms

Young children encounter word-learning opportunities in every context of their daily lives, from shared book reading with parents to encounters with media including television, movies, and electronic devices. For children with a need for early intervention, including those children eligible for Head Start programs, the preschool classroom is an important context for word-learning opportunities. The preschool teacher creates many of these learning opportunities through speaking, playing, and interacting with children in the classroom.

Prior research identifies characteristics of classroom experiences that potentially provide word-learning opportunities for preschool children. While the vast majority of research on early vocabulary development comes from the home setting or parent-child interactions, a growing body of research has focused on preschool classroom experiences. This preschool classroom research is the source of most of the evidence for promising features of word-learning experiences presented here. In some cases, the relative dearth of research from preschool settings leads to the need to rely on strong evidence about word-learning opportunities from the home context. This evidence is used to hypothesize about word-learning opportunities in preschool classrooms. Studies that report both home and classroom data show that homes are a much more potent predictor of child outcomes

(Dickinson & Tabors, 2001; NECCRN, 2002). Thus, it is possible to make cautious conjectures about prerequisites and mechanisms for word learning in classrooms based on evidence from home settings, while recognizing the relationships may be weaker or different and necessitate further study.

Adult-to-Child Speech

For children's vocabulary learning, it is important that novel or challenging words be introduced in adult-to-child speech (ACS). ACS is related to the construct of child-directed speech (CDS; Snow, 1986; 1995). CDS is the simplified register of parent-to-child speech, with shorter utterances and simpler vocabulary than typical adult speech. Child-directed speech is independent of other types of input, including indirect input or overhearing of adult-to-adult conversation, television and other forms of media. Overheard speech is less effective at influencing children's vocabulary learning (Hoff, 2006; Naigles & Mayeux, 2001). While studies of child-directed speech have focused on parent-child interactions, studies of children's experiences at home and in preschool indicate similar discourse patterns are at work in each context (Dickinson & Tabors, 2001; Girolametto & Weitzman, 2002). For the purpose of studying preschool classrooms, ACS may describe any speech directed to children as opposed to other types of language input experienced by children. ACS would exclude adult-to-adult conversation such as a teacher speaking to an aide or parent, teacher self-talk, and teacher talk through a telephone, intercom, or other device. These other types of speech are unlikely to engage children, and they are unlikely to include the features of ACS that make it helpful in learning words such as joint attention, simplified sentences and

vocabulary (Harris, Golinkoff, & Hirsh-Pasek, 2011; Snow, 1995). New or novel words embedded in ACS in preschools therefore present word-learning opportunities for the children to whom the speech is directed. While the volume of ACS each child experiences will vary at times, across the day he or she would likely have similar opportunities to hear ACS in whole-group and small-group activities.

Settings With a Low Child-to-Teacher Ratio

Settings where teachers are speaking and interacting with individual or small groups of children in close proximity are conducive to children's vocabulary learning. Teacher language is richer and children are more interactive in groups of four or fewer as compared to whole group settings (McCabe et al., 1996; Pellegrino & Scopesi, 1990). One example of a preschool activity when teachers interact with individuals or small groups is centers or free play, where preschool teachers' use of sophisticated vocabulary and the balance of teacher-child talk has been found to relate to children's receptive vocabulary in kindergarten (Dickinson & Tabors, 2001). Small group settings, both teacher-led and child-led, tend to feature more frequent use of language support techniques, and therefore provide richer word-learning opportunities, as compared to whole group settings (Turnbull, Anthony, Justice & Bowles, 2009). Settings in which teachers interact with individuals or small groups may approximate the rich interactions between parents and children at home, which is a well-established mechanism for children's vocabulary development.

Whole-group classroom activities have very different linguistic characteristics than interactions at home. Yet whole-group activities in preschool classrooms have been

shown to relate to vocabulary learning. In particular, shared book reading has been widely studied, and book reading interventions on average found to predict children's vocabulary learning (d = 0.60; NELP, 2008). Yet large group settings such as whole-class shared book reading, where language is directed at many children, appears to be less influential in the vocabulary learning of children with low initial skills (Blewitt et al., 2009; Collins, 2005; Robbins & Ehri, 1994; Sénéchal et al., 1995). Even dialogic reading, a method of shared book reading with proven influence on children's vocabulary learning, has larger effects when delivered in a small group (d = 0.42; Mol, Bus, & De Jong, 2009). Book reading in particular has specific benefits, as novel contexts and new vocabulary are introduced through the story, words are often repeated, and words are often paired with visuals and contextual information to help children understand their meaning. Nonetheless, children vary in their ability to take from such input, particularly in a large group setting. Those contexts with a lower child-to-teacher ratio provide plentiful opportunities for the teacher to engage all children in interactions featuring a variety of new words.

Multiple Exposures

Multiple exposures to new words are necessary to advance word learning beyond a superficial level. Preschool children can learn something about words from a single exposure, but without further exposures they typically learn only incomplete word meanings (Anderson & Freebody, 1981; Carey & Bartlett, 1978; Clark, 1995). Frequency of exposure to novel words is related to children's learning of those words and general vocabulary knowledge (Blachowicz, Fisher, Ogle, & Watts-Taffe, 2006;

Dickinson & Smith, 1994; Penno, Wilkinson, & Moore, 2002; Sénéchal et al., 1995). When children have the opportunity to hear instructional words multiple times in their preschool classroom, they add to their semantic construction and are more likely to learn the meanings of those words.

Following the Child's Lead

Interactions in which the adult follows the child's lead are associated with greater vocabulary learning (Bloom, 2000). Particularly in a busy preschool classroom, this approach allows the teacher and child to share joint attention and capitalizes on the child's interest for increased motivation to learn (Akhtar, Dunham, & Dunham, 1991; Harris, Golinkoff, & Hirsh-Pasek, 2011; Tomasello & Farrar, 1986). Vocabulary teaching that follows children's interest or attention is related to greater word learning as compared to adult-directed or adult-prescribed interactions (Valdez-Menchaca & Whitehurst, 1988). Preschool teachers' use of new or novel words during interactions that follow the child's lead or interests provide enhanced opportunities for vocabulary learning.

Implications for the Current Study

Because prior research has linked adult input to children's vocabulary learning, this study examined word learning opportunities that appeared in adult-to-child speech in Head Start classrooms. The activity contexts examined in this study, small groups and centers, were chosen because they represent a teacher-directed and child-directed activity respectfully, and both feature a low child-to-adult ratio. Multiple exposures and following

the child's lead were considered to the extent that they could be reliably measured within the constraints of the research design.

Defining Word-Learning Opportunities

Instructional Words

To expand their vocabulary knowledge, children in preschool classrooms need be exposed to words at their instructional level. In literacy instruction, a text at a child's instructional level is one that is slightly more challenging than the text a child can fluently read and comprehend on his or her own (Allington, 1984). Similarly, words at a child's instructional level are slightly more challenging than the words the child knows and can use or comprehend on his or her own. These words are different for every child depending on their prior experiences and existing vocabulary knowledge. However, in field research in classrooms where teachers are working with large groups of children, general vocabulary targets are needed. In their work with vocabulary instruction in elementary school, Beck, McKeown, and Kucan (2002) conceptualize "Tier II" words, defined as words that are neither so easy that children will encounter and easily learn them in their daily lives, nor so specialized that they will only be encountered and used in restricted contexts.

Biemiller and Slonim (2001) argue that words are learned in a relatively predictable sequence, and there are top priority words to address in early childhood that would mitigate the vocabulary gaps children experience throughout elementary school and beyond. These priority words are the words that children in the top quartile of

vocabulary knowledge tend to know, and the children in the lowest quartile of vocabulary knowledge tend not to know. These words arguably make up the academic register of K-12 schools and texts. For success in literacy, children must learn and use not only age-appropriate vocabulary, but also some more advanced vocabulary (Biemiller, 2003). If this approach is correct, identifying these top priority instructional words for preschoolers provides an alternative to trying to adjust vocabulary instruction to every child's level. Exposure to the appropriate instructional words in preschool classrooms potentially provides children with word-learning opportunities.

Data from the HSS also suggest that the variety of vocabulary input from teachers in early childhood classrooms relates to children's vocabulary growth. When preschool teachers exposed children to sophisticated vocabulary children showed greater growth in vocabulary, narrative, and emergent literacy skills in kindergarten (Dickinson, Cote, & Smith, 1993; Dickinson & Porche, 2011). These findings suggest that the level or complexity of vocabulary in preschool teachers' ACS is associated with children's vocabulary growth.

Another recent study of the language environments in early childhood classrooms yielded similar results. This study examined the teacher language input to 104 native English speakers and English language learners in ten preschool classrooms (Bowers & Vasilyeva, 2010). For the 75 native English-speaking children, varied vocabulary, as measured by the number of different words in teachers' speech controlling for the total number of words, positively and significantly related to receptive vocabulary growth over the preschool year. The overall volume of teacher talk and length of utterances did not relate to vocabulary growth. That study's findings reinforce the importance of exposure

to sophisticated vocabulary in preschools, in addition to homes, for children's vocabulary development.

The instructional word approach to identifying words that expand preschool children's vocabulary differs slightly from the rare word approach used in several prior studies. In the HSS, rare words were defined as words that appear infrequently in the vocabulary of 3- and 4-year-old children (Beals & Tabors, 1995; Dickinson & Tabors, 2001). While the same is true of instructional words, the rare word list consisted of words that were not typically known by fourth grade children. The list of rare words was further narrowed to specialized vocabulary related to reading comprehension in another study (Roskos et al., 2008). These definitions of rare words lead to a corpus of words that is more than "just above" most preschool children's current level of lexical knowledge. The presence of rare words in ACS reflects an important aspect of children's linguistic environment, the variety and sophistication of lexical input. However, instructional words represent more appropriate word-learning opportunities for most preschool children, words that are just within reach of their current knowledge and abilities. The operationalization of the corpus of instructional words is further described in this study's methods in Chapter III.

Semantic Supports

Word-learning opportunities in preschool classrooms occur when teachers use instructional words in ACS. This study examines teachers' interactions with individuals or small groups, occasions when the teacher may have more ability to engage in interactions with children and follow the children's interest or attention than in whole

group activities. Prior research suggests that these learning opportunities will be enhanced when the instructional word use is accompanied by one or more semantic supports. Researchers have found benefits associated with three types of semantic supports that appear to provide children with information to learn the meaning of new words.

Verbal supports for meaning. Prior research demonstrates that new or challenging words introduced with linguistic or verbal information enhance word learning. Specifically, adult use of definitions or contextualizing information with challenging vocabulary relates to children's vocabulary learning. Unlike later in schooling when most new words are encountered in texts, during preschool children arguably learn the majority of new words through explanation by others (Biemiller, 2001). The presence of verbal supports with novel words in ACS during daily interactions with the preschool teacher is a potentially important component for children to learn new words.

The HSS provides evidence that adults providing definitions or contexts for novel words at home is important to children's vocabulary learning. At age five, mothers' use of rare words embedded in instructive interactions related to children's vocabulary scores through third grade (Weizman & Snow, 2001). These interactions featured verbal semantic information that was either directly informative, such as a definition, or indirectly informative, such as contextual information about the word's meaning. Additionally, parents' rare word use with verbal information to support learning during mealtime conversations when children were 3, 4, and 5 years old related to children's PPVT scores at ages 5 and 7 (Beals, 1997). Interactions were considered informative if

they provided enough information that a preschool-aged child could gain some sense of the word's meaning from the interaction. The same relationship between verbal supports for novel words and children's vocabulary learning was found in the preschool classrooms. During book reading, teachers' use of rare vocabulary words with brief explanations of those words' meanings related to children's vocabulary size at the end of kindergarten (Dickinson & Porche, 2011; Dickinson & Tabors, 2001).

Silverman and Crandell (2010) examined the vocabulary teaching practices experienced by a diverse sample of 244 children in 16 prekindergarten and kindergarten classrooms. Each classroom was observed for 90 minutes, three times during the school year. During activities other than book reading, teachers' defining related to children's growth on a researcher-created measure of targeted vocabulary words, and teachers' conceptualizing related to children's growth on the PPVT.

These studies suggest that, in addition to the quantity of vocabulary words used by the adults and the number of uses of each word, providing verbal information about the meaning of words influences children's acquisition of vocabulary. Without the related conceptual information, young children may have difficulty understanding or learning new words that they encounter. Perhaps multiple verbal supports further enhance word learning. In a meta-analysis of vocabulary instruction for school age children, Stahl and Fairbanks (1986) found that vocabulary interventions that provided contextual and definitional support for learning the meaning of words were more effective (d = 1.50) than those that just provided definitions (d = 1.09). Providing definitions, examples, and other contextual information are potentially effective ways for adults to support children's word learning.

Nonverbal supports for meaning. In addition to linguistic supports for word learning in ACS, nonverbal semantic information accompanying new words during adult-child interactions appears to play a role in children's vocabulary learning. In the literature on second language learners, comprehensible input is verbal or linguistic input that is enhanced through additional non-linguistic information, such as intonation, gesture, or visuals (Krashen, 1989). Although comprehensible input is important for children learning a second language, young children learning the vocabulary of their first language also likely need non-linguistic supports to make sense of input and link words to concepts or referents.

Several observational studies make this association. Parents' gestures during interactions with their young children related to their children's later vocabulary size (Pan et al., 2005; Rowe, Özçaliskan, & Goldin-Meadow, 2008). In prekindergarten and kindergarten classrooms, teachers' acting out or illustrating words related to children's end-of-year receptive vocabulary scores (Silverman & Crandell, 2010).

Three studies examining various methods of book reading found that presenting challenging words with nonverbal supports led to greater vocabulary gains for children. Use of gestures such as acting out a word and visuals such as pointing to a picture facilitated greater vocabulary learning during book reading than reading the same book without these supports (Elley, 1989). These strategies were equally effective for low-language children as for high-language children. In another study, teachers' use of a "describing style" of book reading focused on the books' illustrations led to greater vocabulary gains for preschool children with low initial vocabulary skills as compared to teachers' use of a "comprehender style" focused on discussion (Reese & Cox, 1999).

Finally, a small-group intervention that coupled book reading with vocabulary instruction using concrete objects, pictures, and gestures led to significant vocabulary gains (Roskos & Burstein, 2011). While these studies were in the book reading context, they suggest nonverbal supports contribute positively to children's word learning. Additionally, storybooks often feature illustrations or photographs that may serve as nonverbal supports for children understanding novel words in the text. It is possible the pictures in storybooks are one reason that shared book reading is associated with young children's vocabulary skills.

Nonlinguistic input accompanying instructional words appears to provide support for word learning in early childhood. Pictures and concrete objects as referents as well as gestures and other physical supports by adults are hypothesized to facilitate children's word learning.

Extended discourse. The opportunity to learn new words appears to be enhanced when those words are embedded in meaningful, extended adult-child conversations. Such conversations potentially provide children the opportunity to gather more cues about the word, respond to the teacher's word use, or practice with the word. In a number of studies with children from low-SES families, parents' engagement in sustained talk about a single topic with their children related to children's vocabulary growth (Fivush, Haden, & Reese, 2006; McCabe, Boccia, Bennett, Lyman, & Hagen, 2009; Peterson, Jesso, & McCabe, 1999). When preschool teachers provided children with opportunities for extended conversations focused on analytic or decontextualized topics, children showed greater growth in vocabulary, narrative, and emergent literacy skills in kindergarten and beyond (Dickinson, Cote, & Smith, 1993; Dickinson & Porche, 2011;

Dickinson & Smith, 1994). Decontextualized topics included past or future events, books, and content area concepts. Teachers' use of interaction-promoting strategies to engage preschool children in extended conversations in a small group setting related to children's use of diverse vocabulary in that context (Girolametto & Weitzman, 2002). These strategies included responding to children's initiations, maintaining topics over successive turns, expanding children's utterances, and inviting children to respond.

Despite evidence for the importance of extended discourse, research indicates that opportunities to engage in these types of conversations can be very limited for children in preschools such as Head Start, where classroom conversations are often limited to teacher directives and one-word responses from children (Bond & Wasik, 2009; Dickinson, Darrow, & Tinubu, 2008; Gest, Holland-Coviello, Welsh, Eicher-Catt, & Gill, 2006). Embedding instructional words in extended conversations is likely important, because these conversations provide children opportunities to engage with the teacher to gather a more complete understanding of new words.

Implications for the Current Study

Some scholars have worked to identify the words that are instructional for preschool-aged children, though there is no consensus in the field about which words these are. This study builds upon this work while making an effort to match the selected corpus of words to the study sample. While no previous studies have defined instructional words in the same manner as the current study, researchers have attempted to define which words young children should be learning in schools thus providing a foundation for this study.

There is some evidence from the literature that experiences with instructional words featuring semantic supports provide opportunities for vocabulary learning. Not all have been studied thoroughly in preschool classrooms, or with children with a range of initial language skills. It is not clear how prevalent these types of opportunities are in preschool classrooms, particularly those serving children at risk for difficulties in language, literacy, and other academic areas. Further, it is necessary to examine these specific constructs or features of word-learning opportunities to see whether and to what degree they relate to vocabulary learning, and for whom (low- or typical-language children).

While word-learning opportunities arise through other aspects of the preschool environment, such as interactions with peers or materials, the nature of the data used for this study did not allow for analysis of these features. Therefore, these important constructs will be areas for future study of the word-learning opportunities in preschool classrooms.

Word Learning as Conceptualized by the Emergentist Coalition Model

Many current theories of language acquisition acknowledge an interaction between biologically-determined cognitive mechanisms, environmental influences, and prior learning (Hirsh-Pasek, Golinkoff, Hennon, & Maguire, 2004; Waxman, 2004). One such theory, the Emergentist Coalition Model (ECM), posits that as young children develop, the mechanisms they use for word learning evolve (Hirsh-Pasek, Golinkoff, & Hollich, 2000; Hollich, Hirsh-Pasek, & Golinkoff, 2000). Younger children first draw on innate mechanisms for language acquisition, primarily attentional cues such as salience

and novelty. Next, they begin to use social cues provided by conversational partners to form language-learning hypotheses. These cues include eye gaze, pointing, and social context. Finally, with basic language skills as a foundation, children utilize existing lexical and grammatical knowledge for continued language learning. Multiple cues are available to young children as they approach word learning, though they are used to varying degrees at different points in their development.

Interactive theories including the ECM suggest that children's vocabulary is largely influenced by the social and linguistic input of those with whom they interact. This perspective is widely supported in empirical research, where children's interactions with others, particularly adult speakers, have been shown to influence their word learning (Biemiller, 2001; Fernald & Marchman, 2011; Hoff & Naigles, 2002; Hoff, 2006). This view of language acquisition as being progressively determined by children's use of different types of information from their environment leads to this examination of the nature of word-learning opportunities in the preschool classroom, and how these opportunities account for the variability in children's vocabulary learning during preschool.

