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## THE ROLE OF KINDERGARTEN VOCABULARY KNOWLEDGE AND LANGUAGE STATUS ON EARLY READING COMPREHENSION

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THE ROLE OF KINDERGARTEN VOCABULARY KNOWLEDGE AND  
LANGUAGE STATUS ON EARLY READING COMPREHENSION

BY

JENIFFER CRUZ

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF

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**DOCTOR OF PHILOSOPHY DISSERTATION**

**OF**

**JENIFFER CRUZ**

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## **Abstract**

The purpose of this study was to investigate the impact of receptive vocabulary knowledge on first and second grade reading comprehension for 340 Kindergarten Dual Language Learners (DLLs) and monolingual students. An additional purpose of the study was to examine the effect of a Tier 2 vocabulary intervention on students' reading comprehension abilities. Linear regression analyses found statistically significant interactions between initial vocabulary knowledge and DLL status, as well as initial vocabulary knowledge and intervention treatment condition on first grade reading comprehension. Vocabulary at the end of Kindergarten and the change in vocabulary scores also significantly predicted first grade comprehension. Further, vocabulary knowledge was a significant predictor of second grade comprehension, but only when it was assessed at the end of Kindergarten. Effects of treatment condition and language status were not observed for second grade comprehension. Overall findings indicate that vocabulary makes a small, but significant contribution to reading comprehension, although its contribution varied based upon timing of vocabulary assessment. Implications for school professionals and suggestions for future research are discussed.

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## **Chapter 1**

### **Statement of the Problem**

Approximately 22% of the United States population speak a language other than English in the home (U.S. Census Bureau, 2018). Recent data finds that children learning English as a second language make up 10.1% of the public-school population (National Center for Education Statistics, 2020). Further, increasing numbers of students are entering public schools in the US with exposure to multiple languages, as well as varying levels of proficiency in the English language, the adopted language of most schools. These learners face similar, but also unique challenges compared to their English-speaking peers when it comes to academic achievement. These challenges have led to numerous questions regarding the predictors of school success, particularly in reading, for Dual Language Learners (DLLs). One area of focus for such questions is that of the influence of oral language on reading comprehension.

Reading comprehension is a process that involves the ability to decode words and understand oral language. For monolingual students it is well documented that word reading and oral language are main contributors to early and later reading comprehension (e.g., Foorman et al., 2015; Kendeou et al., 2009); but this relationship changes over time as individuals master word reading skills and texts become more complex, thus showing an increase in the role of oral language on reading comprehension (Chall, 1996; Storch & Whitehurst, 2002). Less is known, however, about the nature of this relationship for DLLs. While an abundance of literature exists regarding the relationships between oral language abilities and reading comprehension in English monolingual children, parallel

information about DLLs and their skills that predict reading comprehension is still unclear and requires further investigation (Mancilla-Martinez et al., 2020).

One notable aspect of oral language is vocabulary, which has demonstrated both direct and indirect influences on later reading comprehension (e.g., Perfetti, 2007; Perfetti & Stafura, 2014). Vocabulary is not a skill that can be mastered. Rather, it is an ever-growing knowledge base that must continue to be built upon and expanded over time. The contribution of vocabulary knowledge on reading comprehension for English monolingual children has been well supported (National Reading Panel, 2000; Oakhill & Cain, 2012); the level of vocabulary knowledge students have upon school entry can provide indicators of future literacy outcomes and broader academic success, but particularly for those students with home languages that differ from what they are likely to encounter in school. Research has shown that children who are not performing at expected levels will continue to fall substantially behind their peers (e.g., Coyne et al., 2018). As increasing evidence suggests that explicit vocabulary instruction can have positive benefits for children's vocabulary and oral language development (Wright & Cervetti, 2017), it is important to identify these students and provide them with additional instruction in this area to keep this achievement gap from widening further.

In a multi-tiered systems approach, students requiring more substantial support in one or more academic areas will be identified through a systematic screening process that can assist in differentiating instruction to allow for these students to catch up to their peers (Fien et al., 2011). Examining receptive vocabulary knowledge during screening can help inform practical decisions on the amount and type(s) of support needed to facilitate reading acquisition, determine if the need for these strategies will be different

for DLLs, and monitor student progress to examine student skill and knowledge growth. The importance of early intervention for language and literacy development for future outcomes requires that screening practices are optimal for identifying students in need of intervention and discovering what those specific needs are to address them. Given that students who enter the school setting with exposure to multiple languages may face barriers that will influence their academic trajectories (e.g., Hoff, 2013), it is imperative to question whether or not the way in which early services are allocated for these students is most beneficial to their success.

The current study investigates a sample of Kindergarten students recruited for a vocabulary intervention to examine the contributions of receptive vocabulary knowledge on reading comprehension in first and second grade. As students from differing language backgrounds have unique skills and needs, this study will also examine the role of language status on the relationship between early vocabulary and reading comprehension at school entry. In doing so, the study intends to inform educators and other school-based professionals who participate in decision making processes regarding early language and literacy instruction supports for students likely to be at risk for future reading difficulties, including DLLs.

### **Contribution of Language to Human Development**

Language is a unique system of sounds and symbols used to communicate wants and needs, convey emotions, and relay thoughts and messages to others. Learning a language follows a developmental process that begins at birth and involves the understanding and production of speech sounds that are combined to create words and sentences to convey these messages. The ecological systems theory proposes that

children gain knowledge about their world through interactions with people in their environments (Bronfenbrenner, 1979). And, research suggests that when children's environments are rich in language experiences (i.e., input), they have improved language outcomes (Zauche et al., 2016). For young children, their earliest experiences can also facilitate brain development to help create neural connections for promoting language acquisition (Yoshikawa et al., 2013). Back-and-forth language and social exchanges in early childhood can stimulate both cognitive skills, such as joint attention, and social and emotional skills necessary that can serve as protective factors for children's development while promoting their language skills (e.g., Walker et al., 2011).

### **Variability in Children's Acquisition and Exposure to Language and Vocabulary**

Language development is heavily influenced by experiences children have prior to beginning formal instruction, leading to varying levels of vocabulary knowledge when children enter the school setting (e.g., Whitehurst & Lonigan, 1998). An extensive amount of literature has supported the role of vocabulary in reading achievement, and studies have noted that variability in vocabulary has led to differential outcomes in reading and academic achievement more broadly (Cunningham & Stanovich, 1997). Variability in language can result from multiple factors, such as fewer conversational opportunities in the home and less exposure to printed text. Additional research has noted the negative impact of socioeconomic status (SES) on cognitive and physical development for children (Hojnoski & Missall, 2006; Walker et al., 2011), and SES has been linked to differences in language processing and comprehension in very young children, especially in rates of vocabulary (e.g., Fernald et al., 2013).

In an effort to investigate the effects of SES on language, Hart and Risley (1995) recorded children and their families (N = 42) from three socioeconomic strata (professional, working class, and poverty) to determine the quantity and quality of conversations taking place in their homes. They found that children from professional families had larger vocabularies compared to children from working-class homes and children living in poverty. However, they also noted variability within groups of families regarding the amount of conversations taking place between parents and children and suggested that quality of language environments are indicators of vocabulary knowledge and growth. Differences in the experiences and resources children have at home, known as home literacy environments, can also predict language and literacy outcomes (e.g., Napoli & Purpura, 2018; Puranik et al., 2018). Recently, Gilkerson and colleagues (2018) found that turn-taking in conversations for children between the ages of 18 to 24 months significantly predicted their IQ and language at 10 years old after accounting for SES, suggesting that early language experiences predict later language outcomes. Thus, children entering the school setting with limited exposure to language or weaknesses in their language abilities may struggle to perform academically.

### **Oral Language and Vocabulary Related to Early Literacy**

To be a successful reader one must acquire certain skills that facilitate the comprehension of text. Several early literacy skills, such as letter name knowledge, letter sound knowledge, and phonological awareness have been shown to demonstrate significant impacts on word reading (Grimm et al., 2018; Solari et al., 2014; Whitehurst & Lonigan, 1998; Yesil-Dagli, 2011). However, other skills are necessary to provide greater context to what is being read. The Simple View of Reading proposes that reading

comprehension is the product of word recognition and listening comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). The influence of word recognition, or decoding, is evident in the early years when children are first exposed to formal reading instruction. However, as children progress through elementary school and decoding words becomes increasingly automatic, some students continue to struggle with comprehension. Children with good word recognition skills may simultaneously demonstrate poor reading comprehension abilities due to difficulties with listening comprehension (Catts, Adlof, & Weismer, 2006).

Listening comprehension involves the understanding of oral language, a broad system consisting of syntax, morphology, narrative discourse, and vocabulary (Roth, Speece, & Cooper, 2002). Research has demonstrated that oral language makes unique, independent contributions to reading separate from word recognition abilities (e.g., Kendeou et al., 2009; Storch & Whitehurst, 2002), indicating that both sets of skills need to be fostered for successful reading comprehension. Numerous studies support the positive relationship between oral language skills and children's reading achievement (Clarke et al., 2010; Foorman et al., 2015; Hulme & Snowling, 2011; Kendeou et al., 2009; Nation et al., 2010; Spira et al., 2005). Conversely, weaknesses in oral language skills can be predictive of future academic problems (Madigan et al., 2015), and in young children can lead to poorer school readiness (e.g., Justice et al., 2009; Puranik et al., 2018). One domain of oral language that has received considerable attention regarding its impact on future literacy outcomes is vocabulary knowledge.

The National Reading Panel (2000) identified five pillars essential for reading proficiency: phonemic awareness, phonics, fluency, vocabulary, and comprehension.

Vocabulary is particularly critical in that children begin learning words and their meanings at birth and they continue to expand this knowledge throughout their lifetimes (Biemiller, 2003). Vocabulary knowledge has been shown to be a significant predictor of early and later reading comprehension (e.g., Roth, Speece, & Cooper, 2002). And, there is evidence to suggest that vocabulary influences children's acquisition of word identification skills, emphasizing its importance on reading success (e.g., Hjetland et al., 2018; Wise et al., 2007).

The relationship between vocabulary and reading comprehension has also been demonstrated in individuals learning English as a second language (e.g., Lervåg & Aukrust, 2010). For example, a recent investigation of Spanish speaking children aged 9 to 13 years old who were learning English found that subcomponents of listening comprehension (i.e., morphology, syntax, and vocabulary) each significantly contributed to reading comprehension outcomes (Gottardo et al., 2018). The influence of English vocabulary knowledge on reading comprehension has been shown in bilingual adolescents as well (van Steensel et al., 2016). Although this connection has been documented for both DLLs and non-DLLs, the timing at which these relationships begin to emerge for DLLs during reading development is still debated and needs to be explored further.

