CONNECTIONS BETWEEN PARTICIPATION IN EARLY READING FIRST CLASSROOMS AND SCHOOL-AGED LANGUAGE AND LITERACY DEVELOPMENT

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ABSTRACT

Hillary Van de Carr Haper: Connections Between Participation in Early Reading First Classrooms and School-Aged Language and Literacy Development
(Under the direction of Karen Erickson)

This investigation examined the effects of participation in *The Time is Now in Pre-K* Early Reading First (ERF) project on kindergarten, first, and second grade literacy outcomes. End-of-year language and literacy data collected by the participating school district was analyzed for 170 students (Year 1 = 89; Year 2 = 81). This investigation allowed for a multi-year examination of student performance following participation in an ERF project, and answered the call to conduct research on larger scale preschool programs that significantly improve student oral language and literacy skills.

Independent t-tests demonstrated that intervention students performed statistically significantly better than comparison students on first grade measures of phoneme segmentation and oral retelling fluency. In kindergarten, there were no significant differences on tasks related to book and print awareness and writing. In first grade there were no significant differences on writing and phonological awareness tasks.

Additional analyses examined whether the effects of participation in the ERF project were associated with or mediated by student-level demographics and environmental factors (i.e., teacher and school assignment) and if the effects of participation in the ERF project changed after one year of literacy instruction. Multiple regression equations determined that a full, six-variable model (i.e., age, gender, race, language spoken, exceptionality, and condition) significantly predicted student performance on a writing subtest. Intervention condition emerged

as having the largest negative impact upon student performance with smaller negative impacts associated with language spoken, race, gender and an identified disability. Using Hierarchical Linear Modeling assuming fixed and random effects, the combined effect of teacher and school assignment had a statistically significant impact upon student receptive vocabulary, upper and lower case letter knowledge and use of oral language. Paired samples t-tests revealed that both intervention and comparison Year 1 student oral retelling scores significantly decreased between the end of kindergarten and the end of first grade.

The results of this study provide positive support for the impact of ERF, and help identify for whom value-added impacts were achieved. This project offers valuable information regarding educational practices and future research related to the development of language- and literacy-related skills in young children.

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CHAPTER 1

Introduction

Beginning at an early age, children in the United States are encouraged to develop and interweave a broad base of language- and literacy-related skills (Dickinson & McCabe, 1991). With the eventual goal of becoming literate, children engage in an "interactive, constructive, strategic, and meaning-based" process that includes both the use and comprehension of written text (Steelman, Pierce & Koppenhaver, 1994, p. 201). The development of such skills is essential as it supports children's ability to achieve important literacy-related milestones and enter society as literate and successful adults (Lonigan, Allan & Lerner, 2011).

Literacy: Distinct Yet Intertwined

Recognizing literacy is comprised of multiple layers of language and reading-related skills that are acquired over time (National Institute for Literacy, 2009), literacy can be separated into two distinct but intertwined categories: emergent literacy and conventional literacy. Emergent literacy, or the earliest stage of literacy, consists of the varied skills, knowledge, and attitudes that are developmental precursors to conventional forms of reading and writing (Sulzby & Teale, 1991; Whitehurst & Lonigan, 1998). Examples of language and literacy-related skills associated with emergent literacy include phonological awareness, alphabet knowledge, oral language, concepts about print, and writing (National Institute for Literacy, 2009). As precursors to conventional reading and writing, such skills are targeted as the foundation of literacy instruction provided to young children.

Conventional literacy, a more sophisticated, mature, and later-developing manifestation of reading and writing than emergent literacy (National Institute for Literacy, 2009), is comprised of skills such as decoding, oral reading fluency, reading comprehension, writing, and spelling. A child is considered to be reading conventionally when he or she is able to understand a written text, attend to and use the print cues provided by the author, and move in a flexible and coordinated fashion across various aspects or strategies in order to obtain an understanding satisfactory to the reader (Sulzby, 1985). Mastery of conventional literacy skills is expected for academic success in the educational system.

The Importance of Preschool

Given the roles that language and emergent literacy have in the development of full, conventional reading and writing abilities, high-quality preschool programs can have a critical impact on children's reading achievement. High-quality preschool programs provide instruction that is age-appropriate, explicit, systematic, and purposeful (Justice, Mashburn, Hamre, & Pianta, 2008), and they offer multiple opportunities for modeling, as well as guided and independent practice (National Center for Family Literacy, 2009). Additionally, preschool programs that are most likely to promote later literacy success provide instruction across a number of print-related skills and concepts while also addressing children's development of oral language (National Institute for Literacy, 2006; 2009). Given that preschool children's development of language- and literacy-related skills is predictive of how well they will learn to read once they are exposed to formal reading instruction in elementary school (Dickinson & McCabe, 2001; Lonigan, Allan & Lerner, 2011; Lonigan, Burgess, & Anthony, 2000; Storch & Whitehurst, 2002), access to and attendance at high-quality preschool programs is imperative.

With knowledge of the importance of the preschool period, the Early Reading First (ERF) Initiative was implemented in 2001 to ensure all children entered kindergarten with the language, cognitive and literacy skills necessary for success in reading. As a component of the No Child Left Behind Act (NCLB), the ERF initiative strove to enhance teacher practices, instructional content, and preschool classroom environments (United States Department of Education, 2008a). The initiative was built on the evidence from Head Start studies which indicated that preschool-aged children from impoverished backgrounds demonstrated average levels of development at entry into kindergarten when provided with explicit and systematic language and literacy instruction that was sensitive to their emerging developmental skills (Landry, Smith, Swank, Assel, & Vellet, 2001).

Statement of the Problem

Despite the understanding that high-quality preschool programs can support the development of language and emergent literacy skills that contribute to later literacy success, not all programs provide a high-quality experience. Particularly concerning is the finding that classrooms rated as providing the poorest quality instruction are composed of higher proportions of children in poverty, higher rates of non-Caucasian children, and lower levels of maternal education; all established risk factors for academic difficulties (see LoCasale-Crouch et al., 2007; Pianta et al., 2005). Additionally, approximately 57% of all 3- to 5-year-old children meet eligibility standards for developmental risk (U.S. Department of Education, National Center for Education Statistics, 2012).

In 2007, an ERF project titled *The Time is Now in Pre-K* commenced to address the needs of a heterogeneous group of preschool students in south-central North Carolina. Living in a county that at the time was identified as one of the poorest counties in the country, this group

of children faced "at risk" conditions such as living in poverty, being English Language Learners, and having identified disabilities. With the aim of providing preschool-aged children with the language and literacy skills necessary for later success in reading, *The Time is Now in Pre-K* project examined the impact of combining child interest, interactive reading, and multi-turn conversations with a prescriptive literacy curriculum on children's development of oral language and literacy skills. Data was collected on three successive cohorts of preschool-aged children and focused on the effects of participation immediately following the intervention.

Similar to other ERF projects and research efforts that examined the language and literacy development of young children, *The Time is Now in Pre-K* project did not explore the effects of participation beyond preschool. The absence of a multi-year examination of student performance precluded an in-depth examination of student's oral language skills which are a known predictor of early literacy skills in kindergarten and first grades as well as of reading comprehension in second grade and beyond (see Dickinson et al., 2003; Roth, Cooper, & de la Paz, 1999; Storch & Whitehurst, 2001, 2002; Vellutino, Tunmer, Jaccard, & Chen, 2007; Whitehurst & Lonigan, 1998). In essence, while meaningful information was acquired about the immediate impact of the intervention provided, data on the lasting/long-term effects of participation in *The Time is Now in Pre-K* project was not obtained.

Purpose

The primary aim of the current study was to examine the effects of participation in *The Time is Now in Pre-K* project on kindergarten, first, and second grade language and literacy outcomes. It was hypothesized that children who participated in intervention classrooms would perform better than children who participated in comparison classrooms on measures of language and literacy once they reached school age. Secondary aims of the study examined whether the

effects of the ERF intervention were associated with or mediated by student-level demographic variables, teacher or school assignment, and if the effects of participation in intervention classrooms changed after one or two years of literacy instruction in the primary grades.