Word-Learning Opportunities through Social Interaction

The ECM perspective is underpinned by the work of Vygotsky (1978) whose socio-cultural theory suggests that social interaction in a necessary component of children's learning and development. Vygotsky stressed the fundamental role of social interactions in meaning making, and he saw language as both a product of social learning and an avenue for cognitive development. Application of this theory to word learning

opportunities in classrooms suggests that children's vocabulary learning would take place during interactions with others.

Vygotsky described adult-child interactions within a zone of proximal development (ZPD) as facilitating children's learning. This zone is the "area" between what children can do independently and what they can do with the help of an adult or more knowledgeable peer. As in the ECM, children use a variety of cues in their environment, particularly in interactions with others, to form hypotheses and shape their thoughts. Vygotsky argues that social interaction is the primary vehicle for learning and development.

Vygotsky's (1978) conceptualization of the ZPD informs interactive approaches to language development in general, and word learning in particular. For vocabulary learning, the ZPD would include the opportunities to learn words from others' speech with supports provided by the interaction, whereas a child may be unable to make meaning of the word without such an experience. Likewise, the ZPD could be conceptualized as the classification of instructional words for a child, words that he or she does not know or cannot use independently, but can comprehend or use with some scaffolding from an adult. If words are learned in a relatively predictable sequence once children enter school (Biemiller, 2003), there should be a range of appropriate words preschool children are ready to learn.

Implications for the Current Study

The ECM (Hirsh-Pasek et al., 2000; Hollich et al., 2000) suggests that children experience word-learning opportunities when they use prior knowledge, cognitive

mechanisms, and external cues to make sense of new words. For preschool-aged children then, a word-learning opportunity would likely be an occurrence where the child has access to salient attentional cues, social cues, and linguistic cues, all present in a meaningful interaction with an adult or more knowledgeable peer. It would be possible for children to apply these cueing systems to expand their word knowledge in such instances when the words they encounter are at their instructional level. The ECM also suggests that preschool children at varying levels of language development would draw on environmental cues differentially. The current study examines such opportunities and the accompanying supports that provide these cues. This study also analyzes the relationship between environmental supports and word learning for two samples of children at different stages of language development.

In addition, Vygotsky's (1978) socio-cultural theory is a strong rationale for looking at the everyday interactions between preschool children and their more advanced conversational partners, their teachers. Vygotsky's conceptualization of learning in the ZPD provides a foundation for this study's approach to the selection of instructional words and the identification of supports during word-learning opportunities. Although the design of this study does not allow for identification of those words that would be in the ZPD for individual children, the characteristics of the sample were taken into account when determining which words would represent a word-learning opportunity.

Considerations for the Study of Word Learning in Classrooms

Measures of Vocabulary Knowledge

Vocabulary knowledge has been operationalized in a variety of ways based on how it is measured. Studies of vocabulary learning during the early childhood years have been concerned with multiple dimensions of vocabulary knowledge, including receptive and expressive knowledge as well as breadth and depth of knowledge. Breadth of vocabulary refers to the number of words known, and depth refers to the quality of understanding of and ability to use words (Anderson & Freebody, 1981). Both are important in children's oral language and literacy development. In fact, Henriksen (1999) presented a way of thinking about vocabulary knowledge on continua along three dimensions: (a) partial to precise knowledge, (b) depth of knowledge including synonymy and polysemy, and (c) receptive to productive knowledge. Measures of vocabulary learning reflect each of these dimensions, though the breadth and depth dichotomy is most salient in operationalizing the construct of vocabulary knowledge, particularly with young children.

Breadth. The dominant approach in the field of language research involves studying the breadth of vocabulary knowledge, particularly in terms of receptive word knowledge. Most empirical studies operationalize vocabulary knowledge as the number of words known. Word knowledge is most frequently measured by means of nationally-normed assessments of a broad range of vocabulary knowledge, such as the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981) or the Expressive One-Word Picture Vocabulary Test (EOWPVT; Brownell, 2000). These types of assessments

purport to measure a representative sample of words children should know at a particular age based on a large norming population, and these tests have demonstrated predictive validity. As previously mentioned, early measures of vocabulary breadth predict later reading success across a variety of population samples (Dickinson & Tabors, 2001; NELP, 2008; NECCRN, 2002; Scarborough, 2001; Storch & Whitehurst, 2002). Additionally, receptive and expressive vocabulary breadth have both been specifically linked to decoding skills and visual word recognition (Ouellette, 2006). Limitations of these measures include that they necessarily only sample a relatively small number of words from the corpus of words a child may know and thus may over- or under-estimate the size of a child's vocabulary (Anderson & Freebody, 1981). Due to their structure, which is highly reliant on pictures as referents, these tests have a demonstrated noun bias (de Villiers, 2004). This noun bias may also serve as a cultural bias when vocabulary learning in some families or cultural groups may be more verb-focused (de Villiers, 2004). These general measures have less sensitivity to detect children's short-term vocabulary gains (Roskos et al., 2008). Finally, these measures of vocabulary breadth may tap into words of which a child has only shallow or constrained knowledge.

Some researchers use children's language samples as a measure of their vocabulary knowledge. Language samples are analyzed for the total number of words produced by the child (type), the number of different words (token), or an indicator of the vocabulary diversity of the child's speech (type/token ratio or number of different words). Language samples have been collected for a variety of purposes including clinical diagnosis and in descriptive, experimental, and validation studies (e.g., Beals, 1997; Bornstein, Hahn & Haynes, 2004; Malvern & Richards, 2002; Pan, Rowe, Spier, &

Tamis-Lemonda, 2004). This approach is focused on expressive vocabulary, and those who use it assume that the language a child produces in the setting where the sample was collected is indicative of his or her overall vocabulary size. Language sample measures likely provide information about depth of knowledge as well, because the words analyzed are used voluntarily in context. Despite their utility, these measures are time-consuming and difficult to collect and analyze, and because collection protocols and settings vary they are also difficult to compare across studies (Johnson, 2000).

Depth. Measures that assess how well children know particular words or sets of words, or depth of word knowledge, are less common than measures of vocabulary breadth. Scholars have characterized depth of word knowledge in a hierarchical framework, as a series of successive stages or levels of knowing a particular word (Beck et al., 2002; Blachowicz & Fisher, 2000). These stages are broadly defined as: (a) no knowledge of a word, (b) some familiarity or general sense of the word, (c) narrow, context-bound understanding of the word's meaning, (d) having a clear understanding of the word's meaning but inability to use it in speaking or writing, and (e) having a nuanced understanding of the word's meaning with the ability to use it appropriately. Within this framework, repeated exposure in highly supportive contexts is believed necessary to reach the deepest level of word knowledge, complete or precise word knowledge, and both receptive and productive word knowledge.

Measures of depth of vocabulary knowledge are often researcher-designed protocols that include a set of tasks aimed at vocabulary use in a variety of different contexts. Indicators from children's language samples may also be analyzed as a measure of vocabulary knowledge-in-use, a demonstration of a deep level of word

knowledge. As noted previously, strong mastery of a specific word's meaning is needed to use that word, particularly outside of the context in which the word was learned. Elicited tasks may be designed to examine whether children will use particular words in an obligatory context. Such measures have been used in a variety of experimental studies (e.g., Blewitt et al., 2009; Penno et al., 2002). In addition to elicited tasks, naturalistic samples can be examined for the number or diversity of words a child is able to produce as an indicator of the child's working vocabulary, reflecting both breadth and depth of knowledge.

Despite a relative dearth of studies of this construct, depth of word knowledge has predictive validity for later literacy. Depth of word knowledge in elementary school has been linked to reading comprehension (Ouelette, 2006; Proctor, Uccelli, Dalton, & Snow, 2009). However, measures of depth of vocabulary knowledge are rare in researching early language development in natural settings such as homes or classrooms, and testing is difficult with this age group. Yet knowledge about how experiences relate to depth of word knowledge in early childhood would be useful in studying preschoolers' vocabulary learning.

Differential Effects of Adult Input Based for Subgroups of Children

As suggested by theoretical and empirical literature on vocabulary learning, existing lexical knowledge relates to new word learning. The ECM suggests that as they develop, children draw on different cues to learn the meaning of new words, and preschool-aged children typically rely primarily on linguistic cues (Hirsh-Pasek et al., 2000; Hollich et al., 2000). In both intervention and correlational studies, children

benefitted differentially from teachers' vocabulary support practices based on their initial vocabulary scores.

As noted in Chapter I, there is evidence of a Matthew Effect on vocabulary learning (Stanovich, 1986), where commonly-used adult input strategies seem to work better for children with higher initial vocabulary skills. This pattern emerged in a number of intervention studies, where certain book-reading experiences led to provide better word-learning opportunities for children with higher initial vocabulary skills (Blewitt et al., 2009; Collins, 2005; Robbins & Ehri, 1994; Sénéchal et al., 1995). In each of these vocabulary-focused book-reading interventions, children with lower baseline vocabulary scores learned fewer words than their higher-scoring peers. These differences are also present in Silverman and Crandell's (2010) recent study of vocabulary teaching practices during prekindergarten and kindergarten activities other than book reading. As previously noted, they found that teachers' use of defining and contextualizing vocabulary was associated with children's gains in vocabulary knowledge, yet children with higher initial vocabulary gained more from these strategies than children with lower initial vocabularies. Such activities may widen the disparity in vocabulary scores between children with low-language skills and their peers with typical-language skills at preschool entry. A study of more than 1,800 preschool children demonstrated that higher language abilities of classroom peers related to children's vocabulary development, but this association was stronger for children with higher initial language skills than children with lower initial skills (Mashburn et al., 2009). This finding further suggests that children make use of preschool environmental language supports differentially based on their initial language skill, often advantaging the children who begin with higher skills.

At the same time, some research has identified preschool experiences that may be best suited to raising the vocabulary level of children with low initial skills. An intervention featuring vocabulary-instruction during book reading was delivered to kindergarten children in 108 small-group sessions (Coyne et al., 2004). In a control group using general literacy instruction, children with higher initial PPVT scores made greater gains on a researcher-created measure of vocabulary than children with lower initial PPVT scores. In comparison to the control group, there was a significant effect of initial PPVT such that the intensive intervention led to greater vocabulary gains for children with low initial vocabulary than children with higher initial language. Another intervention evaluated a "say-tell-do" approach to vocabulary instruction with children with low initial vocabulary scores (Roskos & Burstein, 2011). This approach features pictures, concrete objects, and gestures related to novel words introduced with book reading in twice-weekly small group sessions. The "say-tell-do" approach led to significant gains on the PPVT. Silverman and Crandell (2010) found that teachers' acting out or illustrating words related to children's end-of-year receptive vocabulary scores, with children with lower initial vocabulary gaining more from this support than children with higher initial scores. Another study compared several styles of teacher book reading for children with language delays or other risk factors. Teachers' use of a "describing style" focused on pictures led to greater vocabulary gains for these preschool children with low initial vocabulary skills as compared to a "comprehender style" focused on discussions (Reese & Cox, 1999).

These promising strategies for boosting the vocabulary gains of low-language children feature intensive small-group intervention and the use of nonverbal semantic

information focused on vocabulary. These findings suggest there may be other types of supports needed to optimize the word-learning opportunities for subgroups of children with low or typical initial skills. While these supports for low-language children's word learning need to be further explored, they show promise for narrowing vocabulary gaps present at preschool entry.

The same issues need to be pursued for other children with risk factors for difficulty with vocabulary and later reading achievement, such as children with special needs and children for whom English is a second language. For example, a curriculum intervention aimed at improving vocabulary led to no significant vocabulary gains on a proximal curriculum-based measure for children with special needs or considered at risk for disabilities (Roskos et al., 2008). Researchers need to thoroughly explore whether the types of adult input presented with evidence for effectiveness here also hold true for these groups of children.

Challenges of Observational Study in Classrooms

Numerous studies have evaluated vocabulary-focused interventions to examine causal relationships between teaching practices and children's learning. Prior to developing effective educational interventions, strong foundational research is needed to describe current practices and examine associations between these practices and children's outcomes. Additionally, observational research is needed to look at the everyday word-learning experiences of children outside the context of very structured and intensive interventions.

This type of research presents a number of challenges. First, observational research is subject to the influence of uncontrolled variables. It is therefore necessary to consider context when interpreting findings. In research on language interactions in the classroom, it is important to consider the interactions between the teacher, child or children, activity, and broader context (Brophy, 2006). Many variables are at play in classroom interactions beyond what is readily observed. One solution is to measure and control for as many of these variables as possible.

Another challenge is the close and detailed lens needed to examine language practices. Measuring language variables often requires recording and transcribing language samples. It can be difficult and time-consuming to collect and analyze lengthy language samples from classrooms, so short samples may be necessary. Brief samples pose the risk of not accurately and reliably representing the broader environmental language of classrooms. However, prior research has demonstrate that information from a small sample of teacher language can predict children's language growth, even in the longer term (Dickinson & Porche, 2011; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). Characterizations of the instructional focus in preschool classrooms from one half-day observation also predicted children's vocabulary gains (Connor, Morrison, & Slominski, 2006). These studies demonstrate that environmental variables derived from carefully looking at a snapshot of a classroom can have construct and predictive validity for language research.

These studies demonstrate it is possible to examine relationships between classroom language experiences and children's language development, even without examining individual children's experiences. While it is clear the language experiences of

individual children will vary within a classroom, samples of teacher language serve as an approximation of the language environment to which the children are exposed on a daily basis. Aspects of teacher-child interaction measured on the whole appear to be consistent enough across children in a classroom to be associated with children's learning.

Implications for the Current Study

Vocabulary is a multi-faceted construct that is operationalized by many measures. The varied measures assess different aspects of children's word knowledge depending on the dimension and testing mode. For a clearer understanding of children's vocabulary knowledge and skills, a variety of measures are needed. In the current study, child vocabulary outcomes are measured by standardized tests of receptive and expressive vocabulary as well as a language sample measure of productive vocabulary knowledge-in-use.

The differential effects of some supports for vocabulary learning and vocabulary-focused interventions based on children's initial language point to the need to examine initial language in vocabulary research. It is particularly important to see whether hypothesized classroom language variables are related to children's vocabulary gains in preschool for children with low initial skills. This study therefore uses two samples of children, those with very low and those with typical initial language, to examine the relationship between preschool word-learning opportunities and vocabulary growth. In the current study, even the children whose initial language was within the typical range have relatively low language scores compared to the nationally-normed mean on the standardized measures. In light of the importance of academic vocabulary for later

academic success, the word learning of both groups is of concern and important to carefully explore.

In the field of vocabulary research, descriptive information about the word-learning opportunities in classrooms is needed. Intensive vocabulary-focused interventions have demonstrated effects on children's vocabulary growth, but everyday interactions may have different relationships with children's learning. Though unobserved variables are at work in classrooms, observed aspects of teacher-child interaction may be consistent enough across children in a classroom and may have sufficiently potent instructional value to be associated with children's learning. The current study examines aspects of teacher-child interactions hypothesized to serve as word-learning opportunities, under the assumption that these aspects are indicative of how teachers interact with the range of children in their classrooms.

Research Questions and Hypotheses

Research Questions: Describing Vocabulary Teaching Practices.

The following research questions were explored to describe the prevalence of word-learning opportunities in Head Start classrooms.

I. How frequently do instructional words appear in teachers' adult-to-child speech in Head Start classrooms?

II. How frequently do the following types of semantic supports occur during teacher-child interactions featuring teachers' use of instructional words:

a. Verbal supports for meaning?

b. Nonverbal support for meaning?

c. Use in extended discourse?

Hypotheses: Word Learning Opportunities and Children's Vocabulary Growth

The following research hypotheses were tested to analyze the relationship between Head Start classroom word-learning opportunities and children's vocabulary growth.

I. The density of instructional words in teachers' adult-to-child speech will relate to growth in children's vocabulary from the beginning to end of preschool.

II. This relationship will vary by children's initial language status, with matched-language children gaining more in classrooms with greater use of instructional words as compared to low-language children.

III. The density of semantic supports for understanding the meaning of instructional words in teachers' adult-to-child speech will relate to children's growth in vocabulary knowledge from beginning through the end of the preschool year.

IV. These relationships will vary by children's initial language status, with matched-language children gaining more in classrooms with greater use of verbal supports for meaning and embedding instructional words in extended discourse as compared to low-language children.

V. These relationships will vary by children's initial language status, with low-language children gaining more in classrooms with greater use of nonverbal supports for meaning as compared to matched-language children.

CHAPTER III

METHODS: RESEARCH DESIGN & ANALYSIS

Study Description

This study used existing data to investigate the word-learning opportunities available to preschool children in 51 Head Start classrooms. Transcripts of two classroom activities were analyzed to identify occurrences of instructional words in adult-to-child speech. From transcripts and videos, each of these episodes was then coded for semantic supports co-occurring with the instructional words. The resulting data were used to describe the word-learning opportunities in these Head Start classrooms, and analyze the relationship between those opportunities and children's vocabulary growth on a variety of measures.

Participants

The sample for this study came from a larger study for which the author was part of the research team. This sample was part a randomized field trial examining the effects of two interventions. The interventions were implemented in Head Start classrooms under one administrative agency in a metropolitan area in the southeast United States. Six clusters of Head Start centers were randomly assigned to one of three conditions: *Opening the World of Learning* (*OWL;* Schickedanz & Dickinson, 2005) a comprehensive preschool curriculum; *OWL* combined with Enhanced Milieu Teaching (EMT; Kaiser, 1993) intervention for low-language children; and a business-as-usual

control. All classrooms used an enhanced version of *Creative Curriculum* (CC; Dodge, Colker, & Heroman, 2001), the existing literacy program used by the Head Start agency prior to the study. A total of 129 teachers and teaching assistants in 52 classrooms and 247 low-language and 242 matched typical-language children participated in the randomized field trial. The curriculum intervention was implemented during one school year (approximately 8 months).

This sample lent itself to inquiry about preschool vocabulary learning in classrooms for several reasons. First, as the teacher and child participants were largely homogenous, this sample minimizes exogenous demographic variables that may moderate the relationships of interest, such as race or socioeconomic status. Further, due to eligibility criteria, this Head Start site allowed for a focus on children at risk for a variety of academic difficulties, who were therefore likely to benefit from word-learning opportunities. Finally, due to the sampling procedures used in the initial data collection, these data are conducive to examining two subsamples of child word learners: children with low initial language skills and children with initial language skills typical of the Head Start population.

Teacher Participants

For the current study, data were drawn from 51 of the 52 classrooms participating in the randomized trial. The teacher sample from these classrooms included the 51 Head Start teachers who were the lead teachers and the lead of both activities videotaped during the late fall/early winter data collection period. One classroom was excluded because the lead teacher was not videotaped in both activities during data collection. In

the final sample of 51 teachers, all were female and nearly all (96.1%) were African-American. All teachers held at least a Child Development Associate's (CDA) or other associate's degree, and only 15.7% held a bachelor's degree. Descriptive data for this sample are presented in Table 1.