### **DLLs, Early Vocabulary, and Early Literacy**

A growing number of students in the United States are entering the school setting with exposure to, and at times, immersion in a language other than English. With public schools in the United States becoming increasingly diverse, disparities in academic trajectories are apparent between English monolingual children and children who are



learning English in addition to another language (August & Shanahan, 2006; Hoff, 2013). This group has been identified in the literature under numerous terms, including Bilinguals, Second Language Learners (L2), English Language Learners (ELLs), Language Minority (LM) learners, and Dual Language Learners (DLLs). For the purposes of this study, the term “Dual Language Learner (DLL)” will be used to describe children who speak another language other than English in the home. The expectation that the number of DLLs in the US will continue to grow emphasizes the need for research regarding appropriate supports and best practices to foster their academic success. Educators working with culturally and linguistically diverse students in their classrooms require knowledge and skills to provide appropriate instruction to support DLLs and children from lower socioeconomic backgrounds, as these children consistently enter school with smaller English vocabularies than their English monolingual and economically advantaged peers (Hoff, 2013).

Investigations into early language and literacy for English monolingual learners and DLLs reveal similarities and differences in essential reading skills. Comparisons of reading abilities have found that DLLs demonstrated similar or better word recognition skills in their non-native language compared to their monolingual peers (Babayigit, 2014; Kieffer & Vukovic, 2013; Spencer & Wagner, 2017; Verhoeven et al., 2019), but struggled with components of oral language that influenced text comprehension, including vocabulary and syntax (e.g., Gámez et al., 2019; Nakamoto et al., 2008; Raudszus et al., 2019).

Longitudinal research has revealed that DLLs exhibit slower growth rates in oral language and comprehension compared to their monolingual peers well into later

elementary school, although both groups continue to demonstrate similar word reading abilities (Nakamoto et al., 2008; Kieffer & Vukovic, 2013; Verhoeven et al., 2019). In one study, Spanish-speaking Kindergarten students exhibited growth in their receptive vocabulary skills, but they remained behind their monolingual counterparts in this domain as they progressed into second grade (Jackson et al., 2014). This disparity between DLLs and non-DLLs suggests that oral language instruction, particularly in vocabulary, may need to begin as early as Kindergarten for DLLs to reach their peers.

Similar to English monolingual children, vocabulary has been shown to predict reading comprehension for Dual Language Learners over word reading in later elementary school when the demands of text shift and readers must rely more heavily on context and prior knowledge for understanding (Cho, et al., 2019; Hoover & Gough, 1990; Lesaux et al., 2010; Proctor et al., 2005; Silverman et al., 2015). For instance, Grimm and colleagues (2018) followed Spanish-speaking children and found that English letter knowledge and vocabulary, Spanish onset, and Spanish word reading in Kindergarten predicted third grade literacy for this sample, but only English and Spanish vocabulary remained predictors of English reading development through eighth grade. However, less is known regarding the extent to which vocabulary contributes to reading comprehension for DLLs in the early grades. A recent study investigating the influence of Spanish and English receptive vocabulary for Spanish-speaking DLLs in first and third grade found that English receptive vocabulary measured in the fall did not significantly contribute to English reading comprehension assessed in the spring when also taking English word reading into account (Mancilla-Martinez et al., 2020). It is imperative to determine the nature of the relationship between vocabulary and early reading

comprehension, for DLLs in particular, to better facilitate their instruction and learning. As DLLs can display language trajectories that may lag behind their peers, it is critical to examine when these differences emerge, to help pinpoint when DLLs should receive interventions and in which areas of reading.

## **Supports for DLLs**

### ***Instruction and Intervention for DLLs in an RTI/MTSS Framework***

The enactment of the Individual with Disabilities Education Improvement Act (IDEA 2004) called for the use of evidence-based instruction for all students as well as early identification methods to prevent future reading problems, rather than waiting for struggling students to fall further behind their peers. To this end, prevention-based approaches such as Response to Intervention (RTI) or Multi-Tiered Systems of Supports (MTSS) have been implemented in an increasing number of states to address academic and behavioral difficulties before they occur and/or worsen. Inspired by a public health model, a critical assumption of RTI/MTSS is the delivery of high quality, evidence-based instruction to all students. These frameworks consist of multiple levels of increasingly intensive supports designed to meet students' varying needs. Traditionally, schools implement a system involving three tiers of support to provide instruction and intervention at the universal (all students, Tier 1), selective (at-risk students, Tier 2), and targeted (high-risk students, Tier 3) levels (Gutkin, 2012).

The National Reading Panel report (2000) emphasized explicitly teaching component skills necessary for reading, including vocabulary. The effectiveness of teaching vocabulary directly has shown improvements in students' word knowledge and comprehension (e.g., Apthorp et al., 2012; McKeown et al., 1983). Recent investigations

into the most effective methods of teaching vocabulary within an MTSS framework indicate that direct and explicit instruction in vocabulary for children in early elementary school has been related to increases in target word knowledge, as well as more distal measures of vocabulary and listening comprehension (Coyne et al., 2004; Coyne et al., 2010; Cuticelli et al., 2015). Particularly, students identified as at risk for later reading difficulties also demonstrated positive effects to more intensive vocabulary intervention (Pullen et al., 2010). However, although studies document improvements in proximal measures of vocabulary and listening comprehension that relate to target words being taught, the effect of vocabulary intervention on general measures of reading comprehension is unclear (Wright & Cervetti, 2017).

A review of literature on supporting literacy in English Language Learners suggests that explicitly teaching reading skills via high quality instruction can be beneficial, particularly in the early years (August et al., 2014), and a growing body of evidence on oral language and reading instruction suggests that it can be effective for students who are bilingual speakers as well as monolingual English speakers (e.g., Wright & Cervetti, 2017). Studies examining the effects of directly teaching oral language and vocabulary to English monolingual and bilingual students found significant positive gains for both groups (e.g., Carlo et al., 2004; Solari & Gerber, 2008). There is also evidence to suggest that differential responses to instruction may occur based upon children's early vocabulary knowledge. For example, Crevecoeur and colleagues (2014) found that English Only Learners (EOL) responded more positively to vocabulary instruction compared to English Language Learners (ELL), although the authors discovered that the instruction's effectiveness was dependent upon students' initial

vocabulary levels. This finding concluded that all students who had greater initial vocabularies demonstrated greater word learning from the same level of instruction, regardless of language status. Consequently, students with less vocabulary knowledge should be targeted immediately for instructional supports to narrow vocabulary gaps.

The intensity and frequency by which instruction occurs may have differential effects for DLLs due to their proficiencies in their native and non-native languages (e.g., Halle et al., 2012). Yet, a study examining vocabulary depth, that is, the understanding of a particular word in a given context, found that its contribution to reading comprehension was significant over and above grade level, ethnicity, and language status (Proctor et al., 2012). Thus, it is worth investigating whether the potential outcomes associated with multiple language exposure on reading comprehension can provide clarity into the precise role of language status and guide school-based professionals in choosing appropriate strategies and interventions based on level of need.

The documented influence of early language development on later literacy outcomes has highlighted the critical need for early intervention to prevent future difficulties. Without early intervention, struggling students often continue to perform poorly while their peers continue to succeed, thus resulting in a larger, and potentially growing, achievement gap (e.g., Coyne et al., 2018). As the gap continues to widen, it becomes increasingly difficult and unlikely for disadvantaged children to catch up to their peers unless instructional action is taken to ameliorate these weaknesses (Biemiller, 2003). In this regard, research suggests that direct instruction for vocabulary has more positive outcomes than incidental instruction, particularly for students who enter the school setting with more limited vocabularies (Coyne et al., 2004; Cuticelli et al., 2015).

Together, these findings suggest the need to identify students who require more direct instruction in this domain to deliver supports as early as possible.

### ***Screening and Progress Monitoring***

Effective universal instruction is a foundational component of MTSS, but this framework also relies upon accurate and efficient screening measures and procedures to identify students who may not benefit from this level of instruction alone. Such screening allows educators and other school-based professionals to target students already exhibiting difficulties or those who may be at risk for developing academic or behavioral problems, so that additional interventions to enhance their skills can be provided (Glover & Albers, 2007). These students would receive a selected intervention either inside or outside the classroom to supplement the universal instruction. If students are not making progress at adequate rates, they might then be considered to require more intensive, perhaps individualized interventions to increase their rate of learning. Since intensive supports can be costly, it is important that screening accurately identifies students in need of such supports (Sittner Bridges & Catts, 2011). Although the number of tiers can vary, progress of children at all levels would be monitored to ensure their response to instruction is taking place at an expected rate. Mancilla-Martinez and Lesaux (2017) highlight the challenges in the early identification of bilingual learners who may go on to develop reading comprehension difficulties because this population of students may not have the well-developed language skills required for successful reading. Discovering the best early predictors of reading comprehension and when these skills should be assessed will aid to determine needs of DLLs.

Although screening assessments for other skills important for reading, such as

phonemic awareness, have received considerable attention, there has been less research on measures and procedures to screen for potential vocabulary weaknesses (Loftus & Coyne, 2013). In a recent study, Edyburn and colleagues (2017) found that after phonological awareness and word reading, receptive vocabulary screened at the end of Kindergarten was strongly related with first grade reading achievement for Kindergarten DLLs. It is possible, then, that vocabulary knowledge assessed at different points in time could guide decision-making regarding when and to whom supplemental instruction should be provided.

### **Purpose of the Study**

The purpose of this study was to examine the outcomes of a vocabulary intervention provided to Kindergarten monolingual and DLL students considered to be “at risk” for early language and literacy difficulties. The study used an extant data set archived from a large multi-site intervention research project. The first aim of this study was to examine the extent to which receptive vocabulary for all Kindergarten students identified as “at-risk” is predictive of first and second grade reading comprehension. Specifically, the study attempted to determine the extent to which receptive vocabulary assessed prior to a vocabulary intervention (i.e., at screening) demonstrated a significant impact on reading comprehension weaknesses in first and second grade. Given that this sample was retrieved from a larger study designed to evaluate the efficacy of a Tier 2 vocabulary intervention, the present study will also the effects of intervention treatment condition on reading comprehension. Students who are bilingual often have underdeveloped English language abilities compared to their monolingual counterparts (e.g., Hoff, 2013), so the second aim of the study was to determine the extent to which

language status played a role in reading comprehension while considering its relationship to vocabulary. Studies have also considered that DLLs have differing levels of English oral language proficiency that may significantly impact future literacy skills (Mancilla-Martinez et al., 2014; Palacios & Kibler, 2016). Thus, identification as an English Learner (EL) was also examined for the purposes of this study.