Summary

To become independent and literate adult members of society, young children need to begin to develop and interweave a varied base of language- and reading-related skills. Attendance at a high-quality preschool program that provides age-appropriate, explicit, systematic, and purposeful instruction supports children's development of the language- and reading-related skills that are linked to later, conventional literacy. With this emphasis on the preschool period, the current investigation extended the findings of *The Time is Now in Pre-K* Early Reading First project by examining the impact of participation in preschool intervention classrooms upon the language and literacy development of students in kindergarten, first and second grade. The addition of this multi-year component to the original ERF project allowed for a long-term analysis of student performance and a more in-depth examination of student's oral language skills.

Findings from this investigation made valuable and necessary contributions on multiple levels. Nationally, study findings contributed toward the body of research on the impact of the ERF Initiative and specific interventions provided in ERF classrooms. Locally, study results provided an increased understanding of the long-term impact of one school district's financial- and personnel-related investments on the learning outcomes of a heterogeneous group of students that faced multiple "at risk" conditions for later academic failure. Such efforts are necessary to move closer toward the goal of providing high-quality instruction to all preschool-aged children and determining the best avenues for accomplishing this.

CHAPTER 2

Review of the Literature

The Importance of Literacy

In the United States, literacy is a national priority. As an essential contributor to successful adult employment and well-being, the emphasis on literacy begins when children are very young (Lonigan, Allan & Lerner, 2011). This is the time when children are expected to develop and interweave a broad base of language- and literacy-related skills (Dickinson & McCabe, 1991) to achieve important literacy related milestones and ensure their capability of functioning as fully literate adults.

Despite the nation's emphasis on literacy, results of the National Assessment of Educational Progress (NAEP), the Nation's Report Card (National Center for Educational Statistics, 2011), indicate that a substantial proportion of children are not acquiring the levels of literacy skills needed to meet the demands for literacy in school, the workplace, and elsewhere (Lonigan, Allan & Lerner, 2011). More specifically, among fourth-grade children in the United States, only 34% performed at or above the proficient level in reading and 33% performed below the basic level in reading. The results for older children are not more encouraging. By eighth grade, the percentage of children performing below the basic level fell to 24%, but the percentage of children performing at or above proficiency remained at 34%. In short, considerable work continues to be needed in the pursuit of literacy as a national priority.

Defining Literacy

Literacy, once narrowly defined as the quality or state of being literate, or being able to read and write (Merriam-Webster Collegiate Dictionary www.m-w.com/cgi-bin/dictionary), is now viewed as dynamic and evolving. Broadly defined, literacy includes notions of reading, writing, speaking, and listening that change to reflect advances in society. Highlighting the fact that literacy is not situated in isolated bits of knowledge but in students' growing ability to use language and literacy in more and broader activities (Moll, 1994, p. 202), literacy is seen as an "interactive, constructive, strategic, and meaning-based" process that includes both the use and comprehension of written text (Steelman, Pierce & Koppenhaver, 1994, p. 201). Comprised of multiple layers and encompassing both reading and language-related skills, literacy begins with skills such as phonological awareness, alphabet knowledge, oral language, concepts about print and writing (National Institute for Literacy, 2009) and progresses to skills related to decoding words, oral reading fluency, reading comprehension, spelling, and writing (National Center for Educational Statistics, 2005; National Institute for Literacy, 2009).

Broadly speaking, literacy can be separated into two distinct but intertwined subcategories: emergent literacy and conventional literacy. While the goal is for all individuals to possess adult-like, conventional literacy abilities, such ability requires the development of multiple layers of language and literacy-related skills over time. The earliest developing skills and understandings, referred to as emergent literacy, begin developing prior to formal schooling and continue developing throughout childhood. The skills and understandings acquired during the emergent period are now well accepted for their direct connection to conventional literacy, and build the foundation of language and literacy development that lead to conventional reading and writing.

Emergent Literacy

Emergent literacy is the earliest stage of literacy and involves the language- and literacy-based skills presumed to be the developmental precursors to later, conventional literacy acquisition (Sulzby & Teale, 1991; Teale & Sulzby, 1986; Whitehurst & Lonigan, 1998). First introduced by Clay (1966), the term emergent literacy describes the behaviors used by young children in their interactions with books and when reading and writing multiple forms of text. Noting that the behaviors she observed in young children were not truly reading and writing in the conventional sense, Clay stressed the importance of such behaviors in the developmental progression of literacy. Teale and Sulzby (1986) built upon Clay's use of the term emergent literacy in referencing the period of time prior to formal schooling when children learn about language, reading, and writing. They defined emergent literacy as the reading and writing abilities that develop concurrently and interrelatedly when children are actively involved with literacy materials (Teale & Sulzby, 1989).

Whitehurst and Lonigan (1998) offered yet another definition. They suggested that emergent literacy consists of two interdependent sets of skills and processes: outside-in and inside-out. Outside-in processes encompass children's understanding of the context in which the text they are trying to read (or write) occurs (Whitehurst & Lonigan, 1998). As such, outside-in skills include children's ability to apply and follow text-related conventions (i.e., concepts about print), read print found in the environment (i.e., recognizing and reading common symbols), understand and use vocabulary, and produce narratives. In contrast, inside-out processes require children to focus on text and include children's knowledge of the rules for translating the particular text they are trying to read into sounds. Skills classified as inside-out include children's ability to name letters, identify sounds associated with letters of the alphabet, spell,

and demonstrate language-based abilities such as rhyming, as well as blending and segmenting sounds (i.e., phonological and phonemic awareness).

Despite the numerous definitions of emergent literacy, it is widely accepted that emergent literacy consists of varied skills, knowledge, and attitudes that are developmental precursors to conventional forms of reading and writing (Sulzby & Teale, 1991; Whitehurst & Lonigan, 1998). Examples of language and literacy-related skills associated with emergent literacy include phonological awareness, alphabet knowledge, oral language, concepts about print, and writing (National Institute for Literacy, 2009). Now established as precursors to conventional reading and writing, such skills are targeted as the foundation of literacy instruction provided to young children.

Conventional Literacy

Conventional literacy is perceived as a more sophisticated, mature, and later-developing manifestation of reading and writing than emergent literacy (National Institute for Literacy, 2009). Comprised of skills such as decoding, oral reading fluency, reading comprehension, writing, and spelling, a child is considered to be reading conventionally when he or she is able to understand a written text, attend to and use the print cues provided by the author, and move in a flexible and coordinated fashion across various aspects or strategies in order to obtain an understanding satisfactory to the reader (Sulzby, 1985).

Of those skills pertaining to conventional literacy, word recognition is among the earliest to emerge. While some readers learn to recognize words based solely on the print array, word recognition, also referred to as decoding, is the ability to apply knowledge of letter-sound relationships (i.e. phonemic awareness), including knowledge of letter patterns, to correctly pronounce written words (National Institute for Literacy, 2009). Understanding the relationships

between letters and sounds gives children the ability to recognize familiar words quickly and to decode unfamiliar words. Skills specific to children's ability to decode text include knowledge of the alphabet, phonemic awareness (i.e., the ability to focus on and manipulate sound units in spoken words) and phonics (i.e., understanding of the relationship between written letters and spoken sounds). The ability to quickly and accurately decode words contributes directly to a child's developing ability to read fluently with expression and understanding (National Institute for Literacy, 2009).

In addition to recognizing and reading words fluently, children must comprehend the words read. As defined by the National Assessment of Educational Progress (NAEP), reading comprehension is "an active and complex process that involves understanding written text, developing and interpreting meaning, and using meaning as appropriate to type of text, purpose and situation" (National Center for Educational Statistics, 2005, p. 2). To assist with the comprehension process, children must draw upon their understanding of oral language including grammar (i.e., syntax) and vocabulary (i.e., semantics) (Bishop & Snowling, 2004; Catts, Adlof & Weismer, 2006). Without understanding the meaning of words and the rules that govern how they are combined to create meaning, children lack the ability to efficiently understand what they are reading.