The sample consisted of the lead teacher at a single point in the school year, although children also interacted with other adults. In each of the classrooms, one or two assistant teachers worked with the lead teachers and interacted with children on a daily basis. There was a relatively high level of turnover in these classrooms, such that only 43 of these 51 teachers were lead teachers for the full school year. Four of the participating teachers became lead teachers before the late fall/early winter data collection period, and four of the participating teachers left the classroom sometime during the school year following the data collection period.

Table 1

Demographics of Teacher Sample

	Frequency	%
Gender		
Female	51	100
Race/Ethnicity		
African American/Black	49	96.1
European American/White	2	3.9
Highest Degree Obtained		
CDA	8	15.7
Associate's Degree	35	68.6
Bachelor's Degree	8	15.7

	Minimum	Maximum	Mean	Standard Deviation
Age	21	65	44.1	10.8
Years of Teaching Experience	2	37	15.5	8.3

These teachers' 51 classrooms were part of 13 centers, belonging to 6 clusters. Assignment to condition for the randomized field trial occurred at the cluster level. Of the 51 classrooms in this study, 17 were assigned to the OWL condition, 19 were assigned to the OWL + EMT condition, and 15 were assigned to the business-as-usual control condition.

Child Participants

After assignment of clusters to condition, 699 children preparing to enter a preschool classroom within the 13 participating centers were screened for early expressive and auditory language skills using the Preschool Language Scale 3 (PLS-3; Zimmerman, Steiner, & Pond, 1992). In order to be selected for screening, children had to be 4 years old by September of the upcoming school year. Based on the PLS total score, children were designated as low-language (PLS score < 75; more than 1.5 standard deviations below the normative mean) or typical-language (PLS score > 75). The Head Start agency assigned children to classrooms. Following classroom assignment, the research team selected four low-language children and four typical-language children from each classroom to target for the project sample. Typical-language children were matched to low-language children based on gender and age to create a matched-language sample. In the *OWL* + EMT condition some children were moved among classrooms within centers so that four children with low-language skills based on the PLS were included in each classroom. In the *OWL* condition, regardless of their PLS scores, all children received the *OWL* curriculum. In the *OWL* + EMT condition, all children received the *OWL* curriculum, but only children with low-language skills received the EMT component.

From the 51 Head Start classrooms, there were a total of 434 child participants in the final analytic sample. This sample includes consented children who met the screening criteria for the low-language or matched-language sample, and for whom pretest information was available. This total included 206 children in the low-language sample

and 228 children in the matched-language sample. Overall, the child participants were primarily African-American (97.7%) and were, on average, 4.5 years old at the beginning of the preschool year. Girls comprised 45.2% of the total sample. Table 2 presents descriptive statistics for the low-language and matched-language samples at preschool entry.

For the low-language sample, between 1 and 8 child participants were clustered in each classroom, with a mean of 4.04 children per classroom. For the matched-language sample, between 2 and 8 child participants were clustered in each classroom, with a mean of 4.47 children per classroom. In a number of cases the Head Start agency changed children's classroom assignments after children were selected for the study resulting in some classrooms having slightly more or fewer than eight child participants.

Table 2

Demographics of Child Sample

	Low-Language Sample		Matched-Language Sample	
	Frequency	%	Frequency	%
Gender				
Female	87	42.2	109	47.8
Male	119	57.8	119	52.2
Race/Ethnicity				
African American/Black	203	98.5	221	96.9
European American/White	3	1.5	7	3.1
IEP Status[a]				
Yes	19	9.2	4	1.8
No	187	90.8	223	97.8
	Mean	Standard Deviation	Mean	Standard Deviation
Age in Months	54.4	3.5	44.1	10.8
PLS-III Standard Score (Screener)	64.2	6.9	90.1	9.7

Note. Low-Language $N = 206$; Matched-Language $N = 228$
[a]IEP status was missing for one participant.

Procedures

Video Collection and Transcription

Data used for this study included videotapes collected in every classroom during the intervention year. The purpose of this video collection in the randomized trial was to analyze fidelity of implementation to the curricula. Each classroom was videotaped for a full school day including six to seven activity settings. For this study, videotapes were used from two of those settings: centers/free play and small group instruction. Because video data collected for the larger study focused on curriculum implementation, the focus of the videos and matching transcripts was on the teacher leading the activity. Thus, the teacher's language was clear in the video and was accurately transcribed. Individual children were not identified in the videos and could not always be clearly seen or heard, so language could not be attributed to individual child participants.

Classrooms were videotaped at least two times during the intervention year. Due to the amount of time associated with transcribing and coding these videos, only video observations from one data collection wave (late fall/early winter) were transcribed and analyzed. Additionally, due to frequent turnover in the teaching staff, absences, and other circumstances, using a single time point allowed for the inclusion of more classrooms where the focus teacher was the same across activities. Prior studies that sampled ten minutes of classroom language from a single day have yielded useful data (Bowers & Vasilyeva, 2011; Dickinson & Porche, 2011); therefore, this study was conducted under the assumption that such a brief sample of two activities was representative of teachers' typical-language practices in these activities.

Videotapes were transcribed in the Codes for Human Analysis of Transcripts (CHAT) format from Child Language Data Exchange System (CHILDES; MacWhinney, 2000). Transcription began with the announcement that the class would begin a particular activity and concluded with the announcement of a new activity, or after ten minutes. Speech was parsed into utterances based on pausing and intonation and attributed to the appropriate speaker. All transcripts were verified by a second coder, and checked with the Child Language Analysis program (CLAN; MacWhinney, 2000) for transcription accuracy.

Activity Settings

For this study, two classroom activity settings were coded for vocabulary learning opportunities: centers/free play and small group instruction. These two settings were selected because they each presented the affordances of a low child-to-teacher ratio described in Chapter II. In small groups, the teachers led groups of two to six children in an activity, with an average of 3.8 children per teacher. In centers, the teachers often moved from activity to activity, but typically interacted with one to four children at a time. The low ratio allowed for teacher-child interactions conducive to the word-learning opportunities and supports of interest in this study. The quality of the video data in these settings also allowed for more reliable observation of teacher-child interactions than in whole group settings, as the camera was trained on the teacher and those in her immediate vicinity, and both the teacher's speech and the child responses were typically clear.

These two settings also represented differences in terms of the instructional formality and influence of the intervention curriculum. The centers/free play setting allowed for informal teacher-child interactions. While centers time in these Head Start centers included some instructional interactions and teacher-led activities, the amount of time teachers spent engaged in direct instruction varied across classrooms and was not prescribed by the program. The intervention curriculum provided some guidance for teachers to use during centers, though there was little emphasis placed on this part of the curriculum in professional development or by instructional coaches. Further, there was little evidence that teachers used the guidance that was provided. Small group instruction represented a formal instructional setting, where teachers led children in planned activities with a specific instructional focus and guidance from the intervention curriculum. *OWL* recommended that all children be in one of three groups, with the lead and assistant teachers each leading a group and the remaining children engaged in a self-directed activity, such as looking at books.

Video data from centers activities was obtained by following a teacher throughout the classroom as the teacher visited one or more centers and interacted with the children. As noted in the reviewed literature, the centers/free play setting has been previously found to be conducive to word-learning opportunities. For this study, 15 minutes of centers were videotaped beginning when the teacher signaled centers time was beginning. Because these segments often began with the teacher supervising children's transition to centers, only the first 10 minutes of the teacher interacting with children in centers was transcribed.

Small group instruction consisted of each teacher working with a group of 2-6 children on a prepared lesson, focused on a variety of content including literacy, mathematics, and science. As noted in the reviewed literature, these types of small group instructional activities with a low child-to-teacher ratio hold the potential to be conducive to word-learning. For this study, the entire small group instructional activity conducted by one teacher with a single group of children was videotaped, and these ranged in length from 5 to 22 minutes. Up to 10 minutes of small groups were transcribed, beginning when the teacher signaled the start of the small group activity. Because a few small groups activities were less than 10 minutes, the length of the transcribed activity ranged from 4.63 to 10 minutes (mean = 9.81 minutes). This variability in observation length was accounted for in subsequent analyses.

Selection of Instructional Words

In order to identify word-learning opportunities it was necessary to identify a list of instructional words that were "Tier II" for this sample (Beck et al., 2002), or in the children's zone of proximal development (Vygotsky, 1978).). Tier II words are useful, developmentally appropriate words of sufficient difficulty that children do not already know, but have the necessary linguistic and conceptual knowledge to learn with proper support.

The instructional word list for the current study was derived from the "Living Word Vocabulary" (Dale & O'Rourke, 1981). From this corpus of more than 40,000 words, 3,000 word meanings were directly tested on second grade students to establish "words worth teaching" in the primary grades (Biemiller & Slonim, 2001). From this

corpus were selected the "Level T2" list of words that Biemiller (2010) characterizes as "top priority" words for primary grades children (words 40-80% of second graders know). By the end of the second grade, these words are typically known by advanced students and not known by at-risk students. "Level E" words (known by 80% or more of second graders) were determined to be easy and known or easily learned by most preschool children, whereas "Level L2" words (low priority words for second graders) were determined to be too difficult or specialized.

To validate this list as instructional words for the children in this sample, beginning of preschool vocabulary assessment data were examined for six child participants representing the range of initial language skills in the larger sample. This subsample included three children designated as having low-language skills and three children from the matched-language group. See Table 3 for descriptive information about the subsample used for validation. The study included language samples from all of the children taken during the preschool year under three conditions: play, Renfrew Bus Story retelling (Cowley & Glasgow, 1994), and wordless book narration. The first step of the word list validation analysis was to compile all of the words that were used by the subsample of children in their fall language samples. These words were cross-referenced with Biemiller's (2010) lists. Of the words children used that appeared on the Biemiller lists, 91.7% were Level E, 7.3% were Level T2, and less than 1% were Level L2 or above.

Table 3

Subsample of Child Participants for Validation of Word List Selection

	Language Status	Age at Preschool Entry (months)	Gender	PLS-3 Standard Score (screener)	PPVT-4 Standard Score (pretest)	EVT-2 Standard Score (pretest)	NDW in 50 Utterances (pretest)
Child 1	Low	58	Male	57	73	78	59
Child 2	Low	57	Male	73	76	86	58
Child 3	Matched	54	Male	103	106	105	104
Child 4	Low	51	Female	67	85	81	65
Child 5	Matched	57	Female	88	94	94	74
Child 6	Matched	49	Female	107	93	101	41
Sample Mean (SD)		**53.6 (3.6)**		**77.4 (15.3)**	**81.9 (13.5)**	**87.1 (11.7)**	**70.6 (23.4)**

Next, test items were examined on the PPVT and EVT to determine the level of words commonly known by this sample at the beginning of preschool, as well as the words children would need to learn to make significant growth on these standardized measures. Of the specific words known by children at the mean on the PPVT, 80.0% were Level E. Of the words a child at the mean of this sample would need to learn to reach the approximate nationally-normed mean for 4-year-olds on the PPVT, 70.0% were Level E, 25.0% were Level T2, and none were Level L2. Of the specific words known by children at the mean on the EVT, 85.7% were Level E. Of the words a child at the mean of this sample would need to learn to reach the approximate nationally-normed mean for 4-year-olds on the EVT, 91.7% were Level E, 8.3% were Level T2, and none were Level L2. These data suggest children in this sample commonly knew Level E words, and Level

T2 words would be appropriate instructional words for most children in this sample, representing word-learning opportunities in their preschool classrooms. Level L2 words would likely be too challenging for this sample. See Table 4 for a summary of the co-occurrence of words between child participants' performance on pretest assessments and the Biemiller (2010) word lists.

Table 4

Proportion of Words From Participants' Pretest Data Appearing on Biemiller Word Lists

	Level E	Level T2	Level L2	Above Level L2	Not on Biemiller Lists	Slang, Proper Nouns, etc.
Language Samples	0.78	0.07	0.00	0.00	0.05	0.10
PPVT-4 Items	0.70	0.11	0.07	0.00	0.11	NA
EVT-2 Items	0.86	0.08	0.04	0.00	0.02	NA

Note. Language samples include all unique words appearing in the subsample's language samples. PPVT & EVT items include all items through the highest score obtained by participants in the full sample.

Biemiller's (2010) Level T2 list includes 1,632 root words. To complete the target instructional word list for the proposed study, this list was then reduced by removing 404 words that were either duplicates with multiple meanings (e.g. *brave* as a verb or an adjective) or closed-class words, such as prepositions and conjunctions (e.g. *with* and *or*, respectively), which appear too frequently in speech to serve as meaningful word-learning opportunities and are included at this level due to the difficulty in defining such words. For the remaining root words, derivational forms were added using morphemes that did not significantly alter the word's meaning, such as plural markers for

nouns and inflectional endings for verbs. The final instructional word list includes 3,652 individual words. See Appendix B for the full instructional word list. This list was the target list that represented words within the zone of proximal development of the 4-year-old children in the study sample. When these words appeared in teachers' adult-to-child speech within preschool classroom setting, they were interpreted as being markers of an opportunity for the children to expand their vocabulary knowledge.

Identification and Coding of Word-Learning Opportunities

Transcripts of both settings (centers and small group instruction) were searched through the CLAN program for the identified instructional words. The frequency [FREQ] command in CLAN was used to search multiple transcripts at once and identify occurrences of the words in the instructional word list file (Appendix B). When the identified instructional words appeared in the transcripts, a word-learning opportunity was identified. The CLAN analysis also provided counts of the types, tokens, and type/token ratio of instructional words in teachers' speech.

Word-learning opportunities were coded each time one of the identified words appeared in the teachers' utterances, even if the same word appeared in a teacher's speech multiple times in a single transcript. Instructional words were crosschecked with the Level T2 list to ensure the correct meaning was used in the classroom context. Original videotapes were reviewed concurrently with the transcript to enhance the clarity and validity of coding, and to identify non-linguistic features. The entire conversation around each instructional word was examined, including teacher and child speech and actions before and after the instructional word was used. Each instance of instructional

word use was coded for several features, and these codes constituted the teacher language measures of interest. These measures are described in detail later in this chapter.

Pilot coding using coding instrument. To establish validity and functionality of the coding instrument, transcripts and videos from three classrooms were pilot coded prior to the study. This process allowed the author to make refinements and clarifications to the coding guide and demonstrate that the instrument would reflect variability in the word-learning opportunities afforded by different classroom activities and contexts. Next the author pilot tested the coding instrument with an experienced researcher and university faculty member, and made further refinements to the instrument and coding guide.

Reliability. In order to ensure reliable use of the coding instrument throughout the study, a second graduate student coded a randomly-selected subset of 20% of transcripts and videos. The author trained the secondary coder in the coding system, and trial transcripts were double-coded until the two coders reach the reliability criterion, defined as Cohen's kappa value of at least 0.80. Once the two coders were reliable, the secondary coder independently coded 20% of the transcripts/videos to demonstrate maintained reliability. When the primary and secondary coder did not reach Cohen's kappa of 0.80 on a transcript/video, they met to come to consensus on the disputed transcript/video, then double-coded an additional transcript/video to re-establish reliability. Reliability was only below criterion on one occasion. Reliability exceeded this criterion overall, with an average of Cohen's kappa = 0.83.

The data from the coding instrument were entered in a database for analysis. To reduce the likelihood of data entry error, the author and the second coder independently

entered each classroom's data. The hard copy coding forms were consulted when discrepancies were found.

Measures

Teacher Measures

Teacher language variables were derived from coding the transcripts and videos. See Appendix C for a copy of the coding instrument. For each instance of the identified words appearing in the teacher's speech, coding occurred on several tiers. A brief explanation of the coding instrument follows, with more detailed information provided in the coding manual in Appendix D.

Instructional words. For each episode of an instructional word appearing in teacher speech, the teacher-child interaction was examined carefully on both the transcript and video. First, episodes were coded as to whether the word appeared in adult-to-child speech or other, such as self-talk or speech directed at another adult. If the word appeared in something other than adult-to-child speech, no further codes were needed. As previously noted, children learn words best from adult-to-child speech. Only words appearing in teachers' adult-to-child speech were considered word-learning opportunities and included in the analysis. The instructional word tokens were totaled for each activity, and then divided by the number of minutes of the activity that were recorded and transcribed. The resulting teacher language variable for analysis was *instructional words per minute* (IW/Minute).

Semantic supports. The episode was also coded for the use of the three categories of semantic supports identified previously as related to vocabulary learning: *verbal supports for meaning* (VSFM), *nonverbal supports for meaning* (NVSFM), and use in *extended discourse* (ED). Table 5 presents definitions and examples of the three categories of semantic supports. It was necessary to observe from video and read the transcript for the entire conversation to accurately code each word-learning opportunity, in order to capture semantic supports that may have occurred just before or after the instructional word appeared in the teacher's speech.

Verbal Supports for Meaning (VSFM). VSFM was sub-coded as providing a definition, providing semantically supportive contextual information (Beals, 1997; Weizman & Snow, 2001), or providing examples related to or using the word. More than one type of verbal support was sometimes present in the episode and coded, thus providing richer information about the degree to which linguistic supports were available during the word-learning opportunity. If none of these verbal supports were present, the episode was coded as *None* for VSFM. The verbal supports for meaning were totaled for each activity, and then divided by the number of instructional words in adult-to-child speech during that activity. The resulting teacher language variable for analysis was *verbal supports for meaning per instructional word* (VSFM/IW).

Nonverbal Supports For Meaning (NVSFM). NVSFM was sub-coded as a teacher's use of one or more types of nonverbal support with the instructional word, including: pictures, gestures, objects, or other (such as intonation or facial expression). More than one type of nonverbal support were sometimes present in the episode and coded, providing further information about the degree to which non-linguistic supports

were available for children. If none of these nonverbal supports were presented with the instructional word, the episode was coded as *None* for NVSFM. The nonverbal supports for meaning were totaled for each activity, and then divided by the number of instructional words in adult-to-child speech during that activity. The resulting teacher language variable for analysis was *nonverbal supports for meaning per instructional word* (NVSFM/IW).

Extended Discourse (ED). ED was coded when the word was used in the context of a conversation featuring five or more turns between the teacher and a child or children on a single topic. A turn consisted of all of the utterances used by a speaker until another speaker produced an utterance. In order to be considered turns on a single topic, a series of turns had to focus on a specific referent, concept, or idea. Due to the nature of the video data, conversational turns could only be examined between the teacher and children in general, rather than with a specific child. The conversations often featured the teacher talking with two or more children about a single topic. The instructional words embedded in extended discourse were totaled for each activity, then divided by the total number of instructional words in adult-to-child speech during that activity. The resulting teacher language variable for analysis was *proportion of instructional words used in extended discourse* (ED/IW).