The third aim of the study was to examine the relationship between the timing of vocabulary assessment and reading comprehension scores. That is, the study investigated if receptive vocabulary assessed immediately following the intervention, as well as the change in vocabulary scores from pre- to posttest, significantly contributed to reading comprehension in first and second grade. Given the relationship of emergent literacy skills on reading achievement, as well as the importance of decoding in early elementary school, supplemental analyses examined the potential effect of vocabulary knowledge on reading comprehension when a set of these skills (i.e., letter name knowledge, letter sound knowledge, nonword repetition) were taken into account.



## **Chapter 2**

### **Methods**

#### **Procedures**

This study examined and analyzed data collected for Project Early Vocabulary Instruction and Intervention (EVI). Project EVI was a multi-site longitudinal study designed to deliver vocabulary instruction within a multi-tiered framework to Kindergarten students. Prior to beginning data analysis approval was obtained from the Project EVI principal investigators as well as the University of Rhode Island's Institutional Review Board (IRB).

#### ***Project Early Vocabulary Instruction and Intervention (EVI)***

Project EVI was designed to evaluate the effectiveness of a Tier 2 vocabulary intervention known as the Early Vocabulary Intervention, which was developed by researchers to supplement universal vocabulary instruction for Kindergarten students (e.g., Coyne et al., 2018). The goals of Project EVI were to assess the intervention's ability to improve kindergarten students' vocabulary knowledge and listening comprehension, examine its long-term effects on future language and literacy skills, and gather information regarding potential moderating variables that could influence the intervention's efficacy. To accomplish these goals, two randomized control trials were conducted. For the initial efficacy study and follow-up replication study, schools were recruited from Connecticut, Oregon, and Rhode Island. The initial study recruited 159 kindergarten classes from 48 schools, and the replication study recruited a new cohort of kindergarten students from the same schools and classrooms as the initial study.

## **Participants**

*Teachers.* With regard to vocabulary instruction, all participating teachers implemented the Elements of Reading Vocabulary program (EOR-V, Beck & McKeown, 2004) with their students as their Tier 1 curriculum. The program consists of daily 20-minute lessons taught five days a week that include activities such as read-alouds, discussion prompts, and weekly quizzes. This vocabulary program has demonstrated effectiveness in promoting targeted vocabulary development (Apthorp et al., 2012). Teachers underwent training on implementation of the EOR-V program during a full day of professional development support. They were also observed by Project EVI researchers twice during the year to document fidelity of curriculum implementation.

Research staff initially administered the PPVT-4 as a screening measure to classify all Kindergarten students as “at-risk” or “not at-risk” for future language and reading problems. Students with standard scores between 95 and 105 (37<sup>th</sup> to 63<sup>rd</sup> percentiles, respectively) were deemed not at-risk for later language or literacy difficulties, and thus became known as the “reference” group and received only Tier 1 instruction. Students who scored between the 5<sup>th</sup> and 30<sup>th</sup> percentiles were considered “at-risk” and were eligible to receive the experimental Tier 2 intervention. Researchers created groups of 3-4 “at-risk” students matched by their initial PPVT scores within classrooms and schools. To evaluate the intervention’s effectiveness, these student groups were then randomly assigned to either the intervention group or the no-treatment control group. The EVI vocabulary intervention was delivered to students assigned to the intervention group, while the control group received Tier 1 instruction only with no additional interventions provided by the research team. The intervention included

interactive activities intended to support target word learning as well as sentence level comprehension and metalinguistic awareness instruction in multiple contexts.

Interventionists included special educators, paraprofessionals, and school-based specialists, who provided the intervention within these small groups in 30-minute sessions four days per week. Both the EOR-V program and EVI intervention were delivered over the course of approximately 22 weeks. Trained project staff administered screening, pretest, and posttest measures individually to all students. Staff were required to meet 90% reliability for the administration and scoring of these measures. Subsamples of students were followed into first and second grade to examine longitudinal impacts of the intervention.

***Students.*** Data were included from all Kindergarten students who participated in the studies as members of the intervention and control groups. Kindergarten students missing scores from the Woodcock Reading Mastery Test-Revised (WRMT-R) Passage Comprehension measure collected at the end of first grade were excluded from the study. The sample consisted of students from 20 schools across 6 districts in Connecticut and Rhode Island.

Prior to the implementation of the intervention, teachers completed an individual Student Information Form (Appendix A) to report demographic data for their students. Age of participants at time of screening ranged from 56 months to 79 months ( $M = 63.28$  months). The sample comprised of 162 females (47.6%) and 177 males (52.1%). Gender was not reported for one participant (0.3%). Regarding racial and ethnic demographics, teachers identified nearly half of the sample as Hispanic (50.6%), 108 participants as Black or African American (31.8%), and 23 participants as White (6.8%). Racial and

ethnic data for 19 students was not reported (5.6%). Additional demographic information is listed in Table 1.

**Table 1**

*Racial and Ethnic Demographics of Participants (N=340)*

Category	n	Percent
Hispanic/Latino	172	50.6
Black/African American	108	31.8
White	23	6.8
Asian	5	1.5
Multi-Racial	11	3.2
Other	2	0.6
Not reported	19	5.6

Information regarding socioeconomic status pertaining to specific students was not available; however, an examination of Specific School Profiles released by the Connecticut and Rhode Island State Departments of Education for the 2012-2013 school year reported data regarding percentage of students eligible for free and reduced-price meals within each school (Connecticut State Department of Education, 2013; Rhode Island Department of Education, 2013). According to this data, 83.5% of participants (n = 284) attended schools where 95% or more of the school’s population was eligible for this service.

Of the sample, 43 participants (11.2%) had been formally identified as eligible to receive special education services. A number of these students qualified for special education and related services under the category of Speech and Language Impairment (n = 30). To reduce the likelihood that a disability would impact results, particularly one concerning speech or language ability, all children identified eligible to receive special

education and related services were excluded from the study. In addition, two participants for whom special education status was not available were also removed from analyses.

Information was collected regarding the types of special services students received in the schools at the time of the study. There were 106 students who were identified as receiving additional services in school. Importantly, 43 students were identified as receiving Bilingual, ELL, or ESL services (12.6%). There were 57 students listed as receiving additional small group reading instruction (16.8%), however, no additional information was available regarding the type of instruction these students received or the frequency at which they received them. The final sample included 340 participants.

Regarding treatment condition for the Tier 2 vocabulary intervention, 182 participants had been randomly assigned to the intervention group (53.5%) and 158 students were assigned to the control group (46.5%). For the purposes of the current study, participant language status was determined based upon questions regarding language on the Student Information Form. Students whose teachers answered “Yes” to the question, “Does the child speak another language other than English?” were considered to have Dual Language Learner (DLL) language status ( $n = 169$ ), which comprised 49.7% of the sample. The majority of these students were noted to speak Spanish ( $n = 147$ ). Additional questions were examined to determine if decisions could be made regarding English language proficiency. Teachers identified students as having limited English proficiency or receiving ELL or ESL services in school by indicating a “Yes” response to the question, “Is this student of limited English language proficiency (i.e., LEP/ELL) as determined by your state’s language proficiency test?” or indicated

that the student was receiving Bilingual/ELL/ESOL services at school. These students were classified as English Learners (ELs) for this study ( $n = 73$ ).

## **Measures**

**Peabody Picture Vocabulary Test – 4<sup>th</sup> Edition (PPVT-4).** The PPVT-4 is a standardized receptive vocabulary measure. Students are presented with four pictures and asked to select the picture that matches a word provided by the examiner. The measure demonstrates good reliability, with reported reliability coefficients ranging from .87 to .93. The PPVT-4 was normed on individuals with English proficiency and test developers do not recommend reporting normative scores for individuals who are not English proficient (Dunn & Dunn, 2007). However, they do suggest that the measure can help design interventions for individuals with limited English proficiency as the early items consist of high-frequency words spoken in American English. Importantly, it has been supported as an adequate screener for language ability (Miles et al., 2018), as well as a screener for later reading achievement for both monolingual and bilingual students (Edyburn et al., 2017). As receptive vocabulary measures often are used as screeners for language development and in this particular case, the PPVT-4 was used to screen all Kindergarten students for the purposes of placement within a vocabulary intervention, raw scores were reported and used for data analysis in this study. This assessment was administered on five occasions throughout the course of Project EVI. The current study examined students' scores at the time of screening and immediately following the conclusion of the vocabulary intervention. Additionally, another variable was created by calculating the difference in scores between these two time points.

**Woodcock Reading Mastery Test-Revised (WRMT-R).** The WRMT-R is a standardized measure used to assess multiple domains that contribute to reading achievement (Woodcock, 1997). The Passage Comprehension subtest of the WRMT-R was administered to all students during the spring of first grade to assess their reading comprehension. It is comprised of 68 items in which students were asked to silently read sentences of increasing difficulty and choose a possible word to fill the blank within each sentence. Most items had multiple correct responses. The first 21 sentences were presented with a picture. The WRMT-R demonstrated concurrent validity with comparisons to the Woodcock-Johnson Reading Tests (WJ). The concurrent validity coefficient for the Passage Comprehension subtests from the WRMT-R and WJ for children in Grade 1 was .71. Split half reliability coefficients for the Passage Comprehension subtests for children in Grade 1 was .94. Reliability coefficients remained above .90 for all other grade levels. Raw scores were used for analyses.

To assess children's letter knowledge, the WRMT-R Supplementary Letter Checklist was administered at pre-test to all participants. The subtest is a criterion-referenced measure that assesses knowledge of letters names as well as letter sounds. It consists of two sections, 27 items that are capital letters and 36 items are lowercase letters. Trained graduate students and researchers of Project EVI presented each participant with an individual letter and asked them to identify the letter name followed by the letter sound. Raw scores for letter name and letter sound knowledge were analyzed separately for analyses.

**Comprehensive Test of Phonological Processing (CTOPP).** The CTOPP is a standardized instrument used to assess phonological processing in individuals between

the ages of 7 and 24 (Wagner et al., 1999). The assessment measures three areas of phonological processing: phonological awareness, phonological memory, and rapid naming. The Nonword Repetition subtest is designed to measure phonological memory. It contains 18 items that requires one to repeat nonwords of increasing length that are presented on an audio player. Raw scores were used for analyses. The subtest demonstrates good reliability for children ages 5 through 8 ( $r = .80$ ). This assessment exhibits good validity as well (Mitchell, 2001).

### **Research Questions, Hypotheses, and Analyses**

**The following research questions will be addressed by the current study.**

**Question 1:** To what extent do participants' language status, initial receptive vocabulary knowledge, and intervention treatment condition predict participants' reading comprehension at the end of first grade?

**Question 2:** To what extent do receptive vocabulary identified immediately following the intervention and the growth in receptive vocabulary scores predict reading comprehension at the end of first grade?