Emergent and conventional literacy each have important roles in the comprehensive definition of literacy. Emergent literacy focuses on foundations of basic syntax rules and context, while conventional literacy relates to more sophisticated topics of decoding and reading comprehension. The two are interconnected, and high-quality preschool programs can play an important role in ensuring that children develop the emergent literacy skills and understandings that are most likely to contribute to their later conventional literacy learning success.

The Relationship between Oral Language and Literacy

Reading and writing have strong underpinnings in oral language and have been described as having a symbiotic relationship with oral language (NICHD, 2005). The five domains of oral (i.e. spoken) language that are important to literacy development include phonology, morphology, syntax, semantics, and pragmatics. Each oral language domain contributes uniquely and in combination with other domains of oral language to literacy.

Phonology

Phonology is the sound system of a language (American Speech-Language Hearing Association [ASHA], 1993) and comprises the rules that govern the distribution and sequencing of speech sounds (Catts & Kamhi, 2005). Phonological awareness, a subcomponent of phonology, includes the knowledge and conscious understanding of the sound structure of language. Skills pertaining to phonological awareness progress from the simple awareness of speech sounds and rhythms, to rhyme awareness and sound similarities to, at the highest level, the awareness of syllables and phonemes (Erickson, 2008), or the smallest units of speech composing spoken language. Phonemic awareness is the ability to hear and manipulate the sounds in spoken words and to understand that spoken words and syllables are made up of sequences of speech sounds (Yopp, 1992). Phonological awareness is crucial to literacy as it is related to both reading acquisition (decoding) and fluent reading in Grades 1-3 (see e.g., Roth, Speece, & Cooper, 2002; Schatschneider et al., 2004; Sénéchal, LeFevre, Smith-Chant, & Colton, 2001; Storch & Whitehurst, 2002).

Morphology

Morphology is the system that governs the structure of words and the construction of word forms (ASHA, 1993). Morphological awareness refers to the ability to reflect on and

manipulate both morphemes, the smallest linguistic units that carry meaning, and word formation rules in a language (Kuo & Anderson, 2006). The ability to identify the morpheme boundaries such as base words and conjoining prefixes and suffixes enables students to decode and identify the meaning of words (Kirk & Gillion, 2009). The ability to recognize and manipulate morphemes contributes directly to student's reading comprehension as it supports both decoding and recognizing the meaning carried by each morphological unit of a word (e.g. Carlisle, 2000; Carlisle & Stone, 2005; Singson, Mahoney & Mann, 2000). Morphological awareness also contributes indirectly to reading comprehension as it aids in student's vocabulary skills, which is known to significantly contribute to reading comprehension (Nagy et al, 2006).

Facility with morphological awareness becomes increasingly important as readers encounter multisyllabic and complex words (Apel & Lawrence, 2011; Shankweiler, Lundquist, Dreyer, & Dickinson, 1998). Without strong morphological skills, students are unable to efficiently chunk words into meaningful units and instead continue to decode words phoneme by phoneme. Such continued emphasis on decoding at the word level precludes students from focusing their attention and effort on comprehending texts.

Syntax

Syntax, another domain of oral language, is the system of rules that governs sentence structure (ASHA, 1993). With syntactic awareness, readers can construct meaning from text by predicting or building an expectation of words based upon sentence organization and the use of punctuation (Scott, 2009). Syntactic awareness also enables readers to reflect on and manipulate the order of words in a sentence (Nagy & Scott, 2000).

Syntactic awareness has an evolving relationship with reading ability. It is a skill that begins to develop in young children and continues to develop through adolescence with the

emergence of increasingly complex abilities and understandings (Nippold, Mansfield, Billow, & Tomblin, 2008; 2009). Specifically, syntactic awareness contributes to isolated word reading and spelling as it enables readers to use the syntactic constraints of a sentence to decode unfamiliar words (Chiappe, Siegel, & Wade- Woolley, 2002; Willows & Ryan, 1986). For reading comprehension, syntactic awareness facilitates a reader's sentence- and text-level integration and monitoring skills (Bentin, Deutsch, & Liberman, 1990; Demont & Gombert, 1996; Tunmer & Bowey, 1984). With the continuous and evolving relationship between syntactic awareness and literacy, it is not surprising that young children with a limited array of syntax in their speech are vulnerable to developing later reading problems (Nation & Snowling, 2000, 2004).

Semantics

Semantics is the domain of language that governs the meanings of words and sentences (ASHA, 1993). Often referred to as vocabulary skills, semantic skills include knowledge of word meanings as well as the efficiency of access to and retrieval of word meanings (Cain & Oakhill, 2007). Having a broad vocabulary base facilitates the recognition of word meanings and assists the reader in understanding constraints on certain word combinations (Stanovich & West, 1989) found within the body of a text.

Research offers strong evidence of an association between vocabulary knowledge and reading comprehension (Beck & McKeown, 1991; Daneman, 1991; Droop & Verhoeven, 2003; Sénéchal, Ouellette & Rodney, 2006; Torgeson, Wagner, Rashotte, Burgess, & Hecht, 1997; Verhoeven, 2000; Verhoeven & van Leeuwe, 2008). Such a relationship is logical given that the ability to comprehend written and spoken language is dependent upon knowledge of individual word meanings (McGregor, 2004). As stated by Stahl and Nagy (2006, p.9), "The size of a person's vocabulary is one of the strongest predictors of how well that person can understand

what he or she reads." Without strong vocabulary skills, individuals struggle to assign meaning to the words and text they decode.

While the relationship between semantics and reading comprehension is well established, less is known about the relationship between semantics and word decoding. Although a few studies have found a moderate association between vocabulary and decoding (see Scarborough, 2001; Senechal et al., 2006), semantics has largely been neglected in explanations of single word reading ability (Keenan & Betjemann, 2007). In instances where the relationship between semantics and word identification was examined, semantics was viewed as assisting readers in pulling contextual cues from the text to determine the meaning and pronunciation of single words. Whether or not a strong relationship between semantics and word recognition is ever confirmed, semantics makes an important contribution to comprehension in conventional reading ability.

Pragmatics

Pragmatics is the domain of language that encompasses effective, functional and socially appropriate communication (ASHA, 1993). Pragmatics applies to both spoken and written language at the discourse level. Pragmatic knowledge developed naturally in children's use of oral language can be transferred and applied to enhance comprehension of the language's function in text (Myers, 1982). Pragmatics becomes increasingly important for students in primary grades as they encounter text and sentences with different contextual meanings, as pragmatic knowledge allows readers to interpret and understand how context determines the meaning of the sentence. Additionally, by combining their knowledge of the world with their pragmatic skills, readers can decipher the author's purpose, understand a character's point of view, and interpret messages from the text that are not literally expressed (Pershey, 1997).

In conclusion, from the earliest stages of understanding that print carries meaning to comprehending complex texts, oral language skills play an invaluable role in students' progression toward conventional literacy. Skills and knowledge related to phonology, morphology, syntax, semantics and pragmatics, the five domains of oral language, provide the foundation upon which all students build, as they become conventional readers and writers. These language domains begin to develop at birth, continue to develop through early childhood, and contribute directly to conventional literacy learning success.

Predictors of Conventional Literacy

Since the early 1960s, researchers and government programs have sought to understand the connection between literacy understandings developed in early childhood and later school success (National Institute for Literacy, 2009). This increasing attention to and understanding of the relationship between skills such as alphabet knowledge and kindergarten readiness prompted the introduction of publically funded preschool for children living in poverty, Head Start (National Institute for Literacy, 2009). As in the 1960's, a growing understanding of the importance of high-quality preschool in preparing children for literacy learning success led to the Early Reading First grant programs. At the same time that Early Reading First was established to provide services to children while building our research-based understanding of the impact of high-quality preschool on emergent literacy learning, an extensive, systematic review of the extant research was commenced. This review conducted by the National Early Literacy Panel (NELP; National Institute for Literacy, 2009), provided important information regarding the best early childhood predictors of later conventional literacy learning success.