Table 5

Categories and Examples of Semantic Supports

Semantic Support	Description	Types	Examples from Adult-to-Child Speech
Verbal Supports for Meaning (VSFM)	Teacher provides spoken information related to the meaning of the instructional word.	Definition	TEACHER: Make you a design of a flower. We gonna make us a **stem**. That's the long part.
		Context	TEACHER: Sometimes it takes a lot of sugar to make lemonade really **sweet**.
		Example	TEACHER: We're taking turns and being **patient**.
Nonverbal Supports for Meaning (NVSFM)	Teacher provides non-spoken information related to the meaning of the instructional word.	Pictures	TEACHER: A **mailbox** (*holds up card with picture of mailbox)*, what book had the **mailbox** in it?
		Gestures	TEACHER: Take the lemon and **squeeze** the juice into your cup. (*demonstrates squeezing)*
		Objects	TEACHER: (*pointing to chart on wall)* We don't have this on our shape **chart** in the classroom, but…
		Other	TEACHER: Oh, that does taste **sour**! (*puckers lips)*
Extended Discourse (ED)	Teacher uses the instructional word within a conversation including 5 or more turns between teacher and child(ren).		TEACHER: And why did she give them some money? CHILD: Because they want bubblegum. TEACHER: (Be)cause they wanted some bubblegum. TEACHER: What did they do to **earn** that money? CHILD: Uh they gave her…they gave…and she gave them some bubblegum. TEACHER: What did they do to **earn** the money though? TEACHER: They rescued who? CHILD: The kitten. TEACHER: The kitten and then because they rescued the kitten, she gave them some money to buy some bubblegum with.

Additional teacher language variables. Note that in addition to the variables described here, other features of the word-learning opportunities were included on the coding instrument and coded from the transcripts and videos. These included the part of

speech of the instructional word, the content of the discourse in which the word appeared, and whether and how the child responded to the teacher's use of the word. These variables are not described in detail here, although additional information about these variables is included in the coding manual in Appendix D. While these features of the word-learning opportunities were not a focus of the current study, these data were collected as they may be of interest in extending the findings of this study for future research.

The coding instrument also includes variables for type-token ratio for instructional words (calculated by the CLAN program), and whether the interaction including the instructional word focused on the teacher's or child's lead. While prior research suggests that multiple exposures to words and interactions that follow a child's lead are important features of word-learning opportunities, these variables were not included for analysis because they could not be measured reliably based on the constraints of this study. In the development and piloting of the coding system, it was determined that while these small group and centers videos were a sufficient sample for measuring many features of teachers' language, multiple exposures could not be accurately measured without a much larger observation window. In the early stages of the coding phase, it was determined that the teacher's or child's lead could not be reliably coded from the video data available. Coding proceeded without this variable.

Child Measures

Preschool Language Scale III (PLS-3). The PLS-3 (Zimmerman et al., 2002) is a standardized assessment of language development that yields scores for expressive,

receptive and total language for children ages 12-60 months. The PLS was used as a screening measure for this study. This assessment was administered by trained research staff at Head Start registration in the summer before preschool entry. The PLS standard score was used to identify children for the low-language and matched-language samples. Descriptive statistics for each sample on the PLS are reported in Table 2.

American Guidance Service (AGS). The AGS (Harrison et al., 1990) Early Screening Profiles are a nationally-normed standardized battery of items used as a screener for young children. The AGS language subscale measures expressive and receptive language. This assessment was administered by the staff of the Head Start agency at preschool entry. The results were reported for all children enrolled in the program without the children's identifying information. The AGS data was averaged to yield a classroom-level baseline language score that could be compared between classrooms. The mean of classroom average AGS scores was 95.59 (sd = 3.48), with a range of 89.30 to 103.63.

Vocabulary measures. This study was primarily interested in children's gains on three vocabulary measures. Children were individually assessed by trained research staff in quiet locations within each site at the beginning and end of the preschool year. Table 6 presents descriptive statistics for the low-language and matched-language samples on each of these measures. Standard scores are presented for the standardized measures for ease of interpretation.

Peabody Picture Vocabulary Test 4th Edition (PPVT-4). The PPVT-4 (Dunn & Dunn, 2007) is a standardized assessment of children's receptive vocabulary skills and

can be used with children and adults ages 2 to 90+. During the assessment, a subject is read vocabulary words and asked to point to one of four pictures that the word represents.

Expressive Vocabulary Test, 2nd Edition (EVT-2). The EVT-2 (Williams, 2007) is a standardized assessment of children's expressive vocabulary skills and can be used with children and adults ages 2 to 90+. During the assessment, a subject is shown pictures and asked to verbally label the illustration with the correct vocabulary word.

Language samples. These 30-minute interactions with a trained examiner were designed to provide a sample of children's expressive language in a standardized context. The examiner followed a specific protocol for language elicitation and interaction. Approximately 10 minutes were spent in each of three contexts (narrative recall, play, and book reading). These contexts were counterbalanced among participants to ensure the order did not influence the language sampling data overall. In the narrative recall context, children were asked to retell the *Renfrew Bus Story* (Cowley & Glasgow, 1994) after looking at the book while the examiner read it. The *Renfrew Bus Story* is accompanied by a standard protocol for narrative recall. In the play context, children played with a standard set of toys. In the book reading context, children looked at a wordless picture book. Appendix A presents the protocol for the narrative recall and book language sample collection. The full language sample consisted of all language collected from the three contexts. All child utterances were transcribed and verified by a second coder prior to analysis. A standard set of linguistic measures was derived from the language sample, including Number of Different Words in 50 complete utterances (NDW50). NDW is a commonly-used measure of vocabulary production and word knowledge-in-use.

Table 6

Descriptive Statistics for Child Vocabulary Measures

	Low-Language Sample		Matched-Language Sample	
	Mean	Standard Deviation	Mean	Standard Deviation
PPVT-4				
Pretest	75.26	11.46	88.82	11.94
Posttest	81.07	10.03	94.50	11.08
EVT-4				
Pretest	80.61	9.91	93.55	8.75
Posttest	86.59	8.84	98.15	9.46
NDW50				
Pretest	66.13	23.65	73.76	22.78
Posttest	89.61	20.26	95.54	20.08

Note. Standard scores are presented for the PPVT-4 and EVT-2.

Data Analysis

Coded data were analyzed in SPSS. To account for some differences in the length of activities, instructional words were analyzed as a density measure of instructional words per minute. Semantic supports were analyzed as a density measure of semantic supports per instructional word.

Prior to examining the primary research questions and hypotheses of this study, several preliminary analyses were conducted to determine the appropriate models for analysis. The independent variables of interest were examined for normality, outliers,

collinearity, conditional differences, and setting differences. The dependent variables of interest were examined to determine to what degree the nested structure of the original study design needed to be accounted for in hypothesis testing.

Descriptive analyses were used to answer the two research questions. For hypothesis testing, linear mixed modeling was used to account for the clustering of children in classrooms, and classrooms in the clusters that were assigned to condition in the randomized control trial. This multi-level analysis also allowed for the inclusion of variables at the child and classroom levels. Relationships between classroom-level variables representing word-learning opportunities and child outcomes were analyzed in separate models for the low-language and matched-language samples. The dependent child vocabulary variables were residualized preschool gain on each of the vocabulary measures, meaning the children's end-of-preschool vocabulary score controlling for their beginning-of-preschool score. Raw scores were used for the standardized measures.

Finally, exploratory analyses were conducted to further investigate the pattern of results that emerged throughout the analysis phase. The results of each stage of analysis are presented in Chapter IV.

CHAPTER IV

RESULTS

Preliminary Analyses

Prior to examining the research questions and hypotheses for this study, the collected data were examined to determine the appropriateness of planned analyses and make decisions about the models. Each teacher language variable was examined for normality by examination of a histogram and a normal probability plot. These variables were normally distributed, so no transformation was necessary for analysis. Descriptive statistics for each variable of interest are presented later in Tables 12 and 13 in response to the research questions.

Extreme values or outliers were identified as values more than 1.5 times the interquartile range (IQR) outside the IQR, and each teacher language variable was examined for the presence of outliers. Outliers were transformed for analysis by taking the difference between the last two non-extreme values and using that difference between the extreme values and the closest non-extreme value. Few extreme values were present. No more than two extreme values were recorded for any teacher language variable with the exception of Small Groups Extended Discourse Per Minute (SG_ED/Minute) for which there were five outliers. Sensitivity analyses were conducted to ensure these transformations did not significantly alter the results. These analyses confirmed the pattern of results were the same when these extreme values were transformed, so the results reported here represent the dataset with transformed values.

Because this study uses a sample collected as part of a randomized field trial, condition differences were examined. Linear mixed modeling predicted the teacher language variables from experimental condition assigned at the cluster level. These three-level models included classroom, center, and cluster. The following model illustrates how this relationship was examined with Small Group Instructional Words Per Minute (*SG_IW/Minute*) at the classroom level regressed on Experimental Condition (*Condit*) at the cluster level.

$$SG\_IW/Minute_{ijk} = \gamma_{000} + \gamma_{010} Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$$

Results are presented in Table 7. For seven of the eight models, condition was not a significant predictor of the teacher language variables. For Centers Extended Discourse Per Instructional Word (*CTR_ED/IW*) there was a significant difference by condition. Teachers in the *OWL* condition used instructional words in extended discourse during centers time significantly more often than teachers in either the *OWL+EMT* or Control conditions. Because this teacher language variable differed significantly by condition, condition was included in the primary analyses to account for variance in teacher language influenced by experimental condition. Sensitivity analyses were conducted to investigate whether the inclusion of condition in the models significantly altered the pattern of results. These analyses confirmed the pattern of results were the same when condition was included, so the results reported here are from models including experimental condition.

Table 7

Condition Effects on Teacher Language Variables

	Condition	Mean	SE	F	p
Small Groups					
IW/Minute	Control	1.76	.24	2.47	.10
	OWL	2.15	.23		
	OWL + EMT	2.49	.22		
VSFM/IW	Control	0.32	.08	1.17	.43
	OWL	0.48	.08		
	OWL + EMT	0.41	.07		
NVSFM/IW	Control	0.30	.05	0.18	.84
	OWL	0.26	.05		
	OWL + EMT	0.29	.05		
ED/IW	Control	0.58	.08	3.55	.11
	OWL	0.29	.09		
	OWL + EMT	0.33	.08		
Centers					
IW/Minute	Control	2.06	.30	0.67	.52
	OWL	2.28	.29		
	OWL + EMT	1.82	.28		
VSFM/IW	Control	0.45	.05	0.23	.80
	OWL	0.42	.05		
	OWL + EMT	0.47	.05		
NVSFM/IW	Control	0.31	.05	0.35	.89
	OWL	0.27	.05		
	OWL + EMT	0.25	.05		
ED/IW	Control	0.32	.05	3.61	.03
	OWL[C, E]	0.49	.05		
	OWL + EMT	0.33	.05		

Note. IW/Minute = Instructional Word Tokens Per Minute; VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

[C] = significantly > Control at $p < .05$; [E] = significantly > OWL + EMT at $p < .05$.

Due to the nested design of the randomized control trial from which the sample was drawn, the intraclass correlation coefficients (ICCs) at both the center and cluster levels were examined for each of the child outcome variables to determine whether the primary analyses needed to account for variance at these levels. ICCs are presented in Table 8. In unconditional models, no significant variance in any of the three child vocabulary outcomes was explained at the center or cluster level. Thus, the center level was collapsed under the cluster level to maximize power (Bloom, 2001). Cluster remained in the models because random assignment to condition happened at this level.

Table 8

Intraclass Correlation Coefficients for Child Outcome Variables

	Level	*ICC*	*p*
PPVT-4	Center	0.02	0.57
	Center	0.02	0.64
	Classroom	0.02	0.59
EVT-2	Cluster	0.01	0.83
	Center	0.01	0.85
	Classroom	0.01	0.69
NDW50	Cluster	0.00	0.96
	Center	0.00	0.98
	Classroom	0.00	0.97

Correlations between the three child vocabulary outcomes were examined to verify that they did not represent a single construct. Although the *Peabody Picture Vocabulary Test, 4th Edition* (PPVT-4; Dunn & Dunn, 2007) and the *Expressive Vocabulary Test, 2nd Edition* (EVT-2; Williams, 2007) are both standardized measures of vocabulary, these tests measure receptive and expressive vocabulary respectively. Although the EVT and number of different words in 50 utterances (NDW50) are both measures of expressive vocabulary, these measures differ in administration in that the EVT is a standardized measure and NDW is a measure from a naturalistic language sample. Correlations demonstrate that these measures were not overly intercorrelated. End-of-preschool scores were analyzed, and raw scores were used for the standardized measures. Table 9 presents correlations between each of the measures. All three measures were significantly correlated at ($p < .01$), yet the correlations ranged from 0.16 (PPVT and NDW) to 0.74 (PPVT and EVT). Even the relatively high correlation between PPVT and EVT was not a level not considered representative of collinearity (Cohen, Cohen, West, & Aiken, 2003) so all three measures were included for the primary analyses.

Table 9

Correlations Among Child Vocabulary Outcomes

	PPVT-4	EVT-2	NDW50
PPVT-4	1		
EVT-2	.735***	1	
NDW50	.160**	.177***	1

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

The teacher language variables were next examined by setting: centers and small groups. These analyses determined whether teachers' use of instructional words in adult-to-child speech and accompanying semantic supports differed by setting. Because setting observations were nested within teachers, setting was the independent variable in separate models with each of the teacher language variables as the dependent variable. In these linear mixed models, setting was nested within teacher. Table 10 presents the unstandardized beta coefficients, standard errors, and significance values for the relationship between setting and the teacher language variables. None of the teacher language variables differed significantly by setting. Thus, variables from the two settings were averaged into a single score for the hypothesis testing.

Table 10

Mixed Model Regressing Teacher Language Variables on Setting

	ß	SE	*p*
IW/Minute	-0.11	0.19	0.54
VSFM/IW	0.05	0.04	0.18
NVSFM/IW	-0.02	0.03	0.49
ED/IW	-0.01	0.05	0.77

Note. IW/Minute = Instructional Word Tokens Per Minute; VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

Correlations between the four primary teacher language variables of interest were examined to verify that each represented an independent construct. Correlations demonstrate that these variables were not highly correlated. Table 11 presents correlations between each of the variables. Only two of the variables, instructional words per minute (IW/Minute) and verbal supports for meaning per instructional word (VSFM/IW) were significantly correlated ($p < .05$), and this correlation was small ($r = 0.32$).

Table 11

Correlations Among Teacher Language Variables

	IW/Minute	VSFM/IW	NVSFM/IW	ED/IW
IW/Minute	1			
VSFM/IW	.321*	1		
NVSFM/IW	.205	.212	1	
ED/IW	-.185	.048	-.228	1

*$p < .05$.

Note. IW/Minute = Instructional Word Tokens Per Minute; VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

Primary Analyses

Describing Word-Learning Opportunities in Head Start Classrooms

These analyses depict the word-learning opportunities the preschool children in these samples experienced in their Head Start classrooms through descriptive statistics.

Research question I. *How frequently do instructional words appear in teachers' adult-to-child speech in Head Start classrooms?* Table 12 presents the means, standard deviations, and ranges for types and tokens of instructional words as a density measure per minute, for each activity setting and overall. These statistics depict the instructional words to which the children were exposed in adult-to-child speech in these Head Start classrooms, with extreme values transformed.

Table 12

Descriptive Statistics for Instructional Words in Adult-to-Child Speech

	Mean	SD	Minimum	Maximum
Small Groups				
IW/Minute	2.16	0.99	0.40	4.08
IWTypes/Minute	1.02	0.47	0.20	2.50
Centers				
IW/Minute	2.04	1.19	0.30	4.90
IWTypes/Minute	1.14	0.51	0.20	2.39
Overall				
IW/Minute	2.10	0.87	0.37	4.47
IWTypes/Minute	1.08	0.41	0.25	2.09

Note. IW/Minute = Instructional Word Tokens Per Minute; IWTypes/Minute = Instructional Word Types Per Minute.

There was considerable variability in the word-learning opportunities children experienced based on the presence of instructional words in adult-to-child speech during small groups and centers. In small group instruction, teachers used an average of 1.02 unique instructional words per minute (*IWTypes/Minute)* and 2.16 total instructional words per minute (*IW/Minute)*. In centers, teachers used an average of 1.14 unique instructional words and 2.04 total instructional words per minute. Teachers used more diverse instructional words in centers than small groups, and more overall instructional words in small groups than centers, yet these differences were not significant as previously noted. Across the two settings, teachers used just over 2 instructional words

per minute, but instructional word use ranged from 0.37 instructional words per minute to 4.47 instructional words per minute. Descriptive statistics of instructional word types and tokens show that teachers used each instructional word an average of about two times within each activity.

Research question II. *How frequently do semantic supports occur during teacher-child interactions featuring teachers' use of instructional words?* Descriptive statistics for semantic supports for word learning are presented in Table 13. Table 13 presents the means, standard deviations, and ranges for the frequency of each type of semantic support as a density measure per instructional word for each activity setting and overall.

Verbal supports for meaning. Verbal supports for meaning included defining, contextualizing, or offering examples for instructional words. Descriptive statistics depict the verbal supports for word learning to which children were exposed in these Head Start classrooms, with extreme values transformed. There was considerable variability in the supports for word learning children experienced based on the density of verbal supports for meaning per instructional word (VSFM/IW) in adult-to-child speech during small groups and centers. In small group instruction, teachers used an average of 0.39 verbal supports per word. In centers, teachers used an average of 0.45 verbal supports per word. As previously noted, there were no significant differences in verbal supports for meaning between the two settings. Across both settings, teachers used 0.42 verbal supports per word, with a range of 0.17 to 0.84 verbal supports per word. Verbal supports for meaning were the type of semantic support teachers used most frequently with instructional words.

Table 13

Descriptive Statistics for Semantic Supports in Adult-to-Child Speech

	Mean	SD	Minimum	Maximum
VSFM/IW				
Small Groups	0.39	0.22	0.00	1.00
Centers	0.45	0.20	0.09	0.92
Overall	0.42	0.16	0.17	0.84
NVSFM/IW				
Small Groups	0.28	0.19	0.00	0.68
Centers	0.26	0.17	0.00	0.69
Overall	0.27	0.15	0.04	0.65
ED/IW				
Small Groups	0.39	0.27	0.00	1.00
Centers	0.38	0.21	0.00	0.88
Overall	0.39	0.17	0.11	0.84

Note. VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

Nonverbal supports for meaning. Nonverbal supports for meaning included pictures, gestures, or objects that represented the instructional words. Descriptive statistics depict the nonverbal supports for word learning to which children were exposed in these Head Start classrooms, with extreme values transformed. There was variability in the density of nonverbal supports for meaning per instructional word (NVSFM/IW) in

adult-to-child speech in both settings. In small group instruction, teachers used an average of 0.28 nonverbal supports per word. In centers, teachers used an average of 0.26 nonverbal supports per word. As previously noted, there were no significant differences in nonverbal supports for meaning between the two settings. Across both settings, teachers used 0.28 nonverbal supports per word, with a range of 0.04 to 0.65 nonverbal supports per word. Of the three types of semantic supports, nonverbal supports for meaning were the type teachers used least frequently with instructional words in both settings and overall.