**Question 3:** To what extent do participants' language status, initial receptive vocabulary, and treatment condition in the vocabulary intervention predict participants' reading comprehension in second grade?

**Question 4:** To what extent does receptive vocabulary identified immediately following the intervention and the change in receptive vocabulary scores predict reading comprehension in second grade?



## Chapter 3

### Results

#### Preliminary Analyses

Descriptive statistics for all continuous measures, which includes Kindergarten PPVT-4 raw scores, first and second grade WRMT-R Passage Comprehension raw scores, and raw scores for additional literacy measures used as covariates are listed in Table 2. The PPVT-4 given at the beginning of Kindergarten was used for screening, so the maximum standard score students could obtain was 93 because this was the cutoff score used to designate students as at-risk for future language or literacy problems. As a result, the maximum raw score obtained was 92.

**Table 2**

*Descriptive Statistics for Continuous Measures*

Measure	n	Mean	SD	Minimum	Maximum
PPVT-4 Start of K	340	64.91	9.67	41	92
PPVT-4 End of K	338	85.94	13.65	41	122
PPVT-4 Change in Scores	338	21.00	11.93	-9	68
WRMT-R PC - 1 <sup>st</sup> grade	340	16.90	8.06	0	34
WRMT-R PC - 2 <sup>nd</sup> grade	206	23.80	7.84	1	37
CTOPP Nonword Repetition	338	6.14	3.02	0	18
WRMT-R Letter Name	338	19.52	7.79	0	29
WRMT-R Letter Sound	338	15.88	8.66	0	29

Note: PPVT-4 = Peabody Picture Vocabulary Test-4<sup>th</sup> Edition, K = Kindergarten,

WRMT-R = Woodcock Reading Mastery Test-Revised, PC = Passage Comprehension subtest, CTOPP = Comprehensive Test of Phonological Processing

Data were examined to ensure it met criteria for assumptions of normality, homoscedasticity, linearity, and multicollinearity for regression analyses. Histograms were examined to test normality of distributions. Figures 1 and 2 display the histograms

for the dependent variables WRMT-R Passage Comprehension in first grade and WRMT-R Passage Comprehension in second grade, respectively. Skewness and kurtosis values were calculated for all variables (Table 3). For first grade passage comprehension scores, a negative kurtosis value was found (-.862). Passage comprehension scores in second grade are negatively skewed, indicating that many scores fall in the higher range (-.842). Nevertheless, values for all main study variables are generally between -1.0 and 1.0 and are considered acceptable for analysis (Harlow, 2014). Normal probability plots also were examined to test the assumption of normality; plots did indicate skewness, but no severe deviations were identified. Additionally, residual statistics that were calculated for each model found that Cook's distance values were all below 1, indicating no extreme outliers that would be cause for concern.

Figure 1. Distribution of Scores for WRMT-R Passage Comprehension in 1<sup>st</sup> Grade

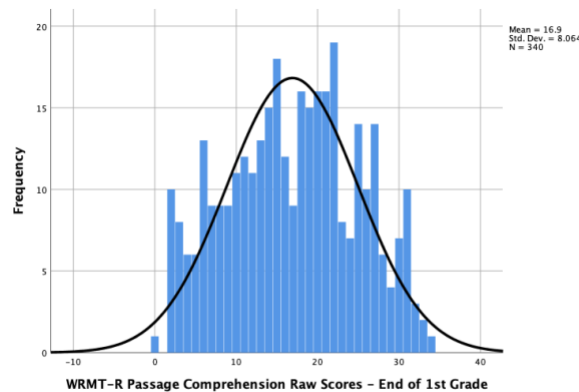
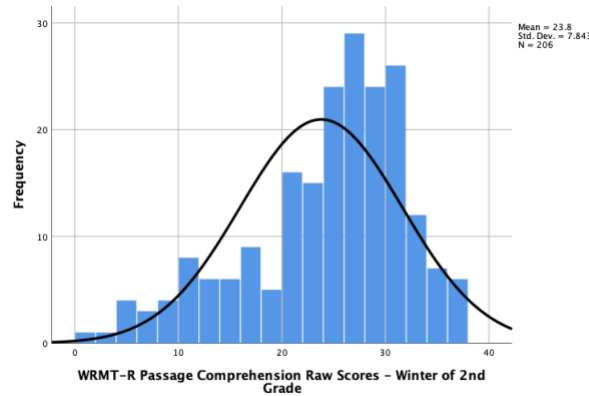


Figure 2. Distribution of Scores for WRMT-R Passage Comprehension in 2<sup>nd</sup> Grade



**Table 3**

*Skewness and Kurtosis Values for Continuous Variables*

<i>Measure</i>	<i>Skewness</i>	<i>Standard Error</i>	<i>Kurtosis</i>	<i>Standard Error</i>
PPVT-4 Start of K	.107	.132	-.332	.264
PPVT-4 End of K	-.100	.133	.065	.265
PPVT-4 Change	.204	.133	.140	.265
WRMT-R PC – 1 <sup>st</sup> grade	-.039	.132	-.862	.264
WRMT-R PC – 2 <sup>nd</sup> grade	-.842	.169	.177	.337
CTOPP	.428	.133	.060	.265
WRMT-R Letter Name	-.811	.133	-.595	.265
WRMT-R Letter Sound	-.271	.133	-1.172	.265

Scatterplots of residuals and predicted values were graphed to test the assumption of homoscedasticity. Plots examining residuals and predicted values for all models indicate that observations are mostly randomly distributed. To address multicollinearity, bivariate correlations were run to examine relationships between independent variables (Table 4). Unsurprisingly, reading comprehension in first grade as measured by the WRMT-R Passage Comprehension subtest was positively correlated with reading comprehension in second grade ( $r(205) = .81, p < .001$ ). Additionally, letter name and letter sound knowledge were also highly positively correlated ( $r(337) = .85, p < .001$ ).

Correlations above .90 are typically considered highly correlated and may require one to consider removing a variable or combining variables, although correlations above .70 may also warrant investigation (e.g., Harlow, 2014). However, these measures are not part of the main research questions, and it is worth identifying if these skills alter the influence of main predictors on reading comprehension when taken into account. Generally, all other correlation coefficient values were acceptable, with the highest coefficient at .58.

**Table 4***Correlation Analyses for All Measures*

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Age in Months	-											
2. Treatment Condition	.05	-										
3. DLL Status	.09	-.10	-									
4. EL Status	.13*	.01	.53***	-								
5. PPVT-4 Beginning of K	.53***	-.00	-.02	-.05	-							
6. PPVT-4 End of K	.24***	-.01	-.02	-.10	.52***	-						
7. PPVT Change in Scores	-.15**	-.01	-.01	-.07	-.22***	.72***	-					
8. WRMT-R PC 1 <sup>st</sup>	.02	.08	.04	.06	.21***	.26***	.14*	-				
9. WRMT-R PC 2 <sup>nd</sup>	.05	.06	-.02	-.01	.13	.23**	.16*	.81***	-			
10. CTOPP Nonword Repetition	.08	-.02	-.06	-.10	.21***	.15**	.00	.23***	.12	-		
11. WRMT-R Letter Name	.09	.06	.00	.05	.17**	.18**	.07	.55***	.58***	.24***	-	
12. WRMT-R Letter Sound	.12*	.10	.02	.07	.15**	.16**	.06	.52***	.50***	.24***	.85***	-

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

## **Main Analyses**

Linear regression analyses were conducted to examine the relationships between the vocabulary intervention treatment condition, DLL status, EL status, and student vocabulary knowledge. Separate analyses were used to examine the potential differences in relationships depending upon the time point at which the PPVT-4 was administered; specifically, the study examined PPVT-4 raw scores at the beginning of Kindergarten and the end of Kindergarten, and the change in scores between these two time points. The change in vocabulary scores was calculated by subtracting raw PPVT-4 scores at the start of Kindergarten from the scores earned at the end of Kindergarten.

For each regression equation, the independent variables (i.e., treatment condition, EL status, DLL Status, and PPVT-4) as well as their interaction terms were entered simultaneously. EL status was subsumed under DLL status; that is, any student with EL was also considered DLL for regression analyses. This was done to determine if exposure to another language in the home impacted reading comprehension scores (i.e., DLL vs. monolingual) or if having limited English proficiency influenced future comprehension (i.e., EL vs. not EL). Therefore, interaction terms between DLL status and EL status were omitted from all models. The study tested two 3-way interactions (treatment condition x DLL Status x PPVT-4 score, treatment condition x EL Status x PPVT-4 score), five 2-way interactions (treatment condition x EL status, treatment condition x DLL Status, treatment condition x PPVT-4 score, EL status x PPVT-4 score, DLL Status x PPVT-4 score), and the four main independent variables. Additionally, age in months was included in each iteration of the models to account for participants' age at the time of screening. To determine best fit of the regression model, beginning with the highest-level

interaction term, each nonsignificant interaction term with a p-value greater than 0.10 was removed from the regression model.

To account for possible effect of school clustering, linear mixed models were considered. Linear models with and without the random intercept were conducted and covariance parameter estimates were significant for first grade reading comprehension, indicating a significant dependency of schools (Appendix B). However, parameter estimates of the fixed effect results from the linear mixed models do not alter model conclusions from original linear regression models. As a result, the linear models without the random intercept were interpreted for this study.

### **Research Questions 1 and 2**

The first three models address the first and second research questions regarding the extent to which language status, treatment condition, and vocabulary at multiple time points predict first grade reading comprehension.

***Model 1.*** The first regression model was carried out to investigate whether vocabulary knowledge measured at the beginning of Kindergarten, that is, at time of initial screening, is predictive of first grade reading comprehension. The final model that fit the data included all independent variables and two interaction terms with p-values less than 0.10 (Table 5). Results revealed a significant relationship between the model and the dependent variable,  $F(7, 325) = 4.4469$ ,  $p < .001$ ,  $R^2 = .088$ . The  $R^2$  value provides the amount of variance in first grade reading comprehension accounted for by this set of variables. The  $R^2$  value for this model has a small to medium shared variance effect size and indicated that this model explained 8.8% of the variance in reading comprehension (Cohen, 1992). After adjustment for student age, the significant

interaction terms suggest that the effects of treatment condition and language status on first grade reading comprehension were dependent upon initial vocabulary knowledge. Age in months was a significant negative predictor of reading comprehension ( $B = -256$ ,  $p = .022$ ); that is, older children tended to score lower on the reading comprehension measure compared to younger children. EL status was not a significant predictor of comprehension. Further analyses were conducted to understand the effects of these interactions.