National Early Literacy Panel

In 2002 the National Institute for Literacy formed the NELP to study the relationship between literacy knowledge and skills in preschool and school-aged literacy outcomes. They instructed the NELP to conduct a comprehensive review of the literature for two purposes: (a) to inform educational policy and practice that affects early literacy development, and (b) to determine how teachers and families could support young children's language and literacy development (National Institute for Literacy, 2009, pg. iii). The panel included expert researchers in the areas of reading, early literacy, language, cognition, English as a second language, pediatrics, special education, research methodology, and early childhood education.

Predictors of Later Literacy Development

One goal of the NELP was to identify the skills and abilities of young children that best predicted later reading, writing, and spelling outcomes. To accomplish this, the panel conducted a meta-analysis of approximately 300 studies that addressed the predictive relationship between skills measured in preschool or kindergarten and reading outcomes (e.g., word decoding, reading comprehension, spelling) in later grades. The meta-analysis revealed six emergent literacy variables that were strong predictors (e.g. the predictor variables explain at least 25 percent of the variance in the outcome variable) of later literacy development and maintained their predictive power even when the roles of other variables, such as IQ or socioeconomic status (SES), were accounted for. These six predictors were: (a) alphabet knowledge, (b) phonological awareness, (c) rapid automatic naming of letters or digits, (d) rapid automatic naming of objects or colors, (e) writing or writing one's name, and (f) phonological memory (National Institute for Literacy, 2009). Brief definitions of each of these variables are provided in Table 2.1.

Table 2.1
Emergent literacy variables that strongly predict later literacy development

Variable	**Explanation**
Alphabet knowledge	The knowledge of the names and sounds associated with printed letters.
Phonological awareness	The ability to detect, manipulate, or analyze the auditory aspects of spoken language (including the ability to distinguish or segment words, syllables, or phonemes), independent of meaning.
Rapid automatic naming of letters or digits	The ability to rapidly name a sequence of random letters or digits.
Rapid automatic naming of objects or colors	The ability to rapidly name a sequence of repeating random sets of pictures of objects (e.g., “car,” “tree,” “house,” “man”) or colors.
Writing or writing name	The ability to write individual letters on request or to write one’s own name.
Phonological memory	The ability to remember sound-based information for a short period of time.

Note. From The National Institute for Literacy (2009). *Developing Early Literacy: Report of the National Early Literacy Panel*. Retrieved on October 7, 2014 from: https://www.nichd.nih.gov/publications/pubs/documents/NELPReport09.pdf.

Beyond the six variables found to be strongly predictive of later literacy development, five other emergent literacy variables were found to have a moderate correlation (i.e. the predictor variable explains between 9 and 25 percent of the variance in the outcome variable) with at least one measure of later literacy development. These variables included: (a) concepts about print, (b) print knowledge, (c) reading readiness, (d) oral language, and (e) visual processing (National Institute for Literacy, 2009). Unlike the six strongly predictive variables, these five emergent literacy variables either did not maintain their predictive power when other important contextual variables were accounted for or have not yet been evaluated as thoroughly

by researchers (National Institute for Literacy, 2009). Brief definitions of the variables can be found in Table 2.2.

Table 2.2
Emergent literacy variables that moderately predict later literacy development

Variable	**Explanation**
Concepts about print	Knowledge of print conventions (e.g., left–right, front–back) and concepts (book cover, author, text).
Print knowledge	A combination of elements of alphabet knowledge, concepts about print, and early decoding.
Reading readiness	Usually a combination of alphabet knowledge, concepts of print, vocabulary, memory, and phonological awareness.
Oral language	The ability to produce or comprehend spoken language, including vocabulary and grammar.
Visual processing	The ability to match or discriminate visually presented symbols.

Note. From The National Institute for Literacy (2009). *Developing Early Literacy: Report of the National Early Literacy Panel*. Retrieved on October 7, 2014 from: https://www.nichd.nih.gov/publications/pubs/documents/NELPReport09.pdf.

Of the many variables found to predict children's later literacy acquisition, five variables are relevant to the current investigation. As the investigation focused on participation in a preschool program that included a rich oral language environment and its lasting, positive effect on students' literacy achievement during the primary grades, the variables included were alphabet knowledge, phonological awareness, writing, concepts about print, and oral language. Each of the variables has a unique predictive relationship with conventional literacy acquisition and can be taught and assessed independently. A more thorough discussion of the five variables follows.

Alphabet Knowledge. Alphabet knowledge, or letter knowledge, is the ability to recognize and name the letters of the alphabet in print (Johnston, 2004). Alphabet knowledge and the ability to recognize and produce sounds associated with letters of the alphabet are skills that are collectively referred to as the alphabetic principle (Adams, 1990). As an emergent literacy skill, alphabet knowledge is one of the easier skills for children to learn and is a stable indicator of individual difference in emergent literacy knowledge. In the late preschool period, letter knowledge as indexed by knowledge of both letter names and letter sounds was found to predict 72% of the variance in kindergarten and first-grade children's letter knowledge (Lonigan, Burgess & Anthony, 2000).

There is a strong relationship between alphabet knowledge and conventional literacy achievement. As reported by the National Institute for Literacy (2009), alphabet knowledge has a strong (r = .50) relationship with word decoding and a moderate relationship (r = .48) with reading comprehension. Furthermore, alphabet knowledge is a significant predictor of phonological awareness and reading acquisition at the end of Grade 1 (Sénéchal, LeFevre, Smith-Chant, & Colton, 2001) and word decoding and fluency in Grades 1 and 2 (Schatschneider et al., 2004).

Phonological Awareness. Phonological awareness includes the knowledge that words are made up of smaller units of sound (McGuiness & McGuiness, 1998) and the ability to hear similarities and differences among phonemes (sounds) in spoken language. Rooted in listening skills, phonological awareness is developmental in nature. Beginning with the simple awareness of speech sounds, rhythms, rhyme awareness and sound similarities, phonological awareness progresses over time to the awareness of syllables and phonemes (Erickson, 2008).

Phonological awareness is crucial to literacy as it is related to both decoding and reading fluency in Grades 1-3 (see e.g., Roth, Speece, & Cooper, 2002; Schatschneider et al., 2004; Sénéchal, LeFevre, Smith-Chant, & Colton, 2001; Storch & Whitehurst, 2002). Specifically, phonological awareness has a moderate relationship (r = .40) with word decoding and a moderate relationship (r = .44) with reading comprehension (National Institute for Literacy, 2009). Additional research supports phonological awareness as a predictor of reading achievement in Grades 1 and 2 (Lonigan, Burgess & Anthony, 2000; Roth, Speece, & Cooper, 2002; Schatschneider et al., 2004; Sénéchal, LeFevre, Smith-Chant, & Colton, 2001; Storch & Whitehurst, 2002).

Writing. For young children, writing begins as an experimental task that includes picture drawing, scribbling that looks like writing, and a combination of intentional and unintentional marks. As children gain experience with printed materials and writing, their early marks evolve to take on characteristics of print (Clay, 1975) and conventional letterforms. Later, as children recognize that letters represent words, they become particularly motivated to write their name and move even closer to conventional print. A child's own name is typically one of the first words to emerge in early writing development (Clay, 1975; Levin et al., 2005; Puranik, Lonigan, & Kim, 2011), as name writing indicates a sense of self and ownership (Drouin & Harmon, 2009).

Of all the stages of writing, name writing has received particular attention as it is viewed as a window into a child's emergent literacy development (Bloodgood, 1999; Levin, Both-de Vries, Aram & Bus, 2005) and one of the first bridges between oral and written language (Drouin & Harmon, 2009). Name writing has been identified as a strong indicator of children's alphabet knowledge (Bloodgood, 1999; Molfese, Beswick, Molnar, & Jacobi-Vessels, 2006;

Welsch et al., 2003) with children often first learning the letters found within their name (Justice, Pence, Bowles & Wiggins, 2006). Children's ability to write their name has also been found to support the development of print-related knowledge and phonological awareness skills (Blair & Savage, 2006; Ferreiro & Teberosky, 1982). Measures of children's ability to write in general or write their names specifically have been moderately correlated with word decoding (r = .49) and reading comprehension (r = .33) (National Institute for Literacy, 2009), thus proving name writing as a good indicator of conventional literacy skills (Strickland & Shanahan, 2004).