Use in extended discourse. Extended discourse was coded whenever an instructional word was used by the teacher in a teacher-child conversation that included at least five turns on a single topic. Descriptive statistics depict the support for word learning to which the children in these samples were exposed through their teachers' embedding instructional words in extended discourse, with extreme values transformed. In small group instruction, teachers on average used 0.39 of instructional words in extended discourse. In centers, teachers on average used 0.38 of instructional words in extended discourse. As previously noted, within classrooms there were no significant differences in teachers' use of instructional words in extended discourse between the two settings. Between classrooms the proportion of instructional words used in extended adult-child conversations varied considerably during small groups and centers. Across both settings, teachers used 0.39 of instructional words in extended discourse, with a range of 0.11 to 0.84 instructional words used in extended conversations.

Word-Learning Opportunities and Children's Vocabulary Growth

These analyses examined the relationship between the preschool classroom word-learning opportunities identified in this study and children's vocabulary growth. Each of the models testing these hypotheses were analyzed for the two separate samples of children within the study: children with low-language on the initial screener (low-language) and children with typical-language skills matched on classroom assignment, age, and gender (matched-language). The dependent child vocabulary variables were residualized preschool gain on each vocabulary measure, the children's end-of-preschool vocabulary score controlling for their beginning-of-preschool score. Raw scores were used for the standardized measures.

Hypothesis I. *The density of instructional words in teachers' adult-to-child speech will relate to growth in children's vocabulary from the beginning to end of preschool.* To test this hypothesis, linear mixed modeling was used to account for the clustering of child participants in classrooms and clusters and to allow for the inclusion of variables at the child, classroom, and cluster levels. Three-level models, nesting children within classrooms within clusters, were conducted separately for each outcome. Child-level covariates included in the models were gender, age at end of preschool testing, and pretest score on each respective measure at beginning of preschool. Condition was included in the models as a cluster-level covariate. Three models were analyzed with the low-language sample for each of the three vocabulary measures (PPVT, EVT, and NDW). Likewise, three models were analyzed with the matched-language sample. Thus, a total of six linear mixed models analyses were conducted regressing children's vocabulary posttest scores on teachers' instructional word density. The following multi-

level model illustrates how this relationship was examined for the PPVT outcome for each of the child samples.

$$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} IW/Minute_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$$

See Appendix E for full models for each hypothesis.

These analyses were conducted using a random intercept and a fixed slope for each covariate including the main predictor of interest, IW/Minute. This approach fixed the relationship between the predictors and the outcome because it was not expected to vary between classrooms. Estimated marginal means were generated for the independent variable of interest for each dependent variable then analyzed for statistical significance. Table 14 displays the unstandardized beta coefficients, standard errors, and significance values for the relationship between the density of instructional word tokens (IW/Minute) and residualized preschool gain on each of the vocabulary measures (PPVT, EVT, and NDW) for each sample.

Table 14

Mixed Models Regressing Children's Residualized Preschool Vocabulary Gains on Density of Instructional Word Tokens

	ß	SE	*p*
Low-Language			
PPVT-4	-0.72	0.98	0.47
EVT-2	-0.44	0.62	0.48
NDW50	1.39	1.54	0.37
Matched-Language			
PPVT-4	-0.08	0.95	0.94
EVT-2	-0.04	0.63	0.96
NDW50	-0.47	1.84	0.80

For both the low-language and matched-language samples, there was no significant relationship between the density of instructional word tokens in adult-to-child speech in the classroom and the children's residualized preschool gain on any of the vocabulary measures. Therefore, Hypothesis I was not supported; preschool children's opportunities to hear instructional words in adult-to-child speech in centers and small group instruction did not relate to gains in their vocabulary size over the preschool year.

Hypothesis II. *This relationship will vary by children's initial language status, with matched-language children gaining more in classrooms with greater use of IWs as compared to low-language children.* Prior to analysis, all variables included in each model were standardized. Separate models were run for the two child samples within the

study: low-language and typical-language. This allowed for a direct comparison of the standardized beta coefficients between the two groups to determine the direction and magnitude of the relationships between the density of instructional words per minute in adult-to-child speech and child vocabulary gains for each group. See Appendix F for standardized beta coefficients for each model. For instructional word density, which did not have a significant relationship with child vocabulary gains for either sample, this hypothesis was not supported and this comparison was unnecessary.

Hypothesis III. *The density of semantic supports for understanding the meaning of instructional words in teachers' adult-to-child speech will relate to children's growth in vocabulary knowledge from beginning through the end of the preschool year.* To test this hypothesis, linear mixed modeling was used again to account for the clustering of child participants in classrooms and clusters and to allow for the inclusion of variables at the child, classroom, and cluster levels. Sets of three-level models, nesting children within classrooms within clusters, were conducted separately for each outcome and each semantic support variable of interest. Child-level covariates included in the models were gender, age at end of preschool testing, and pretest score on each respective measure at beginning of preschool. Condition was included in the models as a cluster-level covariate. For each of the three semantic support variables of interest (VSFM, NVSFM, and ED), separate models were analyzed for each of the three vocabulary measures (PPVT, EVT, and NDW), for a total of nine models for the low-language sample. Likewise, nine models were analyzed with the matched-language sample. Thus, a total of eighteen linear mixed models analyses were conducted regressing children's vocabulary posttest scores on the teachers' density of each type of semantic support per word. The following multi-

level model illustrates how this relationship was examined for the Extended Discourse per Instructional Word *(ED/IW)* teacher variable and the PPVT outcome (*PPVT_post)* for each of the child samples.

$$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} ED/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$$

See Appendix E for full models for each hypothesis.

These analyses were conducted using a random intercept and a fixed slope for each covariate including the main predictor of interest, such as *ED/IW* in the case above. This approach fixed the relationship between the predictors and the outcome as it was not expected to vary between classrooms. Estimated marginal means were generated for the independent variable of interest for each dependent variable then analyzed for statistical significance. Table 15 displays the unstandardized beta coefficients, standard errors, and significance values for the relationship between the density per instructional word of each type of semantic support (VSFM, NVSFM, and ED) and residualized preschool gain on each of the vocabulary measures (PPVT, EVT, and NDW) for each sample.

Table 15

Mixed Models Regressing Children's Residualized Preschool Vocabulary Gains on Density of Semantic Supports

	VSFM/IW			NVSFM/IW			ED/IW		
	ß	SE	*p*	*ß*	SE	*p*	*ß*	SE	*p*
Low-language									
PPVT-4	0.39	5.36	0.94	-2.83	5.95	0.64	6.74	4.72	0.16
EVT-2	-0.40	3.37	0.91	2.66	3.94	0.50	3.37	3.02	0.27
NDW50	-7.59	8.29	0.36	23.88	9.38	0.01	-6.87	7.65	0.37
Matched-language									
PPVT-4	-6.23	5.21	0.24	2.71	5.96	0.65	1.19	5.08	0.82
EVT-2	-4.48	3.60	0.22	-0.12	4.05	0.98	-0.13	3.42	0.97
NDW50	25.48	9.62	0.01	-19.86	11.13	0.08	4.77	9.77	0.63

Note. VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

For both the low-language and matched-language samples, there was no significant relationship between the density of the semantic supports per word in adult-to-child speech in the classroom and the children's residualized preschool gain on either of the standardized vocabulary measures, the PPVT and the EVT. There were significant relationships between some of the types of semantic supports and children's residualized preschool gain on the naturalistic language sample measure of vocabulary, NDW. For low-language children, NVSFM significantly positively related to children's gain in NDW ($\beta = 23.88$, $p < .05$). For matched-language children, VSFM significantly positively related to children's gain in NDW ($\beta = 25.48$, $p < .05$). For matched-language

children, NVSFM had a marginally significant negative relationship with NDW (β = -19.88, $p < .10$). Therefore, Hypothesis III was partially supported; the density of verbal and nonverbal supports for understanding the meaning of instructional words in teachers' adult-to-child speech related to some children's preschool growth in vocabulary knowledge as measured by a language sample. However, using instructional words in extended discourse did not relate to children's preschool growth in vocabulary knowledge as measured by the standardized measures, PPVT and EVT.

Hypothesis IV. *These relationships will vary by children's initial language status, with matched-language children gaining more in classrooms with greater use of verbal supports and embedding instructional words in extended discourse as compared to low-language children.* Prior to analysis, all variables included in each model were standardized. Separate models were run for the two child samples within the study: low-language and typical-language. This allowed for a direct comparison of the standardized beta coefficients between the two groups to determine the direction and magnitude of the relationships between the density of semantic supports per word and child vocabulary gains for each group. See Appendix G for standardized beta coefficients for each model. For density of extended discourse per instructional word, which did not have a significant relationship child vocabulary gains for either sample, this hypothesis was not supported and this comparison was unnecessary.

Verbal supports per instructional word had a significant positive relationship with vocabulary gains as measured by NDW for matched-language children ($p < .05$) but no significant relationship with vocabulary gains as measured by NDW for low-language children ($p = 0.36$). There was no significant relationship between verbal supports for

meaning and vocabulary gains as measured by the PPVT or EVT for either sample. Therefore, Hypothesis IV was partially supported; matched-language children in classrooms with greater density of verbal supports for meaning per instructional word gained more in vocabulary as operationalized by the NDW measure from a language sample. However, this same relationship was not observed for vocabulary gains as operationalized by standardized vocabulary measures, PPVT and EVT.

Hypothesis V. *These relationships will vary by children's initial language status, with low-language children gaining more in classrooms with greater use of nonverbal supports for meaning as compared to matched-language children.* Prior to analysis, all variables included in each model were standardized. Separate models were run for the two child samples within the study: low-language and typical-language. This allowed for a direct comparison of the standardized beta coefficients between the two groups to determine the direction and magnitude of the relationships between the density of nonverbal supports for meaning per word and child vocabulary gains for each group. See Appendix G for standardized beta coefficients for each model.

Nonverbal supports per instructional word had a significant positive relationship with vocabulary gains as measured by NDW ($p < .05$) for low-language children. Nonverbal supports per instructional word had a marginally significant negative relationship with vocabulary gains as measured by NDW ($p = .08$) for matched-language children. There was no significant relationship between nonverbal supports for meaning and vocabulary gains as measured by the PPVT or EVT for either sample. Therefore, Hypothesis V was partially supported; low-language children in classrooms with greater density of nonverbal supports for meaning per instructional word gained more in

vocabulary as operationalized by the NDW as compared to matched-language children. However, this same relationship was not observed for vocabulary gains as operationalized by standardized vocabulary measures, PPVT and EVT.

Exploratory Analyses

Additional exploratory analyses were conducted, based on patterns emerging during analysis, to better understand the pattern of results on the primary analyses.

Total Semantic Supports

To determine whether the overall semantic supports related to children's vocabulary gains, the three types of semantic supports were combined into the total semantic supports per instructional word. This multi-level regression was conducted for each sample in the same manner as the analysis of the primary research hypotheses. These results are presented in Table 16. For both samples, there was no significant relationship between the density of the total semantic supports per word in adult-to-child speech in the classroom and the children's residualized preschool gain on any of the vocabulary measures.

Table 16

Mixed Models Regressing Children's Residualized Preschool Vocabulary Gains on Density of Total Semantic Supports

	ß	SE	*p*
Low-Language			
PPVT-4	-3.11	3.62	0.40
EVT-2	3.53	2.41	0.15
NDW50	6.04	5.90	0.31
Matched-Language			
PPVT-4	-1.17	3.51	0.74
EVT-2	-1.21	2.36	0.61
NDW50	-1.89	6.89	0.79

Typologies of Teacher Vocabulary Support

In an effort to describe the combination of factors that optimize word-learning opportunities, the two teacher language variables related to children's vocabulary gains were further explored. Verbal Supports For Meaning Per Instructional Word and Nonverbal Supports for Meaning Per Instructional Word were dichotomized into *high* (75^{th} percentile and above on the distribution of classroom scores) and *lower* (below the 75^{th} percentile). Teachers were then categorized as either high in both types of semantic supports (HiV-HiNV; n = 6), high in verbal supports only (HiV-LoNV; n = 6), high in nonverbal supports only (LoV-HiNV; n = 7), or lower in both types of supports (LoV-

LoNV; n = 32). Next these typologies were examined to determine if membership in these groups was linked to children's vocabulary gains.

Multi-level analyses were conducted for each sample in the same manner as the analysis of the primary research hypotheses, with category membership as a factor. These results are presented in Table 17. Pairwise comparisons of estimated marginal means examined differences in child vocabulary gains by the teacher vocabulary support typologies. For the low-language sample, teacher typology was significantly related to the NDW measure from the language sample, where children whose teachers were high in nonverbal supports and lower in verbal supports gained significantly more on NDW than children whose teachers were lower in both verbal and nonverbal supports ($p < .05$). Also for the matched-language sample, teacher typology was significantly related to the NDW measure from the language sample, with two typologies emerging as related to children's gains. Children whose teachers were high in verbal supports and lower in nonverbal supports gained significantly more on NDW than children whose teachers were either high in nonverbal supports and lower in verbal supports or lower in both types of supports. Children whose teachers were high in both verbal and nonverbal supports gained significantly more on NDW than children whose teachers were high in nonverbal supports and lower in verbal supports. For both samples, teacher typology was not significantly related to children's residualized vocabulary gain as measured by the two standardized measures, the PPVT and the EVT.

Table 17

Comparing Teacher Typologies on Children's Residualized Vocabulary Gain

	Category	Marginal Mean	SE
Low-language			
PPVT-4	LoV-LoNV	57.83	1.07
	HiV-Lo NV	54.91	2.32
	LoV-HiNV	55.17	2.43
	HiV-HiNV	57.91	2.41
EVT-2	LoV-LoNV	49.90	1.02
	HiV-Lo NV	50.23	1.74
	LoV-HiNV	52.07	1.75
	HiV-HiNV	50.20	1.79
NDW50	LoV-LoNV	88.69	1.93
	HiV-Lo NV	88.99	3.84
	LoV-HiNV^{LL}	97.14	3.95
	HiV-HiNV	93.32	3.94

Table 17, continued

Matched-Language

PPVT-4	LoV-LoNV	75.84	1.06
	HiV-Lo NV	71.93	2.31
	LoV-HiNV	76.29	2.59
	HiV-HiNV	75.29	2.25
EVT-2	LoV-LoNV	60.70	0.71
	HiV-Lo NV	59.09	1.56
	LoV-HiNV	60.10	1.79
	HiV-HiNV	59.83	1.55
NDW50	LoV-LoNV	94.47	1.93
	HiV-LoNV$^{LL, LH}$	103.72	4.25
	LoV-HiNV	88.72	4.63
	HiV-HiNV^{LH}	100.78	4.27

Note. LoV-LoNV = Lower Verbal Supports, Lower Nonverbal Supports; HiV-LoNV = High Verbal Supports, Lower Nonverbal Supports; LoV-HiNV = Lower Verbal Supports, High Nonverbal Supports; HiV-HiNV = High Verbal Supports, High Nonverbal Supports.
^{LL} = significantly > LoVLoNV at $p < .05$; ^{LH} = significantly > LoVHiNV at $p < .05$

Teachers Adjusting Word-Learning Opportunities

To examine whether teachers may have adjusted their word choice and support for word learning based on children's entering language skills, the teacher language variables were regressed on the aggregate class mean AGS language score. This was a single-level linear regression as the independent and dependent variables were both at the classroom level. These results are presented in Table 18. There was no significant

relationship between the class average on the AGS language score and the teachers' use of instructional words or semantic supports in the classroom.

Table 18

Models Regressing Teacher Language Variables on Class Mean AGS Language Score

	β	SE	*p*
IW/Minute	-0.01	0.04	0.88
VSFM/IW	-0.01	0.01	0.30
NVSFM/IW	0.01	0.01	0.22
ED/IW	0.01	0.01	0.47

Note: IW/Minute = Instructional Word Tokens Per Minute; VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

CHAPTER V

SUMMARY, DISCUSSION, & CONCLUSION

This study examined the word-learning opportunities available to children in Head Start classrooms through adult-child interactions in small groups and centers. Based on pretest scores, two samples of children were selected from 51 Head Start classrooms: children with low initial language skills and children with typical-language skills matched on the basis of classroom and gender. The low-language sample was comprised of 210 children, and the matched-language sample was comprised of 228 children, for a total of 438 children with pretest and post-test data. This sample was part of a randomized control trial from which these data were drawn. Videotapes of each classroom during small group instruction and centers were transcribed and analyzed. Instances of instructional words in adult-to-child speech were identified as word-learning opportunities, then these instances were coded for the presence of three types of semantic support (verbal supports for meaning, nonverbal supports for meaning, and embedding in extended discourse). Descriptive results describe the word-learning opportunities experienced by children in these Head Start classrooms. Child-level residualized gain scores on three vocabulary measures were regressed on the teacher language variables to examine the relationship between word-learning opportunities and vocabulary growth. Further exploratory analyses based on patterns emerging during analysis sought to explain word-learning mechanisms at work in these classrooms. This chapter presents a summary of the results, a discussion of the findings, and a review of the study's

limitations and implications.

Summary of Results

In this study, the teacher language variables indicative of word-learning opportunities were normally distributed. Word-learning opportunities did not differ by curriculum condition, with the exception of a single indicator: the proportion of instructional words embedded in extended teacher-child discourse during centers. None of the teacher language variables differed by setting (small groups versus centers). Correlations between the three child vocabulary measures, Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007), Expressive Vocabulary Test (EVT-2; Williams, 2007), and number of different words in 50 utterances (NDW50), were significant and ranged from 0.16 ($p < .01$) to 0.74 ($p < .001$).

Descriptive Analyses

Instructional words were examined as a density measure of instructional word tokens and types per minute. Approximately two instructional words per minute (IW/Minute) appeared in teachers' adult-to-child speech during centers and small groups. Approximately one unique instructional word per minute (IWType/Minute) appeared in teachers' speech. Each instructional word was used an average of two times per activity.

Semantic supports were examined as a density measure of each type of semantic support per instructional word. Verbal supports for meaning (VSFM/IW) were the most common of the three types of semantic support, followed by embedding in extended discourse (ED/IW), and finally nonverbal supports for meaning (NVSFM/IW). There was

considerable variability in the degree to which teachers used each semantic support strategy. Some teachers never used verbal supports or extended discourse with an instructional word during an activity, and others used these strategies once per instructional word on average. IW/Minute and VSFM/IW were positively significantly correlated ($p < .05$). No other teacher language variables were significantly correlated.

Hypothesis Testing

For both the low-language and matched-language samples, there was no significant relationship between the density of instructional word tokens in adult-to-child speech in the classroom and the children's residualized preschool gain on any of the vocabulary measures. For both samples, there was no significant relationship between the density of the semantic supports per word in adult-to-child speech in the classroom and the children's residualized preschool gain on either of the standardized vocabulary measures, the PPVT-4 or the EVT-2.