**Table 5***Linear Regression Analyses of Predictors of Passage Comprehension in 1<sup>st</sup> Grade*

Model	Predictor	B	SE	$\beta$	p	R <sub>2</sub>	Adj. R <sub>2</sub>	F	p
<b>1</b>						.088	.068	4.469	.000***
	Age in Months	-.256	.111	-.147	.022**				
	PPVT-4 Start of Kindergarten	.421	.087	.496	.000***				
	DLL Status	12.662	6.010	.784	.036**				
	EL status	1.425	1.230	.073	.248				
	Treatment Condition	12.814	5.954	.792	.032**				
	Treatment Condition x PPVT	-.175	.091	-.713	.056*				
<b>2</b>	DLL Status x PPVT	-.191	.091	-.781	.037**				
						.093	.079	6.671	.000***
	Age in Months	-.123	.096	-.070	.202				
	PPVT-4 End of Kindergarten	.178	.033	.297	.000***				
	DLL Status	.024	1.011	.001	.981				
	EL status	1.845	1.227	.094	.134				
<b>3</b>	Treatment Condition	1.484	.864	.092	.087				
						.034	.019	2.311	.044**
	Age in Months	.047	.097	.027	.627				
	PPVT-4 Change in Scores	.104	.037	.154	.006**				
	DLL Status	.163	1.043	.010	.876				
EL status	1.223	1.258	.063	.332					
Treatment Condition	1.378	.892	.085	.123					

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$

Interpretation of the meaning of the two significant interaction terms, DLL Status x PPVT-4 score and Treatment Condition x PPVT-4 score was aided by examination of the results of interaction probing analyses. For each interaction term, interaction probing analysis examined the conditional effects of the predictor across a range of values of the moderating variable using simple slopes and Johnson-Neyman regions of significance analyses. In simple slopes analysis, conditional effects of the predictor (second column) are shown at three values of the moderating variable: the moderator mean, and 1 SD above and 1 SD below the moderator mean. Johnson-Neyman analyses provide estimates of the conditional effects of the predictor across all observed values of the moderator.

The simple slopes conditional effects for the interaction between DLL Status and PPVT-4 score are listed in Table 6. The simple slopes results show that the conditional effect of DLL status on reading comprehension varied from positive to negative as the value of the moderator PPVT-4 increased for -1 SD to + 1 SD above the mean, but DLL status was not a statistically significant predictor of reading comprehension for any of these moderator values because all confidence intervals include zero. The Johnson-Neyman results, however, revealed that DLL status is a significant positive predictor of reading comprehension only when PPVT-4 scores are very low, that is, more than 2 SD below the mean (43.9 or lower). In this sample, only 1.5% of participants (n=5) scored at or below this value. For example, the Johnson-Neyman conditional results for students with a PPVT-4 score of 43.6, found that being a Dual Language Learner is associated with a 4.3-point increase in reading comprehension score (95% CI .010, 8.66). This suggests that DLL status is a significant positive predictor of reading comprehension only for students with very low PPVT-4 scores.

**Table 6**

Simple Slope Analysis Conditional Effects for DLL Status x PPVT-4

	Moderator: PPVT-4	Effect	SE	T	P	LLCI	ULCI
- 1 SD	55.116	2.121	1.351	1.570	.117	-.536	4.779
M	64.652	.298	1.012	.294	.769	-1.692	2.288
+ 1 SD	74.188	-1.526	1.317	-1.159	.248	-4.118	1.066

Another interaction term, treatment condition x PPVT-4 score was also significant ( $B = -.175, p = .056$ ). Table 7 shows the conditional effects of the simple slopes analysis with PPVT-4 scores at the beginning of Kindergarten as the moderator. Similar to the previous interaction, the simple slopes results show that the conditional effects of treatment condition on reading comprehension varied from positive to negative as the value of the moderator PPVT-4 increased for -1 SD to + 1 SD above the mean. For participants who scored 1 SD below the mean on the PPVT-4 at the beginning of Kindergarten (first row), the effect of treatment was significant. Specifically, for those who scored 1 SD below the mean of PPVT-4, the treatment group scored 3.19 points higher in reading comprehension compared to students in the control group. The Johnson-Neyman analyses revealed that for approximately 45% of the study sample, those who scored 2 points or more below the mean, the treatment intervention was associated with a small but significant increase in reading comprehension. However, for participants who scored at or above the mean, treatment was not significant, as shown by the confidence intervals which contain zero. In other words, participating in the vocabulary intervention led to a slight increase in reading comprehension for almost half of the students who initially were below the mean vocabulary knowledge as measured by PPVT-4.

**Table 7**

Simple Slope Analysis Conditional Effects for Treatment Condition x PPVT-4

	Moderator: PPVT-4	Effect	SE	T	P	LLCI	ULCI
- 1 SD	55.116	3.190	1.226	2.602	.009	.779	5.602
M	64.652	1.525	.866	1.761	.079	-.178	3.228
+ 1 SD	74.188	-.140	1.228	-.114	.909	-2.556	2.275

**Model 2.** The second model included age in months, treatment condition, DLL status, and EL status as predictors, but included vocabulary at the end of Kindergarten to investigate the relationship of vocabulary to first grade reading comprehension. When fitting the model, no significant interactions were found. Final model results revealed a significant relationship between the model and the dependent variable, and the model accounted for 9.3% of the variance,  $F(5, 325) = 6.671$ ,  $p < .001$ ,  $R^2 = .093$ . To understand the significance of each predictor variable on the dependent variable, the unstandardized coefficient ( $B$ ) explains how much change is expected for the dependent variable for every one-unit change in the predictor variable (Harlow, 2014). After examining individual variables, vocabulary was the only significant predictor of first grade reading comprehension. For each single unit increase in vocabulary, an increase in .17-points for reading comprehension is expected ( $B = .178$ ,  $p < .001$ ). These results indicate that initial vocabulary knowledge is significantly positively related to the outcome, whereas DLL status, EL status, and treatment condition were not.

**Model 3.** To examine the effect of change in vocabulary scores, a new variable, “PPVT change,” was created by subtracting PPVT-4 scores at the start of Kindergarten from PPVT-4 scores at the end of Kindergarten and was included in the following model. No interaction terms were found to be significant. The model that best fit the data only

included main effects, and was significant,  $F(5, 325) = 2.311$ ,  $p = .044$ ,  $R^2 = .034$ . The overall model had a small effect size. These results indicate that change in vocabulary scores had a small but significant effect on first grade reading comprehension ( $B = .104$ ,  $p = .006$ ).

To summarize the analysis for questions 1 and 2, the results indicate the following. The first research question examined the contributions of initial vocabulary knowledge, language status, and treatment condition on first grade reading comprehension. Regression analyses found two significant interactions, indicating the role of initial vocabulary moderated the effects of treatment condition and DLL status. Closer examination of these terms found that for the interaction between initial vocabulary knowledge and DLL status, DLLs showed slightly better scores in reading comprehension over non-DLLs, however this was true only for the few participants who had very low PPVT-4 scores. For the interaction between initial vocabulary knowledge and treatment condition, participating in the Tier 2 vocabulary intervention led to an increase in reading comprehension scores for nearly half of the sample; those students with initial vocabulary scores below the mean. Additionally, vocabulary knowledge at the end of Kindergarten as well as the growth in scores over the course of the year were significant predictors of first grade reading comprehension. There was no significant influence on reading comprehension based upon treatment or DLL or EL status.

The second research question investigated the role of end-of-year vocabulary and the change in vocabulary over the course of the year, as seen in Models 2 and 3, respectively. No significant interaction terms were found in either model. In both models, vocabulary at the end of Kindergarten and growth in vocabulary scores were significantly

related to first grade reading comprehension. There were no differences seen in reading comprehension between participants who were DLL and non-DLL, as well those in either the treatment or control group, as these terms were not significant.

### **Research Questions 3 and 4**

To answer the third and fourth research questions, the next three models examine the relationships between vocabulary knowledge, language status, and treatment condition on reading comprehension in second grade. A subsample of 206 participants were assessed during the winter of second grade on several measures, including reading comprehension. The following regression models follow the same procedures as those conducted for analyses when first grade comprehension was the dependent variable.

***Model 4.*** This model explored the effects of vocabulary at the beginning of Kindergarten on second grade reading comprehension. When examining the impact of vocabulary, treatment condition, DLL status, and EL status, results for this model was not significant,  $F(5, 193) = .758, p = .581$  (Table 8). This finding indicates that this set of variables did not significantly contribute to reading comprehension in second grade.

***Model 5.*** The following model examined the relationship between vocabulary assessed at the end of Kindergarten on second grade reading comprehension, along with the other main predictors. Unlike the previous model, results show the current model significantly predicts the dependent variable, although it only accounted for 6.7% of the variance,  $F(5, 192) = 2.751, p = .020, R^2 = .067$ . There were no significant interaction terms; however, vocabulary knowledge did significantly predict reading comprehension in second grade ( $B = .151, p < .001$ ). The results showed that end-of-Kindergarten vocabulary is significantly associated with second grade reading comprehension, and a

.15-point increase in reading comprehension is expected with every one-point increase in vocabulary assessed at the end of Kindergarten.

**Model 6.** The following model investigated the change in vocabulary scores from the beginning to the end of Kindergarten. As with all previous models, this model also included EL status, DLL status, and treatment condition. Regression analyses showed that the model was not significant,  $F(5, 192) = 1.748, p = .126$ . This indicates that the change in vocabulary scores does not significantly predict reading comprehension in second grade.

**Table 8***Linear Regression Analyses of Predictors of Passage Comprehension in 2<sup>nd</sup> Grade*

Model	Predictor	B	SE	$\beta$	p	R <sub>2</sub>	Adj. R <sub>2</sub>	F	p
<b>4</b>	Age in Months	-.061	.156	-.034	.697	.019	-.006	.758	.581
	PPVT-4 Start of Kindergarten	.121	.075	.143	.108				
	DLL Status	-.196	1.363	-.012	.886				
	EL status	.364	1.553	.020	.815				
	Treatment Condition	.931	1.155	.059	.421				
<b>5</b>	Age in Months	-.018	.129	-.010	.889	.067	.043	2.751	.020**
	PPVT-4 End of Kindergarten	.151	.043	.259	.000***				
	DLL Status	-.355	1.335	-.022	.791				
	EL status	.883	1.513	.050	.560				
	Treatment Condition	1.116	1.132	.070	.326				
<b>6</b>	Age in Months	.152	.128	.086	.238	.044	.019	1.748	.126
	PPVT-4 Change in Scores	.128	.047	.199	.007				
	DLL Status	-.333	1.352	-.021	.806				
	EL status	.117	1.508	.010	.907				
	Treatment Condition	1.026	1.146	.065	.372				

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$



In sum, the third research question investigated the roles of vocabulary at the start of Kindergarten, treatment condition, and language status on reading comprehension in second grade; results indicate that the independent variables were unable to predict reading comprehension. To address the fourth research question, when investigating the roles of vocabulary, treatment condition, and language status on reading comprehension in second grade, only the model that included vocabulary assessed at the end of Kindergarten was significant. Further, vocabulary was the sole predictor significantly associated with the outcome variable in this model. Similar to results for first grade, DLL status, EL status, and treatment condition did not independently predict second grade comprehension. These models' findings suggest initial vocabulary and change in vocabulary were not significantly related to comprehension, but vocabulary at the end of the year was significant.