Concepts about Print. Concepts about print is a term used to describe children's book handling skills and their understanding of how print and text are used to convey meaning. Some of the earliest developing concepts about print learned include proper orientation of a book (holding it right side up and forward facing), knowing the front of the book from the back, turning pages left to right, and differentiating between print and pictures (Ornstein, 1998). Additional and more complex concepts children learn about print include knowing that: (a) pages are read from top to bottom, (b) reading begins from the top left and continues right across the page until you have to sweep down to the next line, (c) sentences begin with a capital letter and end with punctuation, and (d) sentences are comprised of individual words (Clay, 1966). While some of these skills must be explicitly taught (Justice & Ezell, 2002), children will develop many print concepts skills as they continue to interact with adults and varied forms of texts.

By developing concepts about print at an early age, young children obtain the tools they will need to independently read and write in conventional ways. Evidence for the connection between concepts about print and conventional literacy learning exists in the moderate relationship between concepts about print and word decoding (r = .34) as well as reading comprehension (r = .48) (National Institute for Literacy, 2009). Research also supports the role

of concepts about print in reading achievement in kindergarten, first, and second grades (Nichols, Rupley, & Rickleman, 2004; Storch & Whitehurst, 2002). With a well-developed sense of print and book concepts, children are in a strong position to begin formal reading instruction and become independent readers.

Oral Language. Oral language, including all five domains addressed earlier, is a term that is comprised broadly of the modalities of both expression and comprehension in the areas of form (e.g., syntax) and content (e.g., vocabulary). Specific skills that comprise oral language include vocabulary and semantic knowledge, grammatical skill, narrative discourse, auditory comprehension and memory (NICHD Early Child Care Research Network, 2005). While certain skills are later developing, oral language begins to develop in infancy as children and parents interact and communicate with one another in the natural surroundings of the home environment (Teale, 1978; Yaden, 1988). The early development of oral language is critical as children's speaking and listening skills lead the way for the development of reading and writing skills (Roskos, Tabors, & Lenhart, 2005).

As a predictor, oral language plays both a direct (Dickinson, McCabe, Anastasopolous, Peisner-Feinberg, & Poe, 2003; Kendeou, van den Broek, & White, 2009; Roth, Speece, & Cooper, 2002; Senéchal et al., 2001; Storch & Whitehurst, 2002; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001; Westerveld, Gillon, & Moran, 2008) and an indirect role (Storch & Whitehurst, 2001, 2002; Whitehurst & Lonigan, 1998) in later literacy acquisition. Because "a child's oral language knowledge influences and sets limits for the operation of the reading system" (Jackson & Coltheart, 2001, p. 110) and children's oral language skills evolve with time, specific and differing relationships exist between oral language and both word decoding and reading comprehension.

Research supports the role of oral language skills as a direct predictor of preschool, kindergarten, and first grade decoding (Kendeou, van den Broek, & White, 2009; NICHD, 2005). A caveat of these findings is that with time, the relationship between oral language skills and decoding weakens. Other researchers believe that oral language skills have only an indirect influence on the accuracy of decoding in early grades citing that oral language skills feed into skills such as print knowledge, phonological awareness and writing, which in turn form the foundation for early reading success (Storch & Whitehurst, 2001, 2002; Whitehurst & Lonigan, 1998).

As children's reading skills progress to comprehending units of text larger than individual words, oral language skills become increasingly important (Mason, 1992; Nation & Snowling, 1998). Specifically, oral language in preschool has a direct relationship with third and fourth grade reading comprehension (Kendeou, van den Broek, & White, 2009; Roth, Speece, & Cooper, 2002; Senéchal et al., 2001; Storch & Whitehurst, 2002; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001; Westerveld, Gillon, & Moran, 2008). Such a relationship between oral language and reading comprehension was predictable as measures of oral language moved beyond narrowly defined receptive vocabulary tasks that dominated the early literature to include broader measures of receptive and expressive vocabulary, syntax, and narrative discourse. By examining the influence of a breadth of skills, the chance of capturing oral language as a direct predictor of reading comprehension increased.

Code-Related vs. Oral Language: Differing Roles with Literacy

The predictors of later literacy achievement identified by the NELP are generally viewed as belonging to one of two groups of processes and skills: code-related or oral language. Code-related processes include skills such as phonological awareness, alphabet knowledge, emergent

writing, and print awareness. Oral language processes encompass various skill sets including vocabulary (receptive and expressive), syntactic and semantic knowledge, and narrative discourse processes (memory, comprehension, and storytelling) (Storch & Whitehurst, 2002).

There is disagreement as to whether code-related or oral language processes are most important for later literacy acquisition. As much of the research on the connections between emergent and conventional literacy has studied children up through second grade when children's literacy success is primarily dependent on their ability to decode words, code-related processes and skills have been found to be most predictive of beginning reading acquisition (see Lonigan, Anthony & Burgess, 2000; Schatschneider et al., 2004; Senéchal et al., 2001; Storch & Whitehurst, 2002). A limited number of studies have also noted oral language (e.g. vocabulary) as both a direct (Dickinson et al., 2003) and an indirect predictor (Storch & Whitehurst, 2001, 2002; Whitehurst & Lonigan, 1998) of decoding skills in the primary grades, but that research base is much more limited. Depending on which measures are included in the study, either code-related processes and skills or oral language can be supported as most important for later literacy acquisition.

While the role of code-related skills as a direct predictor of reading acquisition is consistently supported in the research, there are limitations to these findings. One limitation is the dependence upon measures of decoding to represent conventional literacy. Without the inclusion of measures of reading comprehension, an incomplete model of literacy acquisition is presented. A further limitation is the dependence on a single measure of receptive vocabulary skills to represent the entire domain of oral language. By restricting the contribution of oral language skills to receptive vocabulary, only a portion of oral language's potential influence upon reading is captured (Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003;

Dickinson & Tabors, 1991). Additionally, as many studies track students from kindergarten through the second grade, a period during which children rely heavily upon decoding skills; little attention is given to reading comprehension skills. By extending studies to include students in third grade and beyond, more opportunities would exist to highlight the connections between more complex oral language skills (e.g., grammar, listening comprehension, and ability to define words) and reading comprehension.

Understanding the individual impact of code-related and oral language processes and skills on conventional literacy is important; however, it is also important to highlight the relationship between the two domains. Beginning in preschool, oral language skills predict 48% of the variance in code-related skills (NICHD, 2005). Although this relationship diminishes in successive grades, oral language skills clearly provide the early foundation upon which children begin to acquire literacy skills during the preschool years. As more is understood about these two groups of skills and processes and their relationship with later reading achievement, early childhood professionals will be able to more effectively design and implement preschool programs that teach children the foundational skills needed for later literacy learning success.

The Importance of the Preschool Period

Given their ability to impact early language and literacy learning, the preschool years can play a defining role in a child's school achievement. While the specific impact of varying preschool programs is still being understood, the value of the preschool period and preschool programs is generally accepted (U.S. Department of Health and Human Services, 2010), and our understanding of the impact of emergent literacy development in the preschool years on later literacy achievement is growing (see e.g., National Institute for Literacy, 2009).

Effective Programs, Interventions, and Instructional Approaches

The opportunities young children are provided to learn during the preschool years are influenced for some children by their participation in preschool programs and the interventions or instructional approaches that are employed in those programs. Many young children develop important language and literacy skills as part of their day-to-day interactions with family members in the absence of participation in a formal preschool program; however, the quality and quantity of these interactions appear to be influenced by numerous factors including socio-economic status and maternal education (Nord, Lennon, Liu, & Chandler, 2000). The current investigation focused on the impact of a formal preschool program on later literacy achievement. As such, the research regarding the effectiveness of particular programs, interventions, and instructional approaches are reviewed here.

Programs. Given the roles that early language and emergent literacy development have in the eventual development of full, conventional reading and writing abilities, it is clear that the preschool period can have a critical impact on reading achievement. Preschool children's development of language and literacy-related skills is predictive of how well they will learn to read once they are exposed to formal reading instruction in elementary school (Dickinson & McCabe, 2001; Lonigan, Allan & Lerner, 2011). There is a high degree of continuity between reading-related skills displayed by preschool children and the reading skills they display in elementary school (e.g., Lonigan, Burgess, & Anthony, 2000; Storch & Whitehurst, 2002). As such, the role of quality learning opportunities during the preschool period is well accepted.