There were significant relationships between two of the types of semantic supports and children's residualized preschool gain on the naturalistic language sample measure of vocabulary, NDW50. For low-language children, NVSFM/IW was significantly positively related to children's gain in NDW ($\beta = 23.88$, $p < .05$). For matched-language children, VSFM/IW was significantly positively related to children's gain in NDW ($\beta = 25.48$, $p < .05$). For matched-language children, NVSFM had a marginally significant negative relationship with NDW ($\beta = -19.88$, $p < .10$). There was no significant relationship between ED/IW and the children's gain on any of the vocabulary measures.

Exploratory Analyses

To explore whether the combination of semantic supports had a relationship with children's vocabulary gains, the three types of semantic supports were combined into total semantic supports. Next the child outcomes were regressed on total semantic supports. For both samples, there was no significant relationship between the density of the total semantic supports per word in adult-to-child speech in the classroom and the children's residualized preschool gain on any of the vocabulary measures.

The next set of analyses explored whether between-class differences in word-learning opportunities were explained by the classes' initial language levels, which would suggest the teachers possibly calibrated their language to the average level of children in their class. Teacher language variables were regressed on the whole class average on the American Guidance Service (AGS; Harrison et al., 1990) Early Screening Profiles language scale. There was no significant relationship between the class average on the AGS and the teachers' use of instructional words or semantic supports in the classroom.

Finally, profiles of teachers were created to explore whether combinations of supports reflected teacher styles that were differentially associated with children's growth on vocabulary measures. Typologies of teacher support for word learning were created based on dichotomizing teachers' use of verbal and nonverbal supports for meaning. For the low-language sample, children whose teachers were high in nonverbal supports and lower in verbal supports gained significantly more on NDW than children whose teachers were lower in both verbal and nonverbal supports ($p < .05$). Low-language children whose teachers were high in both verbal and nonverbal supports did not have significantly different gains on NDW than in any other group. For the matched-language

sample, children whose teachers were high in verbal supports and lower in nonverbal supports gained significantly more on NDW than children whose teachers were either high in nonverbal supports and lower in verbal supports or lower in both types of supports. Matched-language children whose teachers were high in both verbal and nonverbal supports also gained significantly more on NDW than children whose teachers were high in nonverbal supports and lower in verbal supports.

Discussion

The results of this study raise several issues related to the study of word-learning opportunities in preschool classrooms. This study also provides important descriptive information about the word-learning opportunities in these Head Start classrooms. There is some evidence to suggest that children with low initial language skills may benefit from nonverbal semantic supports for word learning, while children with typical-language skills may benefit from verbal semantic supports. However, the lack of evidence for most of the hypothesized relationships based on prior research presents a challenge for interpretation due to the many possible explanations.

Challenges of Using These Data for These Research Purposes

If the assumptions on which this study was based are correct and exposure to instructional words and semantic supports are related to word learning, the question remains as to why the findings of this study did not support the hypotheses related to gains on standardized vocabulary measures. It is possible that these were not the right data to test these hypotheses. Language sample findings suggest it is possible that these

relationships exist but could not be adequately examined in this study. Associations between instructional words or semantic supports and vocabulary gains on standardized measures might be detected using different data. Many issues that arose are associated with secondary data analysis and could, perhaps, be addressed in a study where data were collected specifically to examine these hypotheses.

As this study illustrates, observational research seeking to describe classroom variables and identify those variables that relate to learning present a number of challenges. The most obvious challenge is that classroom observations cannot possibly measure and control for all of the child, teacher, and contextual variables that influence learning processes and outcomes.

The observational classroom research most directly related to this study is the Home-School Study of Language and Literacy Development (HSS; Dickinson & Tabors, 2001). While the current study suggests it is difficult to predict children's vocabulary outcomes from observational classroom or teacher variables, in the HSS researchers found relationships between a number of teacher language variables and children's vocabulary learning. Teachers' use of sophisticated vocabulary, correcting utterances, and analytic talk about books in preschool classrooms predicted children's vocabulary learning as measured by the PPVT (Dickinson & Porche, 2011).

A limitation of observational research is that findings may be representative of unmeasured variables. Researchers from the HSS suggest that some of the observed teacher language variables with relationships to vocabulary learning may actually be a proxy for unobserved teacher characteristics (Dickinson & Porche, 2011). They acknowledge the teachers' use of sophisticated vocabulary may be an indicator of a

particularly skilled and effective teacher. It is possible that teachers with a high rate of rare word use have a cluster of unmeasured characteristics that were not be shared by the teachers in the current study. The sample in the HSS included a variety of preschool centers and programs, including Head Start and private preschools, and more heterogeneous teacher and child samples. With this heterogeneity came many uncontrolled variables. In contrast, the sample in the current study was made up of classrooms in a single Head Start program in one metropolitan area. The teacher and child samples were relatively homogenous across several demographic factors, suggesting fewer uncontrolled variables at work. This homogeneity also likely restricted the range of the variables of interest, limiting the possibility of finding relationships among variables if they existed.

Small sample of teacher talk. The 20 total minutes observed in these preschool classrooms may not have been a sufficient language sample to measure the classroom language environment children experienced as a whole. Teacher vocabulary support may not be stable enough across the day or year to be measured at one time point and with such a small sample of talk.

There was justification for using a small sample, as others have used a similarly-sized sample of preschool classroom talk at one time point (Connor et al., 2006; Dickinson & Porche, 2011; Huttenlocher et al., 2002). However, differences with these prior studies may have been a limitation in the current study. The HSS (Dickinson & Porche, 2011) sampled 15 minutes from three activity settings. As previously noted, this teacher talk drew from a different and heterogeneous population, which may be more stable or present a wider range of teacher language with more power to detect a

relationship. Huttenlocher et al. also collected 15-minute samples in three preschool settings on two consecutive days. They studied syntax, which may be a more stable aspect of teacher language than vocabulary use and support. Finally, Connor et al. sampled two hours in preschool classrooms on one day, and focused on the allocation of instructional time to content areas. These broader-scale classroom variables may be more stable across the year if classroom schedules stay the same, as compared to the detailed language variables used in the current study.

Although this study examined centers and small groups as settings conducive to rich teacher-child interactions, it may be that interactions throughout the day, including in book reading, circle time, or meals are also influential in word learning. Teachers in this sample were consistent across observations of small groups and centers, with no significant differences on any of the teacher language variables between these two settings. A broader sample that measured teachers' instructional word use and semantic supports across the full day might reveal more setting-specific variability and yield different results.

The finding of consistent cross-setting patterns suggests teachers may have consistent patterns of vocabulary support across activities. This finding contrasts with earlier findings by Turnbull et al. (2009). They observed teachers in preschool classrooms serving at-risk children and found more use of language support strategies in small-group child-directed activities such as centers than in small-group teacher-directed activities. The cross-setting similarities in teacher language in the current study might be linked to the similarities between these small groups and centers contexts. In these Head Start classrooms, centers activities were often teacher-directed, such as a prescribed art activity

or teacher-led game. Thus, the teacher-child interactions in these two settings may have been more similar than typically seen in early childhood classrooms. Teachers may have used similar language patterns during these two activities on a single day, but their vocabulary supports may have been quite different during other activities or on other days.

Another possibility is that teacher language may have evolved over the course of the school year in response to teachers' getting to know the children's language skills, children's development, or other factors. A recent study found that few Head Start teachers adjust their language supports over time, but that shifts in language support practices during a school year relate to children's growth in receptive vocabulary (Gerde & Powell, 2012).

Besides the lead teacher observed for this study, other adults contributed to the language interactions children had in these Head Start classrooms. Each classroom had one to two assistant teachers. These assistants often interacted with children just as frequently as the lead teachers during these activities, engaging with children during centers and leading a small group activity. Additionally, there was a relatively high turnover rate in this Head Start program, with the lead teacher changing in 8 of these 51 classrooms during the school year. Therefore, even if a 20-minute sample of teacher talk was enough to represent the lead teachers' supports for word learning, this sample may not have accurately and fully represented the children's preschool language experiences.

Multiple observations would provide a more stable measure of word-learning opportunities over time. Due to the close lens needed to describe children's language

experiences, complete with recording, transcribing, coding, and analyzing classroom language, having longer or more frequent observations would be a large undertaking.

Measures. All of the vocabulary measures in this study were distal in time, and the standardized measures were distal in terms of alignment with the instructional words. Distal vocabulary measures lead to issues in detecting incremental changes in word knowledge, and standardized tests such as the PPVT may present particularly significant challenges in this regard. There may have been too large of a leap between classroom instruction related to word meanings and general word knowledge on standardized measures for learning to be detected by these measures. Although the association between standardized measures and the tool used to examine teachers' language use were considered in validating the word list, instructional words still represented only a small number of items on the standardized measures. A measure of the specific instructional words might better reflect children's word learning from classroom experiences.

There are several other areas of concern when using standardized vocabulary measures to study classroom learning. Earlier editions of both the PPVT and EVT have demonstrated a cultural bias, specifically disadvantaging low-income and African American children who make up the majority of this sample (de Villiers, 2004; Qi et al., 2006; Restrepo et al., 2006; Washington & Craig, 1999). Because of the testing mode, these measures necessarily test a specific sample words and may represent a shallow level of knowledge that is constrained or context-specific.

NDW from the language sample is a more proximal measure than the standardized tests as the children could plausibly use any instructional words they had learned in the language-sampling context. Other observational studies linking preschool

classroom experiences to children's language learning have used language samples as an outcome (Girolametto & Weitzman, 2002; Huttenlocher et al., 2002). NDW is a commonly used measure of the size of children's productive vocabulary and knowledge-in-use (Hoff, 2003). NDW has demonstrated reliability for use in measuring preschoolers' vocabulary (Gavin & Giles, 1996) and construct validity as a developmentally-sensitive measure of lexical diversity (Miller, 1991; Watkins, Kelly, Harbers, & Hollis, 1995). Ease of word recall and linguistic style also influences the variety of vocabulary used in language samples, and both of these factors may be influenced by children's experiences. The frequency with which children hear words may influence the ease with which they retrieve them, and children's style of language use reflects their interactions with others (Hoff, 2003). Thus while NDW is a measure of expressive vocabulary, it also reflects children's broader language abilities and may be especially influenced by language experiences.

The language sample measure may have been more sensitive to word learning occurring during the preschool year than the standardized measures, but the language sampling protocol may not have constituted an obligatory context for many of the instructional words. A more sensitive approach would measure children's knowledge of the instructional words on this list, or even the specific words each teacher used. Such a proximal measure would reflect whether teachers' use of instructional words and semantic supports led to children learning those words.

A strength of this study was the use of multiple measures of vocabulary knowledge, representing both receptive and expressive dimensions and including standardized measures and a language sampling measure. Others in the field have called

for various types of measures to be used, because teacher language practices that are related to learning specific words may differ from those that are useful for building general word knowledge (Graves, 2006; Silverman & Crandell, 2010). In studying preschool vocabulary learning, the proximity, testing mode, and vocabulary dimension of measures are important considerations.

Threshold. It is possible that the hypothesized teacher vocabulary supports are related to children's vocabulary gains but only when a minimum threshold is reached. In this sample, there was substantial variability in the teacher language variables between classrooms. However, the overall word-learning opportunities children experienced during interactions with their teachers in these Head Start classrooms may still have been low overall as compared to other preschools settings with a more heterogeneous sample.

There was substantial variability in vocabulary support between teachers such that across both activities, teachers ranged from 0.37 to 4.57 instructional words per minute. For each type of semantic support, there were some teachers who never used that type of support, and there were other teachers who used the support with nearly every word. Still, the teachers who used instructional words and semantic supports frequently were not necessarily using enough instructional words or supports to significantly influence their students' vocabulary growth.

To exemplify this possibility, an excerpt is presented here. The teacher, Ms. Wilson, was helping children decorate a piñata as a small group activity. Ms. Wilson was in the top 25th percentile for instructional word use as well as verbal and nonverbal supports. Verbal supports are underlined, and nonverbal supports are in parentheses.

MS. WILSON: When you **ball** up one **piece** of your paper (*holds up one piece of paper*), maybe you can make him a nose.

MS. WILSON: What color would you like his nose to be?

CHILD: Um orange.

MS. WILSON: Orange.

MS. WILSON: So put you a **dab** of glue right there, just a little **dab**.

(*demonstrates adding a dab glue onto the piñata*)

MS. WILSON: Maybe that'll hold his nose.

MS. WILSON: Take it down some.

MS. WILSON: We'll make it in the middle of his face.

MS. WILSON: You say you like green and I see green in here.

MS. WILSON: Oh it's a **short piece**. *(holds up one piece of tissue paper)*

Ms. Wilson uses six instructional word tokens, and four unique instructional words in this 15-second segment. She uses both verbal and nonverbal supports fluently to aid children's understanding of the instructional words she is using, as well as her directions overall. Yet even in this interaction she does not use extraordinarily rich language. She could have included more precise vocabulary, elaborated verbal information, emphasized nonverbal information, and engaged the children in extended discourse featuring these words. Thus while she did a strong job introducing and supporting instructional words relative to the sample in this study, her language may not have been supportive enough overall to influence the vocabulary growth of her students.

The field is hampered by a lack of knowledge of the association between classroom instructional supports and children's language learning. Even teachers who were strong in vocabulary support during these two activities may not have provided sufficient input to influence children's vocabulary gains over the preschool year. Teachers not reaching a high enough threshold of vocabulary support may have been a particular issue in this study, as the children in this sample had relatively low language overall. Teachers of such children may need to maintain high instructional word use and support throughout the day to influence children's vocabulary growth.

The measures of semantic supports may have limited the possibility of finding the hypothesized relationships between semantic supports and children's vocabulary gains. These measures operationalized semantic supports as the density of supports per instructional word. If a teacher's instructional word use was low, the density of supports per word may have been inflated to appear stronger than her actual language use. Conversely, a teacher who used many instructional words may have had an artificially low measure of semantic supports though she often supported her children's understanding of words. The overall frequency of semantic supports may better reflect exposure to supports.

A homogenous sample provides some benefits but also limitations in studying language learning in classrooms. One limitation is the inability to determine whether the practices for this sample of teachers reached a critical threshold for word-learning support. Examining word-learning opportunities in a more heterogeneous sample such as the one in the HSS could produce a wider range in teacher vocabulary support. This

would allow for examination of relationships between teacher supports at a high level and children's vocabulary gains.

Alternative Routes

If the hypotheses on which this study was based were incorrect, it may be necessary to explore alternative explanations for how children acquire new vocabulary in preschool classrooms. The field needs to know more about facilitating vocabulary learning in classrooms, particularly in early childhood programs that serve as early intervention for children with risk factors such as poverty or disability. Researchers might consider alternative ways to examine vocabulary learning in preschool classrooms that diverge from commonly-used methodologies in the field.

Matching experiences to children. There was wide variability in these Head Start children's language skills, from children with extremely low language to children with typical skills. The pattern of results from the language sample measure suggests that children with different initial language skills may learn words from different supports. This finding is consistent with prior research indicating nonverbal supports are beneficial for children with low initial language while verbal supports are most beneficial for children with high initial language (Bowers & Vasilyeva, 2010; Reese & Cox, 1999; Roskos & Burstein, 2011; Sénéchal et al., 1995; Silverman & Crandell, 2010; Wasik, Bond, & Hindman, 2006). Initial vocabulary knowledge appears be a factor in the cues children use to learn new words, which is consistent with the Emergentist Coalition Model for word learning (Hirsh-Pasek et al., 2000; Hollich et al., 2000). These data point to the need to look at word-learning opportunities from individual children's

perspectives. Following the teacher, without the ability to know what individual children experienced, might be an imprecise way to measure the relationship between classroom language experiences and vocabulary gains.

Observational measures from the child's perspective such as the *Child Observation in Preschools* (COP; Farran, Kang, & Plummer, 2003) and technological advances such as the *Language Environmental Analysis system* (LENA; Gray, Baer, Xu, & Yapanel, 2007) make such study possible. In fact, researchers in the field have used observations of individual children to characterize aspects of the preschool classroom environment that relate to children's growth (Huttenlocher et al., 2002).

Following the child would allow for richer data about individual teacher-child interactions and interactive elements such as child responsiveness and engagement. A recent study conducted in a preschool classroom examined associations between measures of classroom instruction and children's lexical growth measured by standardized measures and found that children's level of engagement was the best predictor of vocabulary growth in preschool classrooms (D. K. Dickinson, personal communication, November 22, 2012). Other research also has found that adults' responsiveness to children's interests relates to word learning (Bloom, 2000; Valdez-Menchaca & Whitehurst, 1988). These additional factors can only be measured by carefully observing individual children.

A child-focused approach would also allow for an examination of whether teachers were differentiating their vocabulary support based on child's language level. The lack of a relationship between initial class average on the AGS language scale and teachers' use of instructional words and semantic supports indicates that these teachers

may not have adjusted their language supports to match the average language level of students in their classroom. It is also possible that the teachers calibrated their vocabulary supports for individual children or groups of children within the classroom, but this could not be measured without observational data for individual children. Examining the word-learning opportunities experienced by specific children would begin to clarify the relationship between those experiences and vocabulary gains for subgroups of children with varying characteristics.

Instructional word list. The instructional word list was used to identify word-learning opportunities as well as measure the lexical level of teachers' speech in classroom interactions with children. The instructional word list had solid psychometric properties and face validity for this purpose and for this population. The tool effectively captured a feature of the linguistic context of these Head Start classrooms. Across 51 classrooms, there was variation in the frequency with which these words appeared in adult-to-child speech and few floor effects. These words were relatively common (ranging from 0.37 to 4.47 per minute), indicating a linguistic characteristic of typical adult-child interactions in these classrooms. However, it is possible this tool was not the right tool for measuring features of teachers' talk that best predict children's word learning in preschool classrooms.

It could be the fact that the instructional word list was not at the right level of sophistication; the list may need to include more easy or more challenging words. Others have found that teachers' rare word use relates to children's vocabulary growth (Dickinson & Porche, 2011; Roskos et al., 2008). Instructional words appeared approximately twice as often as "rare words" in this sample. The HSS examined

teachers' use of rare words, a corpus of words not known by the typical fourth grader and thus at a higher level of vocabulary than instructional words (Beals, 1997; Dickinson & Porche, 2011; Weizman & Snow, 1994). In that study, teachers' use of rare words predicted children's vocabulary knowledge and later literacy skills (Dickinson & Porche, 2011). Due to the relatively high level of the rare word list, use of rare words may be an indicator of a teacher with a relatively large vocabulary and advanced linguistic skills. In contrast, instructional words need to be within the repertoire of all early childhood teachers and within reach of most preschool children to be instructionally valuable. Thus instructional words are a different construct than rare words, aimed at representing word-learning opportunities for children as opposed to teachers' linguistic sophistication.

More basic lists of words have been validated for use in interventions for children with extremely low-language skills (Kaiser, 1993; Roskos et al., 2008). These words may address the word-learning needs of children with very low language or disabilities but most are likely too easy to provide language-learning opportunities for most preschoolers. Inclusion of such words might better describe effective supports for those with very limited language skills.