### **Supplementary Analyses**

The following six models (i.e., Models 7 through 12) investigated whether vocabulary, language status, and treatment condition were predictors of reading comprehension while also taking additional literacy measures into account. That is, the previous six models were analyzed again but included nonword repetition, letter name knowledge, and letter sound knowledge as covariates. The next three models (Models 7 – 9) examine the variables on first grade reading comprehension, while the last three models (Models 10 – 12) investigate these relationships for second grade reading comprehension.

**Model 7.** This model examined vocabulary scores at the beginning of Kindergarten on first grade reading comprehension while taking into account other early

literacy measures (i.e., letter name, letter sound, and nonword repetition). Results revealed the model was significantly predictive of the dependent variable,  $F(10, 320) = 17.306, p < .001$  (see Table 9). The addition of these three variables shows that the model accounts for 35.1% of the variance in reading comprehension, which is nearly four times more than what was accounted for by the earlier model that did not include the additional literacy measures (i.e., Model 1). No interaction terms were statistically significant in the model. However, several individual terms were significant, including vocabulary, age in months, letter name knowledge, and letter sound knowledge. With each point change in vocabulary, an approximately .21-point increase in reading comprehension is expected ( $B = .211, p = .006$ ). For every additional month in age, there is an expected .26-point decrease in first grade reading comprehension, suggesting that older children in Kindergarten demonstrate poorer performance on reading comprehension compared to younger children.

**Model 8.** End of Kindergarten vocabulary, DLL status, EL status, and treatment condition were included in this model along with additional literacy skills to examine their relationships to first grade reading comprehension. The model was a significant predictor of the dependent variable,  $F(8, 320) = 22.866, p < .001, R^2 = .364$ . When adding three literacy variables as covariates, the model accounts for approximately four times more of the variance than the model without them. Vocabulary at the end of Kindergarten was a significant predictor ( $B = .116, p < .001$ ). Age in months, nonword repetition, letter name and letter sound knowledge significantly predicted reading comprehension. Letter name knowledge had the largest unstandardized coefficient, which

indicates that every one-point increase on this measure showed an approximate 1/3rd-point increase in reading comprehension ( $B = .345$ ,  $p < .001$ ).

**Table 9** – *Linear Regression Analyses of Predictors of Passage Comprehension in 1<sup>st</sup> Grade with Covariates*

Model	Predictor	B	SE	$\beta$	p	R <sub>2</sub>	Adj. R <sub>2</sub>	F	Sig
<b>7</b>						.351	.331	17.306	.000***
	Age in Months	-.267	.094	-.154	.005***				
	PPVT-4 Start of Kindergarten	.211	.076	.250	.006***				
	DLL Status	4.736	5.158	.294	.359				
	EL status	1.019	1.047	.052	.331				
	Treatment Condition	4.619	5.111	.286	.367				
	Treatment Condition x PPVT	-.059	.078	-.243	.448				
	DLL Status x PPVT	-.066	.078	-.271	.400				
	CTOPP Nonword Repetition	.239	.127	.090	.061*				
	WRMT-R Letter Name	.337	.090	.328	.000***				
WRMT-R Letter Sound	.181	.081	.195	.026*					
<b>8</b>						.364	.348	22.866	.000***
	Age in Months	-.190	.081	-.109	.020**				
	PPVT-4 End of Kindergarten	.116	.028	.194	.000***				
	DLL Status	.229	.853	.014	.788				
	EL status	1.294	1.040	.067	.214				
	Treatment Condition	.807	.733	.050	.272				
	CTOPP Nonword Repetition	.266	.125	.100	.034**				
	WRMT-R Letter Name	.345	.089	.335	.000***				
WRMT-R Letter Sound	.172	.080	.184	.034**					
<b>9</b>						.341	.324	20.675	.000***
	Age in Months	-.085	.081	-.049	.300				
	PPVT-4 Change in Scores	.071	.031	.106	.023**				
	DLL Status	.329	.868	.020	.705				
	EL status	.914	1.053	.047	.386				
	Treatment Condition	.727	.746	.045	.331				
	CTOPP Nonword Repetition	.313	.126	.118	.014**				
	WRMT-R Letter Name	.365	.090	.355	.000***				
	WRMT-R Letter Sound	.170	.082	.183	.038**				

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$

**Model 9.** In addition to the change in vocabulary scores, three additional literacy measures were added to determine if controlling for these skills influences the overall impact of the model on first grade reading comprehension. Similar to the model without these measures, this model significantly predicted the dependent variable,  $F(8, 320) = 20.675$ ,  $p < .001$ ,  $R^2 = .341$ . It is noteworthy that this model accounts approximately 34% of the variance, whereas the previous model only accounted for approximately 3% of the variance. The change in vocabulary scores remained a significant predictor ( $B = .071$ ,  $p = .023$ ). The three additional measures were also significant contributors to first grade reading comprehension.

**Model 10.** This regression model investigates the relationship between vocabulary assessed at the beginning of Kindergarten as well as the covariates letter name knowledge, letter sound knowledge, and nonword repetition on second grade reading comprehension. Contrary to the previous model, the regression model is significant,  $F(8, 188) = 13.026$ ,  $p < .001$ ,  $R^2 = .357$ . There were no significant interaction terms found. Additionally, the only variable that significantly contributed to reading comprehension was Kindergarten letter name knowledge ( $B = .614$ ,  $p < .001$ ), suggesting that initial vocabulary does not significantly predict reading comprehension in second grade, but knowledge of letter names does.

**Model 11.** Three additional variables are included in this model to control for early literacy skills while investigating the role of vocabulary assessed at the end of Kindergarten. The current model is significant,  $F(8, 187) = 13.795$ ,  $p < .001$ , and accounted for 37.1% of the variance. Vocabulary assessed at the end of Kindergarten continued to significantly contribute to second grade comprehension even when taking

other early literacy skills into account ( $B = .089$ ,  $p = .014$ ), although it had a smaller impact compared to letter name knowledge, which was also a significant predictor ( $B = .602$ ,  $p < .001$ ).

**Model 12.** This final model included the change in vocabulary scores as well as three additional early literacy measures. The model was significant,  $F(8, 187) = 13.281$ ,  $p < .001$ ,  $R^2 = .362$ . Of the predictors added, letter name knowledge was the only significant predictor while change in vocabulary approached significance. A one-point change in letter name knowledge resulted over half of a point change in reading comprehension ( $B = .609$ ,  $p < .001$ ), while this same change in vocabulary resulted in only a .07-point change ( $B = .073$ ,  $p = .064$ ). This suggests that when taking other early literacy skills into account, the contribution of the change in vocabulary scores becomes less important. Letter name knowledge was a significant predictor of second grade comprehension when the models included vocabulary at the end of kindergarten and the change in vocabulary scores, but not when it included initial vocabulary.

Supplementary analyses investigated the relationships between vocabulary knowledge, language status, and treatment condition on reading comprehension while taking additional literacy variables into account. Regression analyses were conducted on previous models with the addition of letter name knowledge, letter sound knowledge, and nonword repetition, and found that all models for first and second grade were significant. When including these additional covariates, the variance accounted for the models increased substantially, with large effect sizes. Initial vocabulary, end of Kindergarten vocabulary, and vocabulary change all were significantly related to first grade reading comprehension, suggesting that vocabulary continues to play a role in reading

comprehension in first grade when additional literacy variables are included. For second grade comprehension, regression analyses indicated initial vocabulary and change in vocabulary were not significant predictors, and the only variable significantly related to the outcome variable was letter name knowledge. However, vocabulary at the end of Kindergarten continued to make a significant contribution to reading comprehension, although this contribution was relatively small. Supplementary analyses did not find significant relationships for treatment condition or language status on reading comprehension in any models.

**Table 10***Linear Regression Analyses of Predictors of Passage Comprehension in 2<sup>nd</sup> Grade with Covariates*

Model	Predictor	B	SE	$\beta$	p	R <sub>2</sub>	Adj. R <sub>2</sub>	F	Sig.
<b>10</b>						.357	.329	13.026	.000***
	Age in Months	.010	.128	.006	.936				
	PPVT-4 Start of Kindergarten	.077	.062	.091	.215				
	DLL Status	.716	1.121	.045	.524				
	EL status	-1.208	1.279	-.069	.346				
	Treatment Condition	.455	.958	.029	.636				
	CTOPP Nonword Repetition	.132	.153	.053	.387				
	WRMT-R Letter Name	.614	.120	.582	.000***				
WRMT-R Letter Sound	.000	.106	.000	.998					
<b>11</b>						.371	.344	13.795	.000***
	Age in Months	.041	.107	.023	.703				
	PPVT-4 End of Kindergarten	.089	.036	.153	.014**				
	DLL Status	.547	1.115	.035	.624				
	EL status	-.835	1.273	-.047	.513				
	Treatment Condition	.596	.952	.038	.532				
	CTOPP Nonword Repetition	.139	.149	.055	.354				
	WRMT-R Letter Name	.602	.119	.571	.000***				
WRMT-R Letter Sound	-.012	.105	-.013	.907					
<b>12</b>						.362	.335	13.281	.000***
	Age in Months	.138	.106	.079	.193				
	PPVT-4 Change in Scores	.073	.039	.113	.064*				
	DLL Status	.596	1.123	.038	.596				
	EL status	-1.257	1.259	-.071	.320				
	Treatment Condition	.545	.958	.035	.570				
	CTOPP Nonword Repetition	.174	.150	.069	.248				
	WRMT-R Letter Name	.609	.120	.576	.000***				
WRMT-R Letter Sound	-.012	.106	-.012	.913					

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$



## **Chapter 4**

### **Discussion**

The primary aim of this study was to examine the contributions of receptive vocabulary knowledge to the reading comprehension of at-risk Kindergarten English monolingual and DLL students. Of particular interest was how vocabulary at different points in time predicted first and second grade reading comprehension, and whether DLL or EL status and participation in a Tier 2 vocabulary intervention also significantly contributed to reading comprehension. Also examined were the possible interactions between each of these variables. This section is organized in the following way. First, results are presented and compared to previous literature. Second, limitations of the study are provided. Finally, implications for practice and future directions are discussed.