For all children, the development of reading and writing-related skills can be fostered through their participation in high-quality preschool programs (National Center for Family Literacy, 2009). Characteristics of high-quality programs include instruction that is age-appropriate, explicit, systematic, and purposeful (Justice, Mashburn, Hamre, & Pianta, 2008),

and offers multiple opportunities for modeling, as well as guided and independent practice (National Center for Family Literacy, 2009). Additionally, preschool programs that are most likely to promote later success in literacy learning provide instruction across a number of print-related skills and concepts while also addressing children's development of oral language (National Institute for Literacy, 2006; 2009).

High-quality preschool programs can ameliorate the risk of later academic difficulties by supporting the development of critical language and literacy skills that provide the foundation for later success (National Center for Family Literacy, 2009). For example, children who have an identified disability, live in poverty, or have limited English proficiency are all at risk for later academic difficulties (see Storch & Whitehurst, 2002), but those risks can be ameliorated with the opportunity to learn in a high-quality preschool program.

Experiencing quality language and literacy interactions outside preschool is also important. Specifically, the home literacy environment and parent-child interactions are known to significantly influence children's oral language development, literacy-related skills and general cognitive abilities (Clay, 1993; National Center for Family Literacy, 2009; Snow, 1993). By pairing high quality preschool programs with the development of positive home literacy environments, the quality of parent-child interactions during language and literacy-learning activities are enhanced. Homes that are not supportive of children's language and literacy skills provide limited access to shared reading activities, print materials, and other literacy interactions. Children from these homes are likely to have poor oral language skills (Storch & Whitehurst, 2002) and lower academic skills at school entry (Whitehurst & Lonigan, 1998). This is especially the case for children living in poverty who also have limited exposure to language and vocabulary when interacting with their caregivers at home (Hart & Risley, 1995; Hoff, 2003).

Without access to a high-quality language and literacy environment at preschool or home, young children living in poverty can quickly succumb to the effects of limited resources and may demonstrate low levels of language skills on standardized measures (see Fish & Pinkerman, 2003; Spira, Bracken & Fischel, 2005).

Head Start: An Initial Effort. Perhaps the most well known effort to address the early learning needs of preschool-aged children is the Head Start program. Initiated in 1965, Head Start has always served the "whole child" with preschool education serving as one component of the comprehensive services the program provides. With an emphasis on families, many of whom now speak languages other than English (Tarullo, West, Aikens, & Hulsey, 2008), Head Start programs request the regular involvement of parents in programs that are designed to be responsive to each child's and family's ethnic, cultural, and linguistic heritage (U.S. Department of Health and Human Services, 2010).

Although the first evaluation of Head Start documented that cognitive gains children experienced faded after a few years in elementary school (Cicirelli, 1969), this early finding was based on a shortened summer program, did not have equivalent comparison groups, and overlooked the effects of the comprehensive goals of the program (Campbell & Erlebacher, 1970; U.S. Department of Health and Human Services, 2010). Desiring a more complete picture of the Head Start program, Congress mandated that the US Department of Health and Human Services determine the national impact of Head Start upon the children it served (U.S. Department of Health and Human Services, 2010) in conjunction with the reauthorization of the program in 1988 through the Head Start Impact Study.

Examining data collected between the years 2002-2006 for a 3-year-old cohort and a 4-year-old cohort, the Head Start Impact Study found statistically significant differences between

the children enrolled in Head Start and those in the control group. For the 4-year-old group, positive effects were noted for children's language and literacy development, with specific benefits in receptive vocabulary, letter-word identification, spelling, pre-academic skills, color identification, letter naming, and parent-reported emergent literacy. For the 3-year-old group, language and literacy related benefits were also found in vocabulary, letter-word identification, pre-academic skills, letter naming with the addition of elision (phonological processing), parent-reported emergent literacy, and a perceptual motor skills and pre-writing measure.

Interestingly, by the end of first grade, only a single cognitive impact remained for each cohort in the Head Start Impact Study. Specifically, the Head Start 4-year-old cohort performed significantly better on receptive vocabulary, and the 3-year-olds performed better on oral language comprehension. At the end of third grade, early effects of the intervention dissipated for both cohorts with a single favorable impact remaining for the 4-year-old cohort (i.e., ECLS-K Reading) and an unfavorable impact (i.e., grade promotion) noted for the 3-year-old cohort (Puma, et. al, 2012). While findings from the Head Start Impact Study provide support for the short term impact of the comprehensive Head Start program, lower performance on a national reading assessment, lower promotion rates, and attendance at public schools with elevated rates of poverty and minority students may ultimately have a greater impact upon the long term outcomes for the two participating cohorts.

Findings regarding the diminishing effects of Head Start are also consistent with more recent studies examining preschool fadeout (Magnuson et al., 2007), which suggests that children lose skills acquired during preschool during the primary grades, and the relationship between academic content coverage in kindergarten and student achievement (Claessens, Engel & Curran, 2014). In examining preschool fadeout, even students who did not attend preschool

were able to catch up with their preschool counterparts on reading measures if the instruction they received included smaller class sizes and more (than average) time spent on reading instruction (Magnuson et al., 2007). In other words, class size and instructional time during kindergarten were more important than preschool instruction. Additionally, exposure to advanced reading and mathematics instruction in kindergarten was found to best develop children's literacy skills, regardless of their preschool experiences or family economic circumstances (Claessens, Engel & Curran, 2014). While such findings do not provide definitive support for instruction offered during the preschool period, they do emphasize the value of providing high-quality early (i.e., preschool and kindergarten) instruction to young children to support sustained gains.

Interventions. With knowledge of the emergent literacy variables that best predict later literacy development and the programs that positively impact preschool-aged children's learning, the NELP sought to determine which interventions (i.e., procedures, programs or strategies) best support children's acquisition of language- and literacy-related skills and knowledge. To assist with the review of the literature and analyses, the panel focused primarily on code-focused interventions, shared-reading interventions, and language-enhancement interventions. Code-focused interventions, or those designed to teach skills related to the alphabetic code and phonological awareness, consistently demonstrated direct positive effects on children's conventional literacy skills (National Institute for Literacy, 2009). Shared-reading interventions that involved reading books to children produced statistically positive effects on children's print knowledge and oral language skills. Language-enhancement interventions were also found to significantly increase children's oral language skills, with the greatest effects noted when the

intervention was introduced to children toward the beginning of their preschool and kindergarten years.

Child Characteristics. Recognizing that every child is different, the panel sought to determine whether any child characteristics contributed to or inhibited gains in children's skills and abilities that are linked to later outcomes in reading, writing and spelling. While reporting limitations of most studies included in the meta-analysis prevented any true conclusions from being made, variables such as age, SES, and race did not seem to impact intervention effectiveness. Further research is still needed to determine which interventions are most effective with particular groups of children.

Issues with Preschool Programs

Despite evidence that quality preschool programs can support the development of emergent literacy skills known to predict children's later literacy acquisition and success, not all preschool programs provide a high-quality experience that fosters the development of such skills. Specifically, the NELP found that while a preschool program can positively impact children's development of reading- and writing-related skills, mere participation in a preschool program does not produce significant positive effects upon children's emergent literacy (National Institute for Literacy, 2009). Although the average effect sizes for programs were large enough to be of educational importance for literacy variables like reading, writing, and alphabet knowledge, these differences did not reach statistical significance. Literacy-related variables were also measured in too few studies to allow for a reliable determination of the impact of the preschool experience upon these skills (National Institute for Literacy, 2009). Given that approximately 57% of 3- to 5-year-old children attending center-based early childhood care and education

programs in the United States demonstrate developmental risk (U.S. Department of Education, National Center for Education Statistics, 2012), the implications of this finding are immense.