It is possible that the inclusion of a broader range of words at either end of the spectrum would more fully capture the word-learning opportunities experienced by these children in Head Start. The refined instructional words list would still need to fall in the "middle ground" between basic words and rare words to represent word-learning opportunities for most preschoolers. It is also possible that the word list for preschoolers needs to be stratified based on children's initial language levels to meet children at their instructional level.

The instructional word tool was defined and validated to measure instructional words from children's perspective. These were words children would benefit from having the opportunity to hear in preschool classrooms, based on Biemiller's (2010) conceptual work and examination of pretest data from a subsample of the Head Start children. This study did not examine the extent to which this corpus of words was in the repertoire of the Head Start teachers. Although the teachers used instructional words regularly, it is possible they only used a small subset of these words. This study examined how many instructional words the teachers used, but not what proportion of the words on the list did teachers use. Therefore, the tool itself may include appropriate words representing a range of difficulty sufficient to support learning of most children in these classrooms, but the teachers may not have used an ample variety of the words to foster sufficient learning to be detected by standardized measures.

The instructional words were selected as an approximation for this sample based on available lists and pilot data for a range of children in the sample, with the acknowledgement that specific instructional words will be different for each child. The L2 list from the Living Word Vocabulary (Biemiller & Slonim, 2001; Dale & O'Rourke, 1981) was not designed for the purpose of identifying instructional words for this age group, but this study contributes to the field's knowledge about how instructional words may be selected or validated for early childhood education. Because there is not an existing instructional list or clear parameters for the types of words that preschool children should be learning, the selection of words for vocabulary research and instruction needs to continue to be explored.

Other preschool environmental variables are highly influential. Finally, it is possible that other aspects of classrooms beyond teachers' adult-to-child speech are critical to vocabulary development, and these characteristics need to be more thoroughly examined. For example, the content of classroom activities (Turnbull et al., 2009), the materials available to children (Connor et al., 2006) and the make-up of the peer group (Mashburn et al., 2009) may all relate to children's vocabulary growth during preschool. These elements contribute to the richness of classroom learning opportunities, which relates to the words and the concepts children are exposed to as well as children's engagement.

This study looked at interactions through a single lens, through teacher-child interactions. However, interactions occur simultaneously with other aspects of the activities and classroom environment. Not just teachers' language, but how language interacts with content, materials, and peers may be important in examining word-learning opportunities. The field has largely focused on teacher input and instruction when examining vocabulary learning in preschool. A wider lens that considers the broader classroom environment and context may help to illuminate additional factors that characterize word-learning opportunities in preschools.

Directions

This study's findings and limitations highlight several areas of preschool vocabulary research that warrant further exploration. Several possible follow-up studies would extend from this work.

Instructional Words Tool

The instructional word list used in this study shows promise as a tool for identifying and describing word-learning opportunities. The words may be within the repertoire of all early childhood teachers and therefore the instructional word list could be a tool for studying the word-learning opportunities in all preschool classrooms. The process by which it was created could be useful for other researchers creating tools to study vocabulary learning in other settings. However, this tool needs further study and refinements are likely needed. Further research is needed to examine whether this is the right corpus of words, or whether it needs to be expanded. Testing this tool with other samples would help determine whether it is appropriate for use with different populations.

There are several ways to examine the instructional word list's utility for research purposes. First, an inventory of speech samples from a heterogeneous sample of preschool-aged children could identify how many instructional words are known by preschool children at the beginning and end of preschool. This would necessitate a large corpus of language data from children before and after preschool, searched for the percentage of these words that appear in the samples. Alternatively, children could be directly tested for receptive or expressive knowledge of a sample of these words. This work would be similar to Biemiller's (2010) effort to categorize age-appropriate instructional words for elementary school children, the work from which this list was derived. These approaches would begin to clarify whether these words truly represent word-learning opportunities for preschool classrooms.

Also, as previously noted, this study did not examine what proportion of the instructional words actually appeared in teacher language in the classrooms. If these words are of instructional value for children, it would be important to know whether preschool teachers are regularly using them in classrooms. Further study may use this and other samples of teacher language to examine what proportion of the instructional words are typically part of adult-to-child speech in Head Start and other preschool classrooms.

Richer Descriptions of Preschool Classroom Word Learning

Much of what is known about early word learning comes from observation in homes and careful study of parent-child dyads. Yet there is relatively little descriptive research of preschool classroom word-learning experiences. Classrooms are different contexts than homes, and teacher-child interactions differ in many ways from parent-child interactions. More detailed descriptions of classroom variables that potentially relate to children's vocabulary growth are needed (e.g., the impact of group experiences such as singing or classroom discussions on word learning, the effects of peer interactions).

In this study, substantial variability in experiences was observed across classrooms, even within this largely homogenous sample and small corpus. Further descriptive study is needed to examine not just teacher language, but other environmental factors such as content, materials, interactions with peers, and child interests. Ideally, observational studies will follow individual children and look at interactive aspects of their experiences such as their engagement in activities and responsiveness to teacher language. This approach would allow study of how exposure to instructional words,

semantic supports, and other relevant classroom variables relate to word learning for different subgroups of preschool children.

Conclusion

Early childhood classrooms are important contexts for supporting the vocabulary development of preschool-aged children. Examining the word-learning opportunities afforded to children in these classrooms will be an important step in designing optimal environments for enhancing language learning for children at risk for future academic difficulties.

This study raised important issues about which words to teach preschool children, how to assess their word learning, how subgroups of preschool children learn words in classrooms and teachers' approaches to supporting word learning. The detailed descriptive results indicate that the word-learning opportunities experienced by these children in Head Start varied substantially between classrooms. Any number of unobserved variables may have shaped these differences, including the characteristics of the children with whom the teacher was interacting, characteristics of the teacher herself, or the specific activity or materials salient to the activity.

For the most part, the teacher language variables hypothesized, based on the literature, to constitute word-learning opportunities did not relate to children's vocabulary gains. The relationship between teachers' use of verbal and nonverbal supports with instructional words related to children's gains on the most proximal of the measures, NDW in the language sample. This relationship differed based on whether the children were in the sample initially identified as having low-language skills or in the matched

sample initially identified as having typical-language skills. Given these findings, further testing of these hypotheses needs to include multiple, lengthier observations of classroom time, proximal measures of children's vocabulary, and a more heterogeneous sample of teachers.

This study contributes to the discussion in the field about which words are important for preschool children to learn, particularly preschool children from low-SES families and subgroups of children with varying initial language abilities. From this research, better information for preschool language research and practice may emerge to guide program design and professional development. This is an area for further refinement through related research on this instructional word list and other tools.

The complex matrix of classroom language variables, child samples, and vocabulary measures reflects the complicated context of vocabulary learning in preschool classrooms. Given the great variability in word-learning opportunities and the constraints of this secondary data analysis, additional research is needed to fully understand the processes by which preschool experiences influence children's gains in vocabulary knowledge. Alternative approaches to studying children's word-learning in preschool classrooms might feature observation of individual children's experiences in relation to their vocabulary growth and examination of other classroom factors that likely relate to word learning.

APPENDIX A

LANGUAGE SAMPLE COLLECTION PROTOCOL

Goals for the Tester:

- To obtain a 21-minute language sample.
- To accurately capture the child's initiated language that has not been prompted by the adult.
- To avoid language-rich verbs and labels that may not occur spontaneously in the child's language repertoire.
- To promote child talk by being responsive, fun and engaging.

Materials:

1. Carl Goes to Daycare book
2. Little People Preschool, Toy set (including people)
3. 1 Rottweiler puppy and 2 additional plastic dogs

Part I: Carl Goes to Daycare book

1. Show the child the Carl Goes to Daycare book and say:
   "Now here's another book."

2. Immediately turn to the first pair of pages following the text and say:
   "Tell me about this book."

3. **Wait** 5 seconds after the child stops talking:
   (a) If the child has said **5 or more utterances** turn to the next pair of pages.
   (b) If the child has said **less than 5 utterances**, give a non-verbal cue (e.g. pointing, making facial expressions, making sounds like, "uh-oh," or "oops")
   ★★Give up to **5 non-verbal cues per pair of pages** or until the child has said **5** utterances.

4. If the child does not respond after 10 non-verbal cues across 2 pairs of pages, give the verbal prompt, ***"Tell me more."*** OR ***"Tell me what you see."*** (maximum of 6 verbal prompts)

5. Go through the entire book with non-verbal and verbal cues as described above.

6. Only repeat what the child says (changing the intonation pattern) or use non-verbal cues to elicit language, do not use any additional language.

7. If the child asks a question, answer the question non-verbally, repeat the question using rising intonation (as if asking the child the question), or if a verbal response is required, use a little language as possible to answer the question.

8. If the child asks to turn the page before he or she has said 5 utterances, acknowledge the request, but redirect to the current set of pages using as little language as possible (e.g. "after you tell me more about this page).

9. If the child exhibits challenging behaviors, redirect using nonverbal cues or with verbal cue (using limited language). If redirection is unsuccessful after 2 attempts, tester should use the toys to continue the sample (see below).

10. The goal is to a get a 21-minute language sample. Use the book for as long as the child is engaged and talking.

*NOTE: Toys are kept out of sight until the tester has finished with Carl Goes to Daycare.

Part II: Play based language sample using Little People toys

1. Introduce the toys by saying, ***"Now let's play with this dog, I wonder what he will do in this school."***

2. Put the school on the table and give the Rottweiler dog to the child (keep the easel, slide, swing and people out of reach but in sight).

3. Actively engage in play using exclamations and non-verbal actions.

4. Promote language by making sounds, being silly, setting up situations in which the child needs something from the adult & violating the child's expectations (e.g. doing the wrong thing with the toy).

5. Only repeat the child's utterances and pause before repeating, do not introduce new language.

6. If the tester has tried several (more than 3) non-verbal methods (e.g. making noises, modeling play) and more than one minute has elapsed between child utterances, the tester may use an occasional general, open-ended question (e.g. *"What should I do?", "What can the dog do?" ,"What else?"* , *"What now?"*). No more than 6 questions should be used during the entire play-based language sample.

7. Do not ask "yes/no" questions as they are not likely to elicit more than a single word response.

8. It is essential that the tester's behavior be the same during the book and play-based language sample with regard to the number of verbal prompts used, and type and frequency of non-verbal prompts.

9. If the child is not talking after 10 minutes or is exhibiting disrupting behaviors request the help of your supervisor.

APPENDIX B

INSTRUCTIONAL WORD LIST

A-bomb
A-bombs
absence
absences
absent
absolute
absolutely
absorb
absorbed
absorbing
absorbs
abuse
abused
abuses
abusing
accent
accented
accents
accept
accepted
accepting
accepts
accident
accidental
accidents
accompanied
accompanies
accompany
accompanying
accomplish
accomplished
accomplishes
accomplishing
ache
aches
achieve
achieved
achieves
achieving
achy
acre
acres
act
acts
address
addressed
addresses
addressing
adjective
adjectives
adjust
adjusted
adjusting
adjusts
adopt
adopted
adopting
adopts
agenda
agendas
alert
alerted
alerting
alerts
allegiance
allegiances
allegiant
allergic
allergies
allergy
alternate
alternated
alternates
alternating
amuse
amused
amuses
amusing
ancient
angle
angled
angles
anniversaries
anniversary
announce
announced
announces
announcing
annoy
annoyed
annoying
annoys
antibiotic
antibiotics
anxious
anxiously
apologetic
apologetically
apologies
apologize
apologized
apologizes
apologizing
apology
appetite
appetites
applaud
applauded
applauds
applauding
applied
applies
apply
applying
appointment
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areas
argue
argued
argues
arguing
arrange
arranged
arranges
arranging
arrest
arrested
arresting
arrests
arthritic
arthritis
article
articles
assign
assigned
assigning
assigns
assist
assisted
assisting
assists
assume
assumed
assuming
assumes
astonish
astonished
astonishes
astonishing
attach
attached
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avalanches
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avenged
avenger
avengers
avenges
avenging
average
averagely
avoid
avoided
avoiding
avoids
await
awaited
awaiting
awaits
awake
awaked
awakes
awaking
aware
bacteria

bacterial
bad
badly
balance
balanced
balances
balancing
bald
balder
baldest
baldly
ball
ball
balled
balling
ballot
ballots
balls
balls
ban
band
bands
bans
bare
barer
barest
bargain
bargained
bargaining
bargains
bash
bashed
bashes
bashing
bay
bays
beast
beastly
beasts
beat
beating
beats
beverage
beverages
beware
bewared
bewares
bewaring
biceps
biceps
bin
binocular
binoculars
bins
bit
bits
bitter
bitterer
bitterest
bitterly
blast
blasts
blizzard
blizzards
bloodshot
bluff
bluffed
bluffing
bluffs
blush
blushed
blushes
blushing
board
boarded
boarding
boards
boast
boasted
boasting
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propose
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protein
proteins
protest
protested
protesting
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provide
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public
publication
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publishes
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puffs
pulley
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punctuate
punctuated
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punish
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quenched
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reasons
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rebels
receive
received
receives
receiving
reckless
recklessly
recognize
recognized
recognizes
recognizing
recommend
recommended
recommending
recommends
recover
recovered
recovering
recovers
recuperate
recuperated
recuperates
recuperating
recycle
recycled
recycles
recycling
refer
referred
referring
refers
refund
refunds
refuse
refused
refuses
refusing
register
registered
registering
registers
regular
regularly
rehearse

rehearsed
rehearses
rehearsing
reject
rejected
rejecting
rejects
remain
remained
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remark
remarkable
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remarks
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reply
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report
reported
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scratching
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scuba
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shrugging
shrugs
shut
shuts
shutting
sign
signed
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simple
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snap

snapped
snapping
snaps
snatch
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sniff
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song
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soothing
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souvenir
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spanned
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spark
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spattered
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special
specials
speck
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spectacular
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speech
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structure
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struggle
struggled
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subway
subways
success
successes
suck
sucked
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sucks
sudden
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suggested
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summaries
summary
summon
summoned
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supervise
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supplies
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symbolic
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teasing
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technician
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temperature
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throws
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token
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tolerate
tolerated
tolerates
tolerating
tomb
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took
tool
tools
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torch
torches
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torment
tormented
tormenting
torments
torrent
torrents
tour
tours
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towed
towing
town
towns
tows
toxic
trace
traced
traces
tracing
track
tracks
tradition
traditional
traditions
trail
trails
transfer
transferred
transferring
transfers
transmit
transmit
transmitted
transmitting
transport
transported
transporting
transports
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treasured
treasures
treasuring
tremble
trembled
trembles
trembling
tremendous
tremendously
trespass
trespassed
trespasses
trespassing
tribal
tribe
tribes
tried
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trouble
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truest
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tumble
tumbled
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twinkled
twinkles
twinkling
type
typed
types
typing
unit
units
universe
universes
universities
university
usual
usually
value
values
vanilla
varietal
varieties
variety
vehicle
vehicles
vehicular
vein
veins
vent
vents
verb
verbs
verdict
verdicts
vibrate
vibrated
vibrates
vibrating
vicious
viciously
vocal
vocally
volunteer
volunteers
warm
warmer
warmest
warmly
warn
warned
warning
warns
wax
waxed
waxes
waxing
waxy
wealth
wealthy
weapon
weapons
wearier
weariest
wearily
weary
weather
weathers
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week
weeks
weigh
weighed
weighing
weighs
weird
weirder
weirdest
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welcome
welcomed
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welcoming
west
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whisper
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whispering
whispers
whiz
whizzes
whole
wholly
wide
widely
wider
widest
width
widths
wild
wilder
wildest
wildly
wink
winks
wish
wishes
withstand
withstanding
withstands
withstood
witness
witnessed
witnesses
witnessing
wobble
wobbled
wobbles
wobbling
woollier
woolliest
woolly
word
words
world
worlds
worried
worries
worry
worrying
worse
worth
wound
wounded
wounding
wounds
wrap
wrapped
wrapping
wraps
wreath
wreaths
wreck
wrecked
wrecking
wrecks
wrench
wrenched
wrenches
wrenching
wriggle
wriggled
wriggles
wriggling
yank
yanked
yanking
yanks
young
younger
youngest
zero
zeroes
zone
zones

APPENDIX C

CODING INSTRUMENT

Activity	Date	Classroom ID		Teacher ID	Coder
Brief description of activity:		Types	Tokens	TTR	Length of Transcript

Word	POS	TCS	Content		Lead	VSFM	NVSFM	ED	CH Resp	Resp Type
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other
	☐ Noun ☐ Verb ☐ Adjective ☐ Adverb ☐ Other	☐ No ☐ Yes	☐ None ☐ Literacy ☐ Math ☐ Science	☐ Mmgt ☐ Personal ☐ Other	☐ None ☐ Child ☐ Teacher	☐ None ☐ Definition ☐ Context ☐ Example	☐ None ☐ Pictures ☐ Gestures ☐ Objects ☐ Other	☐ No ☐ Yes	☐ No ☐ Yes	☐ Repeat ☐ Use ☐ Define ☐ Example ☐ Other

APPENDIX D

CODING MANUAL

Overall Guidelines

Both the content-coded transcript in the Content Coding folder (when available; if unavailable, use the uncoded transcript in the Transcribing folder) and the activity video in the Segmented_vids folder should be used when coding.

1. Open the transcript and run the word list search program (freq +t*TCH +s@IWList.txt @).
2. For each identified instance of an instructional word occurring in teacher speech in the transcript, complete one row of the coding instrument.
3. After completing coding for an entire transcribed activity, enter data into a the Word Learners Data spreadsheet in the Word Learners Data folder.
4. Record the date completed on the Coding Log spreadsheet.

General Codes

To be completed once for each transcript, cross-checking data from the following sources in the Word Learners folder:

- Coding Log spreadsheet
- Video Status spreadsheet
- Classroom and Teacher IDs.

Only fill out for the first completed coding page; subsequent pages can be numbered and stapled together to represent complete coding of one transcribed activity.

Code	Explanation
Activity	Name activity. Should be: Small Groups or Centers.
Date	Date activity was videotaped. Should be labeled in the Coding Log as well as the video name. EX: 10/19/07
Classroom ID	Classroom ID number. Should be listed in the Coding Log, can cross-check on the Video Status spreadsheet or Classroom and Teacher IDs. EX: 320
Teacher ID	Teacher ID number, for the teacher who is focused on in that video. Should be listed in the Coding Log, can cross-check on the Video Status spreadsheet or Classroom and Teacher IDs. EX: 2037
Coder	Coder name. List your full name. EX: Jill Grifenhagen
Brief description of activity:	In 1-2 phrases or sentences, briefly describe the nature of the activity you observed. Will likely be completed after viewing the video and coding from the transcript. Note any unusual occurrences. EX: [Centers] Blocks, art, writing centers. EX: [Small Groups] Alphabet bingo.
Length of transcript	Use time markers in transcript to calculate the actual length of the activity that was transcribed, in minutes and seconds. Note: length of activity transcribed may be less than full video. EX: [10 minutes transcribed]: 10:00 EX: [9 minutes, 17 seconds transcribed]: 9:17
Types	From the CLAN output, record the number of different instructional word types used in this transcript.
Tokens	From the CLAN output, record the number of unique instructional words (tokens).
Type/Token Ratio	From the CLAN output, record the Type/Token ratio for this activity.