To address the first research question, linear regression analyses examined the contributions of initial vocabulary knowledge, language status, and treatment condition on first grade reading comprehension. Significant interactions were found between vocabulary knowledge and treatment condition, as well as vocabulary knowledge with DLL status; that is to say that the effects of the vocabulary intervention and DLL status were moderated by initial vocabulary knowledge. Further exploration of these interactions, however, revealed that identification as DLL was only influential on reading comprehension outcomes when students had very low PPVT-4 scores. Given that only 1.5% of participants performed in this very low range, it can be surmised that DLL status was not predictive of later comprehension for the study participants.

With regard to the interaction between vocabulary knowledge and treatment condition, vocabulary intervention effects on first grade reading comprehension were

only evident for those with lower initial vocabulary knowledge. Moreover, participating in the vocabulary intervention did not result in independent contributions to first or second grade reading comprehension. These results are somewhat consistent with other studies investigating the effects of vocabulary instruction and finding little impact on distal measures of reading comprehension (Apthorp et al., 2012). This result may be attributed to the nature of the intervention included in the present study, which explicitly taught target words that were not embedded with the passage comprehension outcome measure. Reviews of previous vocabulary intervention studies that examined comprehension did not demonstrate improvements in text comprehension if the outcome measure did not include targeted vocabulary words (e.g., Wright & Cervetti, 2017). Nevertheless, the finding that treatment condition had a small increase in students' first grade reading comprehension if they had lower levels of vocabulary knowledge shows some promise for improving comprehension through vocabulary intervention for students who require additional vocabulary support.

Regression analyses results concerning the second research question found that models including post-intervention vocabulary and change in vocabulary scores were also significantly related to first grade reading comprehension, although effect sizes were somewhat small, especially for the model including change in vocabulary scores. However, vocabulary significantly contributed to first grade reading comprehension in both models, underscoring the importance of vocabulary as an aspect of reading skill. This finding was expected as it is similar to the results of previous research demonstrating that vocabulary was a contributor to English reading comprehension for DLLs and non-DLLs (e.g., Gottardo et al., 2018).

The third and fourth research questions examined vocabulary, treatment condition, and language status on second grade comprehension. Compared to the results for first grade reading comprehension, only end of Kindergarten vocabulary was a significant predictor for second grade comprehension. Additionally, the model accounted for a small to moderate amount of variance. One possible explanation for these findings is the pattern seen in reading development of early readers. Students in these grade levels are learning to decode word, and decoding skill often adds greater variance to reading comprehension than oral language at this point in reading skill development (e.g., Mancilla-Martinez et al., 2020). The significance of vocabulary at the end of Kindergarten for both first and second grade comprehension does offer insight regarding when students should be screened and monitored for progress.

Interestingly, DLL status and EL status did not significantly predict comprehension in most models, suggesting that pre- and post-intervention receptive vocabulary knowledge proved to be important for later reading ability regardless of whether or not children had been identified as DLL or EL. This finding is surprising given that differences in language and reading comprehension are present between monolingual and bilingual children (e.g., Babayiğit, 2014; Gámez et al., 2019). However, the current result is comparable to one found by Proctor and colleagues (2012), who found that individual participant factors, including language status, were not significant to reading comprehension when taking other language and literacy variables into account. Together, these findings indicate that being labeled as DLL, that is, being exposed to a language other than English in the home, is not as meaningful for reading achievement as is the specific cognitive and linguistic strengths and weaknesses a child possesses.

Overall findings suggest that language status is less predictive of reading comprehension when students have similar levels of vocabulary knowledge, and it is this level of vocabulary that most likely determines their response to intervention.

Supplemental analyses examined whether the addition of early literacy skills associated with reading achievement would influence the contribution of vocabulary knowledge on first and second grade reading comprehension. Regarding the contributions of other early literacy skills, results showed overall model  $R^2$  values increased substantially for first and second grade comprehension. That is, letter name and letter sound knowledge and nonword repetition significantly predicted first and second grade reading comprehension. Specifically, letter name knowledge accounted for a significant portion of the variance for reading comprehension. These results support previous research that highlight the influence of skills related to decoding, such as phonological awareness, on reading comprehension in the early grades (e.g., Edyburn et al., 2017). These findings are similar to Grimm and colleagues (2018), who found English letter name and sound knowledge as well as receptive vocabulary in Kindergarten predicted literacy in third grade. Vocabulary remained significant when the models accounted for these skills, although its contribution was smaller compared to letter name knowledge. Evidence has linked vocabulary knowledge to improvements in phonological skills, as learning new vocabulary words can help reinforce phonological representations that will aid in children's decoding abilities (e.g., Metsala et al., 2009). It is possible that the relationship between vocabulary and these early reading skills may have impacted results, suggesting that greater vocabulary knowledge can indirectly support reading comprehension via other critical reading skills (i.e., phonological awareness, phoneme-

grapheme correspondence, visual orthographic memory). Results of the current study suggest that vocabulary is needed for reading comprehension but is likely not sufficient for predicting and explaining developmental contributions to overall reading achievement.

### **Limitations**

Several limitations may have influenced the results of the present study. One limitation concerns the method by which participant language status was defined. Language status was reported by the students' teachers via a student information form. Identifying students as DLLs from one question regarding multiple language exposure can lead to incorrectly placing students with varying abilities in one group to receive similar levels of instruction. Follow-up ANOVA tests comparing DLL, EL, and English monolingual learners on all continuous measures found no significant differences between these groups. Ideally, one would want more information to determine the amount of children's home language exposure and other factors within the home environment that would assist in determining the skills children have as they enter the school setting and how these factors might influence future academic outcomes.

Additionally, several participants were receiving educational services related to the language and literacy development supplemental to the Tier 1 and 2 vocabulary instruction provided through Project EVI. For instance, almost all of the participants identified as EL were receiving ELL/ESL services in school and other participants received Tier 2 reading supports during the course of the initial efficacy and replication studies. Although specific information regarding these services was not available, these additional supports intended to foster their English language and reading development

and could have promoted student growth in these areas (Palacios & Kibler, 2016), and closed the gap between any observed differences when reading comprehension was assessed. These reasons may explain the lack of observed differences seen between bilingual and monolingual children in the current study.

Another limitation involves the lack of specific available information regarding socioeconomic status (SES) of individual participants. Rather, school data regarding the percentage of students eligible for free and reduced lunch provided a snapshot of school SES. A body of literature supports the influence of socioeconomic status on language and literacy development for young children especially within the vocabulary domain (e.g., Hart & Risley, 1995), including various components of SES that have particular importance for language and literacy outcomes, such as parental education (e.g., Huttenlocher et al., 2010). Given the influence of SES on achievement, future studies with DLLs should consider including this factor to examine its mediating or moderating effects on comprehension.

Vocabulary demonstrated a significant relationship with reading comprehension in this study. Although this study accounted for literacy skills that are helpful for early reading ability, the inclusion of other variables that have also been shown to predict reading comprehension may have allowed for stronger conclusions to be made about the contribution of vocabulary knowledge. In line with the Simple View of Reading (Gough & Tunmer, 1986), word reading has been shown to be a significant predictor for children's reading comprehension. It is possible that controlling for word reading ability using other measures, such as oral reading fluency (Fien et al., 2011), would have resulted in improved prediction for the first and second grade reading comprehension in

this study's findings and provided further insight into the types of skills that should be assessed to screen for future reading problems.

### **Implications**

The results of the present research study have important implications regarding the content and timing of instruction and progress monitoring for DLL and non-DLL students. This study did not find a significant individual influence of language status, but previous research indicates that DLLs tend to demonstrate limited second-language skills, which requires that educators focus on fostering the language abilities of these students (Gómez et al., 2019). This information suggests educators should consider DLL status as a possible indicator of risk for later reading difficulties, but that such risk is also dependent upon the vocabulary knowledge of DLLs when they enter school, and both factors should be examined in conjunction with one another when considering instructional design for individual students.

Another issue with critical implications for schooling is that the classification of students as bilingual or EL creates the potential to misrepresent children's skills (e.g., Kim et al., 2018). This is because there is not a consistent definition in the literature for what represents a Dual Language Learner, and several labels with different criteria used for classification makes it difficult to compare and generalize findings. In practice, basing instructional decisions on the assumption that bilingual students are a homogeneous group can lead to a mismatch in the amount and type of supports students receive, as they may enter school with varying abilities in both their native and non-native languages. Ideally, language ability would be formally assessed to assign students to groups based upon native language proficiency as well as on the amount of English language exposure

and proficiency of a specific student. Results of formal assessments after an initial screening would provide a more accurate picture of a child's primary language skills and second language skills and give credence to placing students in instructional groups based upon their specific abilities in each language.

As school professionals consider the most appropriate and effective methods of identifying students in need of more intensive and more frequent instruction, the current study provides insight into the role of vocabulary instruction and how it fits best into an MTSS framework. The implementation of MTSS requires that educators employ the most effective (i.e., evidence based) strategies for facilitating the development of vocabulary in young students (Cuticelli et al., 2015). The Project EVI Tier 2 vocabulary intervention was beneficial to first grade reading comprehension for students with lower levels of initial vocabulary knowledge, and this result provides evidence for a tiered system that allows at-risk students to receive targeted vocabulary instruction to help close achievement gaps in literacy. The importance of high-quality instruction is a key component of an MTSS framework. And as previous research demonstrates positive intervention effects for high quality instruction on oral language, specifically vocabulary, thus suggesting an emphasis should continue to be placed on providing high quality literacy, language, and reading instruction for all students, not just DLLs. Teachers should provide explicit instruction in vocabulary, but also utilize multiple strategies and tools to indirectly foster children's language development in the classroom, such as visual aids with words and pictures, conversation corners to discuss new words, and shared book reading (e.g., Halle et al., 2012).



As vocabulary knowledge at the end of kindergarten was the only significant predictor of second grade reading comprehension, it is important to consider this time point when monitoring students for progress to assess their oral language abilities and deliver interventions to prevent later literacy difficulties. School psychologists, reading teachers, speech-language pathologists, and EL specialists all have unique roles to play in utilizing their training for making decisions that are data driven to promote academic success for all students. These educators can help implement universal screening practices that incorporate measures of vocabulary to prevent later reading failure. Additionally, the inclusion of vocabulary measures in oral language assessments is warranted considering its contribution, albeit small, to early reading comprehension and larger influence on later comprehension. Continued support for vocabulary as an integral component of successful reading means that families also have great influence over their children's language development through their interactions and practices at home. Home language and literacy environments can provide greater insight into the quality and quantity of vocabulary children are exposed to and produce themselves in both languages (e.g., Mancilla-Martinez et al., 2020). School psychologists and other educators can work to engage parents and families from culturally and linguistically diverse backgrounds in providing ideas for activities to help promote children's language skills that will help aid in their development and school success (Hojnoski & Missal, 2006).