Recent large-scale studies suggest shortcomings in some preschool programs may be attributable to teachers' limited use of evidenced-based strategies associated with language development and a lack of explicit and systematic classroom-level instruction (Justice, Mashburn, Hamre, & Pianta, 2008; NICHD ECCRN, 2005). Specifically, unsuccessful programs are failing to offer frequent and positive adult-child verbal interactions that are known to be "critical to children's language growth" (Chapman, 2000, p. 43). Teachers in these programs are not maximizing their use of specific language facilitation techniques that provide adult models of language while encouraging children to practice and develop their expressive language skills (i.e., asking open-ended questions, repeating and extending children's utterances, modeling advanced vocabulary) (Dickinson, 2006; Girolametto & Weitzman, 2002; McKeown & Beck, 2006).

To better grasp the impact of not providing explicit and systematic instruction in preschool classrooms, it is important to detail what high-quality literacy instruction involves. Primarily, high-quality literacy instruction features systematic and explicit direct instruction that teaches children about the characteristics of written language, to include both phonological and print structures. It features a relatively teacher-directed approach to ensure literacy instruction is systematic and explicit (Byrne & Fielding-Barnsley, 1989; Justice, Chow, Capellini, Flanigan, & Colton, 2003; van Kleeck, Gillam, & McFadden, 1998), which means that teachers systematically organize and sequence lessons to "reveal the logic of the alphabetic system" (Adams, 2002, p. 74) and explicitly use clear terminology that focuses children's attention on the concepts being learned (Adams, 2002). Such instruction is different from that of high quality

language instruction, which is responsive to children's interests and conversationally oriented.

Another concern regarding preschool language and literacy instruction is the finding that classrooms rated as providing the poorest quality instruction are composed of higher proportions of children in poverty, higher rates of non-Caucasian children, and lower levels of maternal education; all established risk factors for academic difficulties (see LoCasale-Crouch et al., 2007; Pianta et al., 2005). While many interventions currently in use have been effective in small scale studies of relatively homogenous populations, research is needed on large scale preschool programs that significantly improve children's oral language and literacy skills while accommodating the heterogeneity of students (McDonald, Keesler, Kauffman, & Schneider, 2006). Researchers must seek to identify which programs or curricula are effective, under what circumstances success is achieved, and for whom value-added impacts are achieved (see McDonald, Keesler, Kauffman, & Schneider, 2006).

Moving Preschool Forward: The Early Reading First Initiative

The Early Reading First (ERF) Initiative, a component of the No Child Left Behind (NCLB) Act of 2001, was created in recognition of the growing understanding of the impact of high-quality preschool programs on later reading acquisition. Aimed at preparing preschool-aged children to enter kindergarten with the language, cognitive and reading skills necessary for success in reading (United States Department of Education, 2008a), the ERF Initiative was built on the evidence from Head Start studies. As such, the ERF initiative aimed to provide preschool-aged children from impoverished backgrounds with explicit and systematic language and literacy instruction that was sensitive to their emerging developmental skills (Landry, Smith, Swank, Assel, & Vellet, 2001). Through multi-year grants awarded to local education agencies, as well as other public, nonprofit, and private organizations, the ERF Initiative aimed to enhance teacher

practices, instructional content, and preschool classroom environments to increase the likelihood that children from low-income families began kindergarten with the skills needed for continued academic success.

The purpose of the ERF grant funds were to: (a) encourage and support efforts to enhance early language, cognitive, and reading development of children from low income families and/or English language learners (ELL) through strategies and professional development based on scientifically-based reading research (SBRR); (b) provide cognitively stimulating opportunities using high quality language and print-rich environments to foster knowledge and skills required for optimal learning; (c) incorporate language and literacy activities grounded by SBRR to support development of phonological awareness, oral language, print awareness, and alphabet knowledge; (d) use screening assessments to identify and monitor progress of preschool children at risk for reading failure; and (e) integrate SBRR materials and programs into existing preschool programs (United States Department of Education, 2008b). Overall, the ERF Initiative provided an opportunity to understand the wide-scale impact of participation in preschool programs that employed evidence-based practices explicitly and systematically. The current study was designed to build on the opportunity created by the ERF Initiative to investigate the impact of participation in an ERF program on literacy outcomes in kindergarten through second grade.

The Time is Now in Pre-K

In 2007, 32 Early Reading First grantees received funding for a total appropriation of $117,666,000. Of those grants selected for funding, one was awarded to Richmond County Schools in south central North Carolina. The project, *The Time is Now in Pre-K*, was designed to have a positive impact on the cognitive, early language, and literacy skills of preschool children by enhancing teacher practices, instructional content, and preschool classroom environments.

Faculty and staff at the Center for Literacy and Disability Studies of the University of North Carolina at Chapel Hill worked as subcontractors on the project leading the professional development and evaluation efforts. As the current investigation aimed to determine if the intervention provided to students who participated in *The Time is Now in Pre-K* ERF project resulted in lasting, positive effects upon literacy achievement during the primary grades, the design and other relevant details of the original project are provided in the following sections.

ERF Instructional Framework: The Hourglass Model

The *Hourglass Model* (Pierce, 2005) (Figure 2.1), an inclusive, integrated model of oral and written language development, assessment, and intervention, was selected as the instructional framework for *The Time is Now in Pre-K* project. As the shape suggests, the *Hourglass Model* symbolizes the imperative, time-sensitive need to develop pre-Kindergarten (pre-K) children's language and literacy-related skills prior to formal schooling.

Connecting early literacy instructional strategies with conventional literacy outcomes, each element of the *Hourglass Model* is grounded in scientific research and evidence-based practices. The base of the model contains evidence-based strategies that are known to positively impact children's oral language and literacy-related skills. Evidence-based strategies that support the development of oral language include rich oral language environments, extended conversations, and regular opportunities for shared storybook reading (National Center for Family Literacy, 2009). Providing rich oral language environments in a variety of meaningful, play-based activities is essential as it encourages children to produce and comprehend spoken language. Children's literacy-related skills are supported through emergent reading and writing interactions that include wide access to information, the alphabet, storybooks, writing tools and participation in purposeful writing activities.

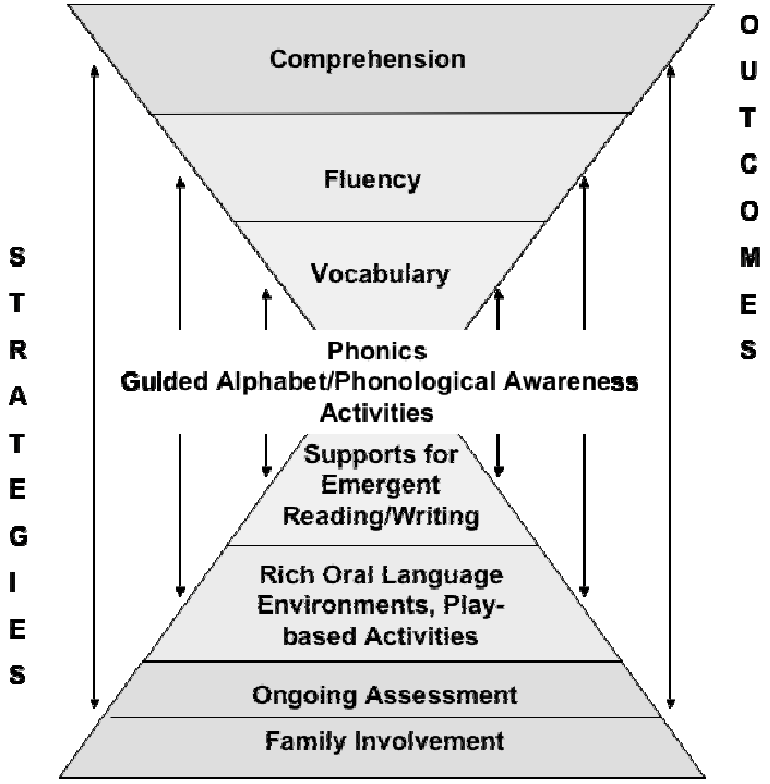

Figure 2.1
The Hourglass Model of Language and Literacy Development, Assessment, and Intervention

The upper portion of the *Hourglass Model* illustrates the individual outcomes (e.g. phonics, vocabulary, fluency and comprehension) that comprise conventional literacy (National Institute of Child Health and Human Development, 2000). Each of the conventional literacy outcomes is supported by the systematic and intentional use of the strategies contained within the base of the model. With the coordination of family members, early childhood special educators, related service providers, and early care and education personnel, young children develop the oral language and literacy-related skills necessary to support their development of conventional literacy skills. Employing a model that directly connected the evidence-based practices of preschool with the intended outcomes for older children, the *Hourglass Model* was intended to provide a framework that would accomplish the kindergarten readiness intended by the ERF

program while also increasing the likelihood that the gains would be maintained throughout the primary grades and beyond.