Word Codes

After running the word list search program, record each word on one row of the coding document and complete each relevant code associated with that word's occurrence. If a single word appears more than once in the same transcript, complete one row for each time the word occurs. Mark a time stamp by the word if it appears more than once to ensure consistency when checking reliability.

Notes:

- The CLAN search program will only identify instructional word occurrences in Teacher speech. If the word appears in Child speech (or someone else), there is no need to code that occurrence.
- If you notice an instructional word used by the teacher that was not originally transcribed, please do not code that word. Unfortunately, there is no way to systematically code these omissions. So please just code those words that were actually transcribed and picked up by the analysis program.
- If the word appears as part of a compound word, it is considered a different word and unless it is identified by CLAN as part of the instructional word list, it should not be coded.
- CLAN will recognize words pronounced differentially due to slang, dialect, etc. If you have difficulty finding an identified instructional word in the transcript, search for parts of that word that will be transcribed as pronounced (example: "excuse" = [ex] cuse).

POS: Part of Speech

To the best of your ability, determine the part of speech for the word as it is used in the context of the video/transcript. The options are noun, verb, adjective, adverb, or other. If the part of speech cannot be determined, you may leave this column blank.

TCS: Teacher-to-Child Speech

This code indicates whether the instructional word occurred in child-directed speech, or speech from adult-to-child. For coding purposes, we are interested in whether the word occurred in the speech of the focus teacher to a child or children in the classroom.

No	The word **did not** occur in child-directed speech. This includes when the word occurred in a child's speech, in another adult's speech who was not the focus teacher for this video, or when the teacher uses the word when talking to another adult, on the telephone, etc. This includes when the word was misattributed to the teacher but upon careful review of the video was clearly used by a child or other adult. *If TCS = No, no further coding needs to occur, and you may move on to the next word.*
Yes	The word **did** occur in child-directed speech. The word occurred in the focus teacher's speech, and she was speaking to one or more children at the time. If the word occurred in an episode where the teacher is speaking to someone off-camera, and after reviewing this portion of the video it is unclear whether that person is a child or another adult, code TCS as "yes."

Content

This code indicates the content of the talk the teacher was engaging in with the child when the instructional word was used. The focus here is on the most immediate content of the utterance; if the video is content coded, the content code (CON) may be used for guidance (if the utterance is coded as vocabulary (VO), look for the general content of the talk surrounding that utterance). Use the content codes as a guide when available, but make a holistic judgment of the content of talk in which the instructional word appears. This does not necessarily indicate the more general content of the activity going on; for example, the teacher may be working on a math game with a group of children, but the particular utterance is related to the child's feelings, so the content code would be "personal" rather than "math."

None	There is no clear content to the utterance in which the instructional word occurred. This utterance may be an aside that does not seem to relate to any other content-driven talk, or the meaning may be unclear. Typically used when giving *general* directions, setting up or cleaning up, passing out materials. Likely coded as HT, OA, or XX for content.
Literacy	This instructional word occurred in the context of talk about literacy. The utterance may focus on reading, writing, alphabet, spelling, phonological awareness, or another literacy skill. Likely coded as BO, LR, PA, PC, or PM.
Math	This instructional word occurred in the context of talk about mathematics. The utterance may focus on counting, number sense, operations, patterns, shapes, measurement, or another mathematics skill. Likely coded as MT.
Science	This instructional word occurred in the context of talk about science. The utterance may focus on weather, animals, light, health & nutrition, or some other science content. Likely coded as SW.
Mgmt	This instructional word occurred in the context of talk about classroom management. The utterance may focus on rules and routines, behavior, classroom procedures, etc. Likely coded as RR.
Personal	This instructional word occurred in the context of talk of a personal nature. The utterance may focus on a person's feelings, preferences, likes and dislikes, pretend play, or on their personal experiences such as talk about past and future activities outside of school, friends and family, pets. Likely coded as EF, PE, or PR.
Other	This instructional word occurred in the context of talk about some clear content, but not one of the content areas listed above. The utterances are likely focus on the immediate activity (such as directions for how to complete an art project) that does not relate to one of the content areas above. Likely coded as HT or OA.

Lead

This code indicates whether the word occurs in talk that is more child-directed or teacher-directed. The purpose is to determine whether, in the use of this word, the teacher is following the child's lead or interest, or leading the child with their talk in the immediate interaction (not necessarily the overall activity).

None	It is *unclear* whether the word is used in talk that is following the child's lead or teacher-directed.
Child	This instructional word occurred in the context of talk where the teacher is following the child's lead or interest. The teacher may be responding to a child-initiated utterance or question, watching and describing something the child is doing (including praising a specific action), or talking about a topic the child brought up. EX [Centers]: Child is playing with a funnel at the sand table. Teacher: Maurice, it looks like you're pouring your sand through that *funnel*! EX [Small Groups]: Child: Teachername, what is this? Teacher: That's some shiny paper. We use it to make a *reflection*.
Teacher	This instructional word occurred in the context of talk where the teacher is leading the conversation. The teacher may be introducing new content, labeling an item or action without the child first engaging with that object or activity, or talking about a topic they brought up themselves. EX [Centers]: Teacher: Amy is over here in the block center. Amy, have you tried building a *community*? Let's work on it together. EX [Small Groups]: Teacher: Today we're going to talk about animals that *camouflage*, or change color.

VSFM: Verbal Support For Meaning

This code indicates what verbal supports are presented for understanding the meaning of the instructional word. Consider whether it is enough *verbal* information for a 4-year-old child to learn something about the meaning of the word. For this code, it is likely necessary to read the immediate utterance in which the word occurs and previous and subsequent utterances in the same interaction. The verbal support must occur within 3 utterances before or after the utterance containing the instructional word. If the support for meaning occurs with previous or subsequent uses of the word, code those uses as the appropriate SFM, and only code this occurrence with any immediate information presented as a support for meaning (i.e. don't give credit twice for one verbal support with multiple uses of the same word). Does not include labeling of pictures or concrete objects without additional verbal information (this is Non-Verbal Support). Note that more than one form of SFM may be used with a given instructional word.

None	There is no clear verbal information presented about the meaning of the word. The word is likely used in passing, in an utterance that provides no semantic or contextual information about what the words means.
Definition	This instructional word is accompanied by some definition of the word. May be a simple definition or synonym, a categorical/taxonomical definition, or a more elaborated definition. May occur in previous or subsequent 3 utterances. This is a more specific form of context—so if the information seems to be both providing a definition and context, code definition (although the teacher may provide both a definition and further context, so both codes would be marked). EX [taxonomical]: Teacher: We're having *rotelli* today, which is a type of pasta or noodles. EX [full definition]: Teacher: Why don't we take the baby to see the *pediatrician*? That's a doctor who takes care of babies and children. EX [synonym]: Teacher: This stack is *enormous*, very big!
Context	This instructional word is embedded in context, in a meaningful way that provides some information about the meaning of the word. May be verbal/linguistic context or social context. Though not a definition, the context itself provides information as to them meaning of the word that would be clear to a preschool-aged child. May occur in previous or subsequent 3 utterances. EX [explicit]: Teacher: We're going to go to a *haunted* house. I'm very scared to go in there, we might see some ghosts! EX [implicit]: Teacher: Today we worked with all kinds of *reflective* materials. You did a great job exploring them!
Example	The teacher provides one or more examples of instructional word. The examples provide information as to the meaning of the word. May occur in previous or subsequent 3 utterances. This is a more specific form of context—

	so if the information seems to be both providing an example and context, code definition (although the teacher may provide both an example and further context, so both codes would be marked). This includes an example when the word is used as part of a phrase that is a specific type of that referent (ex. lion's *den*, chess *board*), but not with a phrase that just includes a describing word for that referent (ex. blue *stick*, loud *noise*). For verbs, the example may be something you would perform that action on (we *squeeze* the ketchup out of the bottle), or a time when you would perform that action (you *swim* in the ocean). EX: Teacher: We going to read a book about *athletes*. We'll probably read about runners, swimmers, and soccer players. Teacher: Let's get a drink from our water *bottle.* Teacher: You *throw* the ball out on the playground.

NVSFM: Non-Verbal Support for Meaning

This code indicates what non-linguistic or physical supports are presented for understanding the meaning of the instructional word. For this code, it is necessary watch the segment of the video including the word and the rest of the interaction. NVSFM may occur during the utterance where the instructional word appears or immediately before or after during the same interaction. If the non-verbal support occurs with subsequent uses of the word, code those uses as the appropriate NVSFM, and only code this occurrence with any immediate supports presented as a support for meaning. Note that more than one form of NVSFM may be used with a given instructional word.

None	There is no clear non-linguistic information presented about the meaning of the word. The word may be used with verbal supports, but there is no indication of non-verbal or physical supports.
Pictures	This instructional word is accompanied by a picture, drawing, or graphic, either of the word itself (for concrete nouns) or providing some information related to the word (for verbs, adjectives, etc.). The word must be clearly linked to the picture, drawing, or graphic, either through the teacher calling attention to the picture, the salience of the picture in the activity or discussion, or pointing or otherwise indicating physically. EX: Teacher: (pointing to a picture card) What book did we find this *envelope* in? That's right, A Letter to Juno.
Gestures	This instructional word is accompanied by a gesture on the part of the teacher. The word must be clearly linked to the gesture. Includes acting out/dramatizing a word. Includes demonstrating or performing an action and using the word to describe that action. Does not include pointing at a picture or object for labeling. EX: Teacher: This was a *tiny* mouse. (uses fingers to demonstrate something very small)
Objects	This instructional word is accompanied by a concrete object, either of the word itself (for concrete nouns) or providing some information related to the word (for verbs, adjectives, etc.). Typically used for labeling. The word must be clearly linked to the object, either through the teacher calling attention to the object, the salience of the object in the activity or discussion, or pointing or otherwise indicating physically. EX: Teacher: (pointing to a dish on the lunch table) Today we're having a sweet potato *casserole.* Doesn't it look delicious?
Other	This instructional word is accompanied by some form of non-linguistic support not included in the categories above. May include (but not limited to) intonation or facial expression. EX: Teacher: I would feel really *furious* if that happened to me (makes a face and uses tone of voice to indicate anger).

ED: Extended Discourse

This code indicates whether the instructional word occurred in the context of extended discourse, defined as a conversation with 5 or more turns between the teacher and a child or children on a single topic. If the transcript is content coded for topic maintenance, the topic maintenance code (TOP) may be used for guidance. Simply look ahead to see whether this instructional word occurs in an utterance that is part of a topic maintained for 5 or more turns (NTO, SPC, TN2, TN3…in a series that continues through at least TN5). Look for the teacher and child or children to have 5 or more turns on a single topic before, including, and/or after the utterance with the instructional word occurs.

No	The word **did not** occur in extended teacher-child discourse. This includes when the word occurs in teacher talk that is not part of a sustained topic of conversation with one or more children, or when the word occurs in a conversation on a topic that is maintained for 4 or fewer turns (T00 or any TOP code when the conversation does not extend to at least TN5).
Yes	The word **did** occur in extended teacher-child discourse. This is when the word occurs in teacher talk that is part of a sustained topic of conversation with one or more children, when the word occurs in a conversation on a topic that is maintained for 5 or more turns (NTO, SPC, TN2, TN3, etc. when the conversation extends to at least TN5).

CH Resp: Child Response

This code indicates whether the teacher's use of the instructional word is followed by a child or children's response. The purpose of this code is to indicate whether the child or children were given the opportunity to use or practice with the word, though the teacher's intent cannot be determined. Therefore, only actual child responses will be coded. This may be any response, either verbal or non-verbal, that indicates the child understood the use of the word in the utterance. For this code, it is necessary watch the segment of the video and review the section of the transcript including the word and the rest of the interaction. Coding is only for the child or children's response immediately following the teacher's utterance in which the instructional word occurs.

No	The instructional word use **was not** followed by any child response. This includes when the word occurs in teacher talk that continues to another topic without any opportunity for children to respond, or teacher talk that is not followed by any child response. Also includes child responses that are off-topic or have nothing to do with the instructional word or the context in which the teacher is using the word. *If CH Resp = No, no further coding needs to occur, and you may move on to the next word.*
Yes	The instructional word use **was** followed by a child response. This is when the word occurs in teacher talk that is followed, either immediately or within the interaction, that relates to the instructional word or the context in which the teacher uses the word. May be verbal response or non-verbal response, such as nodding or pointing.

Resp Type: Type of Child Response

This code indicates what type of child response follows the teacher's of the instructional word. Note: if there is no CH Resp, there should be no code selected here. For this code, it is necessary to read the immediate utterance in which the word occurs and subsequent utterances in the same interaction, and review the segment of the video including the word and the rest of the interaction. If the a child response occurs after subsequent uses of the word, code those uses as the appropriate Resp Type, and only code this occurrence with any immediate response following the teacher's use of the instructional word. Note that more than one form of Resp Type may be used with a given instructional word.

Repeat	In the subsequent utterance, the child or children repeat the word, without any additional talk about its meaning. EX: Teacher: Maria did not give up, even though she scared. She was very *brave*. Child: *Brave*.
Use	In the subsequent utterance, a child or children use the word in a sentence of their own. EX: Teacher: I drew a *sofa* in this picture of my living room at home. Child: Ooooh…I have a new *sofa* in my living room too.
Define	In the subsequent utterance, the child or children define the word, with or without prompting from the teacher. EX: Teacher: I'm going to *dispose* of these scraps later. Does anyone know what I'm going to do with them? Child: Throw them away.
Example	In the subsequent utterance, the child or children offer an example of the word. EX: Teacher: This is an *oval*, something shaped like an egg. Child: Like that mirror over there!
Other	This includes a non-verbal response such as nodding or pointing, as well as any other general response that relates to the instructional word or the context in which the teacher uses the word. In utterances that have multiple clauses, must indicate some comprehension of the part of the utterance that included the word. EX: Teacher: Look at all of these blocks! Can you show me the *parallelogram?* Child points to a block.

APPENDIX E

ANALYTIC MODELS FOR HYPOTHESIS TESTING

Hypotheses	Dependent Variable	Independent Variable	Model
I & II	PPVT-4	IW/Minute	$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} IW/Minute_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
I & II	EVT-2	IW/Minute	$EVT\_post_{ijk} = \gamma_{000} + \gamma_{010} IW/Minute_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} EVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
I & II	NDW50	IW/Minute	$NDW\_post_{ijk} = \gamma_{000} + \gamma_{010} IW/Minute_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} NDW\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	PPVT-4	VSFM/IW	$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} VSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	EVT-2	VSFM/IW	$EVT\_post_{ijk} = \gamma_{000} + \gamma_{010} VSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} EVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	NDW50	VSFM/IW	$NDW\_post_{ijk} = \gamma_{000} + \gamma_{010} VSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} NDW\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	PPVT-4	NVSFM/IW	$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} NVSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	EVT-2	NVSFM/IW	$EVT\_post_{ijk} = \gamma_{000} + \gamma_{010} NVSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} EVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	NDW50	NVSFM/IW	$NDW\_post_{ijk} = \gamma_{000} + \gamma_{010} NVSFM/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} NDW\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	PPVT-4	ED/IW	$PPVT\_post_{ijk} = \gamma_{000} + \gamma_{010} ED/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} PPVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$

III, IV, & V	EVT-2	ED/IW	$EVT\_post_{ijk} = \gamma_{000} + \gamma_{010} ED/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} EVT\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$
III, IV, & V	NDW50	ED/IW	$NDW\_post_{ijk} = \gamma_{000} + \gamma_{010} ED/IW_{jk} + \gamma_{100} Age\_post_{ijk} + \gamma_{200} Gender_{ijk} + \gamma_{300} NDW\_pre_{ijk} + Condit_{jk} + r_{0jk} + u_{00k} + e_{ijk}$

Note. Each model was run for each of the child samples in this study, low-language and matched-language. Child-level covariates in each model are age at posttest, gender, and pretest score on the dependent measure. Cluster-level covariate in each model is condition. PPVT_post = end-of-preschool PPVT-4 raw score. EVT_post = end-of-preschool EVT-2 raw score. NDW_post = end-of-preschool NDW50. IW_Minute = instructional words per minute in adult-to-child speech (ACS). VSFM/IW = verbal supports for meaning per instructional word in ACS. NVSFM/IW = nonverbal supports for meaning per instructional word in ACS. ED/IW = proportion of instructional word embedding in extended conversations between adult and child. Age_post = child age at end-of-preschool posttest on the dependent measure. Gender = child gender. PPVT_pre = beginning-of-preschool PPVT-4 raw score. EVT_pre = beginning-of-preschool EVT-2 raw score. NDW_pre = beginning-of-preschool NDW50. Condit = cluster assigned experimental condition.

APPENDIX F

STANDARDIZED COEFFICIENTS FOR MODELS REGRESSING CHILDREN'S RESIDUALIZED PRESCHOOL VOCABULARY GAINS ON DENSITY OF INSTRUCTIONAL WORD TOKENS

	Standardized *β*	SE	*p*
Low-Language			
PPVT-4	-0.03	0.05	0.47
EVT-2	-0.03	0.05	0.48
NDW50	0.06	0.07	0.37
Matched-Language			
PPVT-4	0.00	0.04	0.94
EVT-2	0.00	0.05	0.96
NDW50	-0.02	0.08	0.80

APPENDIX G

STANDARDIZED COEFFICIENTS FOR MODELS REGRESSING CHILDREN'S RESIDUALIZED PRESCHOOL VOCABULARY GAINS ON DENSITY OF SEMANTIC SUPPORTS

	VSFM/IW			NVSFM/IW			ED/IW		
	St. *β*	SE	*p*	St. *β*	SE	*p*	St. *β*	SE	*p*
Low-language									
PPVT-4	0.01	0.05	0.94	-0.02	0.04	0.64	0.06	0.04	0.16
EVT-2	-0.01	0.05	0.91	0.03	0.05	0.50	0.05	0.04	0.27
NDW50	-0.06	0.06	0.36	0.16	0.06	0.01	-0.06	0.06	0.37
Matched-language									
PPVT-4	-0.05	0.04	0.24	0.02	0.04	0.65	0.01	0.05	0.82
EVT-2	-0.06	0.05	0.22	-0.00	0.05	0.98	0.00	0.05	0.97
NDW50	0.20	0.08	0.01	-0.14	0.08	0.08	0.04	0.08	0.63

Note. VSFM/IW = Verbal Supports for Meaning Per Instructional Word; NVSFM/IW = Nonverbal Supports for Meaning Per Instructional Word; ED/IW = Extended Discourse Per Instructional Word.

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