### **Future Directions**

Researchers should consider evaluating the appropriateness of current screening measures and procedures for identifying DLLs and predicting later outcomes. Although this study did not find significant effects of language status, future studies should

continue to investigate how best to identify literacy difficulties within this specific population, particularly with students with varying levels of language proficiency. Identifying students through multi-step and multi-method screening processes may be more efficient administering a single screening assessment once per year to provide these students with instruction within specific areas of language and reading. The significant finding for end-of-year vocabulary knowledge also warrants further investigation into appropriate timing of screening to determine when to adjust instruction based upon students' needs. Future research should examine the appropriateness of gated screening for DLLs to determine its usefulness in predicting comprehension for these students.

It is important to consider that receptive vocabulary is one measure of vocabulary knowledge, and vocabulary itself is only one factor that comprises skills needed for successful reading comprehension. Nevertheless, results from this study provide further evidence of the importance of vocabulary knowledge for reading comprehension in early elementary school for both DLLs and non-DLLs. Given that the Tier 2 vocabulary intervention did not have significant influence on reading comprehension, future research should focus on the development of effective vocabulary instruction that focuses on teaching strategies to help DLL students learn words in addition to explicitly target words to help improve general comprehension. Future studies should also consider implementation fidelity regarding vocabulary instruction for young children. Employing qualitative methods to interview teachers regarding their experiences can reveal vital information, including teachers' perceptions of training and ease of implementation, as well as insight into supports educators need to provide effective vocabulary interventions in the classroom.

Research has demonstrated that first-language vocabulary can aid in the identification of DLL students who may require support because strong primary language skills may be predictive of second-language vocabulary and general oral language abilities (Jackson et al., 2014). Thus, future studies should examine the relationships of both native and non-native languages on reading comprehension. Additionally, other factors shown to influence reading comprehension scores were not accounted for in the analyses, such as syntax, verbal working memory, and metalinguistic awareness. These skills may have an important influence on reading comprehension for DLLs and should be investigated further.

### **Conclusions**

Overall findings from this study suggest that vocabulary development demonstrated an influence on first and second grade reading comprehension for this sample of at-risk students, although its contribution was somewhat small and varied based upon time point of assessment as well as when controlling for other additional literacy skills. Results of this study support concluding that receptive vocabulary knowledge assessed at the start and end of Kindergarten, as well as change in vocabulary over the course of the year, significantly predicted reading comprehension at the end of first grade. When reading comprehension was assessed in a subsample of participants in the middle of second grade, only vocabulary knowledge assessed at the end of Kindergarten was a significant predictor. In other words, initial vocabulary knowledge at screening did not significantly contribute to students' reading comprehension ability in second grade. The relatively small effect size of these results is not particularly

surprising, given that prior research demonstrates a greater impact of word reading skills over oral language in the early years.

Results of this study suggest further, that vocabulary knowledge is important for subsequent reading comprehension for both DLL and non-DLL students, and that targeted vocabulary instruction can improve reading comprehension particularly for students who have lower initial levels of vocabulary. Limitations regarding the criteria for establishing DLL status and the lack of differences between language groups on measures likely influenced current findings. Future research should consider the appropriateness of including vocabulary and broader oral language assessments within screening tools and practices for identifying all students who may be at later risk for reading difficulties. This study's findings support building semantic knowledge for reading success through a multi-tiered system, as Kindergarten vocabulary is a predictor of reading comprehension for both DLLs and non-DLLs.

**Appendix A**

**Early Vocabulary Intervention (EVI-1)  
2011-2012 Student Information Form**

*Instructions: Please answer each question below regarding the identified student.*

**Student:** \_\_\_\_\_ **Today's Date:** \_\_\_\_\_  
(First and last as it appears on official school records)

**Classroom Teacher:** \_\_\_\_\_

**Language:** Does this child speak a language other than English?  Yes  No

If yes, please respond to the following:

- a. What language(s) does the child speak? \_\_\_\_\_
- b. Is this student of limited English language proficiency (LEP, ELL) as determined by your state's language proficiency test?  Yes  No

**Gender:**  Male  Female

**Race/Ethnicity:**

(Check all that apply)

- White (not of Hispanic origin)
- Black/African American (not of Hispanic origin)
- Hispanic
- Multi-racial \_\_\_\_\_
- American Indian/Alaskan native
- Asian
- Other \_\_\_\_\_

**Special Education:**

As of today's date, has the student been formally identified as eligible for special education services? (This includes services from a licensed speech pathologist.)

- Yes  No

If yes, which category of special education? (Check all that apply)

- Learning disability
- Hearing impairment
- Speech or language impairment
- Visual impairment
- Serious emotional disturbance
- Orthopedic impairment
- Autism/Autism Spectrum Disorder
- Traumatic brain injury
- Other health impairment \_\_\_\_\_
- Developmental delay
- Intellectual Disability
- Other: \_\_\_\_\_

**Special Services:**

What special services does the student receive at your school? (Check all the apply)

- None
- Speech/Language pull-out
- Special Education (push-in or pull-out resource)
- Bilingual/ELL/ESOL instruction
- Dyslexia
- Additional small-group reading instruction

Other: \_\_\_\_\_

## Appendix B

### *Results of Unconditional Models for 1<sup>st</sup> and 2<sup>nd</sup> Grade Reading Comprehension*

Parameter	Estimate	SE	Wald Z	P	CI	
					Lower	Upper
<b>1<sup>st</sup> Grade</b>						
Residual	58.877	4.650	12.662	.000	50.434	68.734
Intercept	6.931	3.657	1.895	.058	2.464	19.495
<b>2<sup>nd</sup> Grade</b>						
Residual	59.594	6.151	9.688	.000	48.679	72.957
Intercept	2.090	2.682	.780	.436	.169	25.832

### *Linear Mixed Model Analysis of Predictors of Passage Comprehension in 1<sup>st</sup> Grade*

Parameter	Estimate	SE	p
<b>1</b>			
Age in Months	-.246	.109	.025**
PPVT-4 Start of K	.388	.086	.000***
DLL Status	10.994	5.891	.063*
LEP status	1.063	1.216	.383
Treatment Condition	12.486	5.831	.033**
Treatment x PPVT	-.172	.089	.055*
DLL x PPVT	-.168	.089	.060*
<b>2</b>			
Age in Months	-.140	.095	.141
PPVT-4 End of K	.165	.032	.000***
DLL Status	-.206	1.011	.839
LEP status	1.496	1.211	.218
Treatment Condition	1.401	.838	.096*
<b>3</b>			
Age in Months	.014	.095	.881
PPVT-4 Change in Scores	.098	.036	.007***
DLL Status	-.143	1.038	.890
LEP status	.906	1.236	.464
Treatment Condition	1.304	.859	.130

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$

*Linear Mixed Model Analysis of Predictors of Passage Comprehension in 2nd Grade*

Model	Parameter	Estimate	SE	p
<b>4</b>	Age in Months	-.035	.157	.824
	PPVT-4 Start of Kindergarten	.115	.075	.129
	DLL Status	.070	1.388	.960
	LEP status	.192	1.559	.902
	Treatment Condition	1.061	1.145	.355
<b>5</b>	Age in Months	-.007	.129	.955
	PPVT-4 End of Kindergarten	.146	.043	.001***
	DLL Status	-.181	1.354	.894
	LEP status	.753	1.519	.621
	Treatment Condition	1.196	1.128	.290
<b>6</b>	Age in Months	.160	.129	.216
	PPVT-4 Change in Scores	.123	.046	.009***
	DLL Status	-.104	1.374	.940
	LEP status	.038	1.514	.980
	Treatment Condition	1.131	1.139	.322

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$



*Linear Mixed Model Analysis of Predictors of Passage Comprehension in 1<sup>st</sup> Grade with Covariates*

Model	Predictor	Estimate	SE	p
<b>7</b>	Age in Months	-.244	.093	.009***
	PPVT-4 Start of Kindergarten	.188	.076	.013**
	DLL Status	3.705	5.080	.466
	LEP status	.930	1.038	.371
	Treatment Condition	3.922	5.047	.438
	Treatment Condition x PPVT	-.051	.077	.514
	Bilingual Status x PPVT	-.052	.077	.505
	CTOPP Nonword Repetition	.241	.126	.056*
	WRMT-R Letter Name	.350	.090	.000***
	WRMT-R Letter Sound	.172	.082	.037**
<b>8</b>	Age in Months	-.182	.080	.024**
	PPVT-4 End of Kindergarten	.112	.028	.000***
	DLL Status	.139	.855	.871
	LEP status	1.214	1.029	.239
	Treatment Condition	.715	.716	.319
	CTOPP Nonword Repetition	.265	.122	.031**
	WRMT-R Letter Name	.352	.088	.000***
	WRMT-R Letter Sound	.165	.081	.042**
<b>9</b>	Age in Months	-.079	.080	.324
	PPVT-4 Change in Scores	.071	.030	.021**
	DLL Status	.206	.869	.812
	LEP status	.863	1.040	.407
	Treatment Condition	.637	.726	.381
	CTOPP Nonword Repetition	.312	.124	.012**
	WRMT-R Letter Name	.366	.089	.000***
	WRMT-R Letter Sound	.167	.082	.043**

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$

*Linear Mixed Model Analysis of Predictors of Passage Comprehension in 2nd Grade with Covariates*

Model	Predictor	Estimate	SE	p
<b>10</b>	Age in Months	.042	.128	.745
	PPVT-4 Start of Kindergarten	.076	.062	.223
	DLL Status	1.058	1.144	.357
	LEP status	-1.321	1.282	.304
	Treatment Condition	.435	.948	.647
	CTOPP Nonword Repetition	.111	.154	.471
	WRMT-R Letter Name	.621	.121	.000***
	WRMT-R Letter Sound	-.002	.108	.982
<b>11</b>	Age in Months	.066	.108	.540
	PPVT-4 End of Kindergarten	.085	.036	.019**
	DLL Status	.857	1.136	.451
	LEP status	-.971	1.275	.448
	Treatment Condition	.578	.946	.542
	CTOPP Nonword Repetition	.125	.150	.404
	WRMT-R Letter Name	.611	.120	.000***
	WRMT-R Letter Sound	-.017	.107	.876
<b>12</b>	Age in Months	.159	.106	.135
	PPVT-4 Change in Scores	.068	.038	.080*
	DLL Status	.921	1.144	.422
	LEP status	-1.376	1.262	.277
	Treatment Condition	.525	.951	.582
	CTOPP Nonword Repetition	.160	.151	.292
	WRMT-R Letter Name	.615	.120	.000***
	WRMT-R Letter Sound	-.014	.108	.894

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$

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