The goal of *The Time is Now in Pre-K* project was to examine the impact of combining child interest, interactive reading, and multi-turn conversations with a prescriptive preschool literacy curriculum on children's oral language and literacy outcomes. The main effects of the combined intervention were investigated in relation to children's expressive and receptive language, as well as their emergent literacy skills. The main hypothesis was that children receiving the combined intervention would show higher performance on oral language and literacy skills than their peers receiving a business as usual intervention that employed only the prescriptive literacy curriculum.

ERF Study Design

During Year 1 (2007-2008) and 2 (2008-2009) of the grant, *The Time is Now in Pre-K* project employed a quasi-experimental two-group pretest-posttest design using naturally occurring classroom groups assigned by the school system administration. Ten classrooms participated, with five serving as intervention classrooms and five serving as comparison classrooms. The administration of RCS selected teachers for each condition, but the criteria for the selection was not clear and no obvious pattern to the assignment was clear. Teachers in the five intervention classrooms received intensive professional development, in-class coaching, and guidance in planning interventions to address the language and literacy learning needs of their students with a focus on the neediest students who scored in the lowest percentile of the pre-test measures. Teachers in the five comparison classrooms used the existing programs, Creative Curriculum (Dodge, Colker & Heroman, 2002) and Opening the World of Learning (OWL;

Schickendanz, Dickinson & Charlotte-Mecklenburg, 2006). Outcomes for the students in the five intervention classes were compared to those of students in the five comparison classrooms.

ERF Participants

Teachers and teacher assistants of preschool classrooms, as well as a portion of the parents and caregivers of the children, served as adult participants. All teacher participants held either a Bachelors (n=7) or Masters (n=3) degree in early childhood education. The teacher assistants who participated were those assigned to work in classrooms selected for participation, and the parents and caregivers were volunteers from the group of parents and caregivers who participated in the program's family outreach program.

All of the participating preschool classrooms were funded primarily through the state's public pre-kindergarten (Pre-K) initiative, Exceptional Children funding, or Title I (i.e., Even Start). Each classroom had the capability to serve children with identified disabilities as each teacher had achieved Birth-Kindergarten licensure, which certifies the ability to teach children with, at risk for, and without disabilities ages birth-through six years. All programs were designed to serve at-risk children, and prioritized certain risk factors to determine eligibility. For the state Pre-K classrooms, enrollment was prioritized for children living in poverty whose families were at or below the 75% of the state's median income. Up to 20% of the students could exceed this income stipulation if they (a) had an identified disability, (b) were limited English proficient, (c) had a developmental or educational delay, and/or (d) had a chronic health problem. Admission to the Title I (i.e., Even Start) classrooms was prioritized for families with 3- and 4-year old children who wanted to improve their employment skills, and/or prepare for, and earn a GED. Prior to implementation of *The Time is Now in Pre-K* project, the primary language and literacy curriculums used in all of the classrooms were Creative Curriculum

(Dodge, Colker & Heroman, 2002) and Opening the World of Learning (OWL; Schickendanz, Dickinson & Charlotte-Mecklenburg, 2006).

The child participants for the first two years of *The Time is Now in Pre-K* project included 111 preschool-aged students (intervention n=55; comparison n=56) in Year 1 and 129 preschool-aged students (intervention n=70; comparison n=59) in Year 2. At the time of pre-testing in Year 1 and Year 2, students ranged in age from 38 to 71 months with a mean age of 54.87 months (SD = 5.7) and 36 to 67 months with a mean age of 52.85 months (SD = 5.65). Student demographics (e.g., gender, disability status, language spoken, race and ethnicity, socioeconomic status) specific to each year of the project are listed in Table 2.3. Students with identified disabilities demonstrated either a 30% delay in one developmental domain, or a 25% delay in two domains as required by the North Carolina Department of Public Instruction, Exceptional Children's Division.

Table 2.3
Student Demographics

	Year 1(2007-2008)		Year 2 (2008-2009)	
	N	Percent (%)	N	Percent (%)
Gender				
Male	60	54.10	80	62.00
Female	51	45.90	49	38.00
Disability Status				
None Identified	80	72.10	113	88.00
Identified	31	27.90	16	12.00
Language Spoken				
English	95	85.60	115	89.00
Spanish	16	14.40	14	11.00
Race/Ethnicity				
White	46	41.40	51	40.00
Black	41	36.90	47	36.00
Hispanic/Latino	17	15.30	17	13.00
Mixed Race	1	0.90	6	5.00
Native American	4	3.60	4	3.00
Other	2	1.80	4	3.00
SES Status				
Free Lunch	80	72.10	98	76.00
Reduced Lunch	8	7.20	9	7.00
Full Price	23	20.70	22	17.00

ERF Setting

When *The Time is Now in Pre-K* project was awarded, Richmond County was ranked within the lowest 300 locations in the US with respect to unemployment rates and within the top 500 poorest locations in the country (STAT Indiana, 2007). The county's unemployment rate was 7.9% compared to North Carolina's overall rate of 4.8% (N.C. Rural Economic

Development Center, 2007) and the national unemployment rate of 4.7% (U.S. Department of Labor, 2006). The census statistics at the time of the award (U.S. Census Bureau) reported that over 21% of the county's population of children aged 5-17 years lived below the federal poverty level with the average annual income of persons under the age of 25 ($20,411) substantially below the state average ($39, 184). Additionally, in the participating schools, an average of 77% (NC DPI: ERATE, 2006) of children were eligible for free or reduced-price lunches and fewer than 60% passed both the reading and math exams at the end of third grade (Public Schools of North Carolina, 2007).

With knowledge of the multiple risk factors encountered by children enrolled in Richmond County Schools, the Early Language and Literacy Classroom Observation Toolkit (ELLCO, Smith, et al., 2002) was completed to assess the language and literacy environment of all participating intervention and comparison classrooms. For Year 1, both intervention and comparison classrooms earned similar scores with relative strengths on the General Classroom Environment and the Literacy Environment Checklist subtests and relative weaknesses on the Literacy Activity Rating Scale and the Language, Literacy and Curriculum subtests. During Year 2, intervention classrooms earned scores higher than comparison classrooms at pre-test on all subtests of the ELLCO with the greatest difference in performance noted on the Literacy Environment Checklist and the Language, Literacy and Curriculum subtests.

Using the ELLCO findings, classroom level weaknesses were identified for Year 1 and Year 2 intervention and comparison classrooms. For Year 1 intervention classrooms, materials were purchased to address weaknesses identified and improve the overall learning environment. Intervention teachers also received guidance on how the materials could be effectively used to support student performance. In Year 2, the administration of RCS required that materials be

purchased for all classrooms (i.e., intervention and comparison) participating in the project. While intervention teachers again received support for how purchased materials could be used to support the learning of students, teachers of comparison classrooms were not given specific guidance on how to incorporate the materials in their classrooms.

ERF Professional Development/Intervention

In Year 1, all teachers assigned to the intervention condition received over 55 hours of professional development on emergent language and literacy assessment and intervention. The professional development was delivered through monthly 3-4 hour professional development sessions, weekly coaching sessions, and a three-day training seminar during the summer months. In Year 2, teachers and other classroom-based staff assigned to the intervention condition each participated in an additional 115 hours of professional development. Using the *Hourglass Model* as a framework, the content of professional development sessions targeted evidence-based strategies for promoting the oral and written language of young children. Specifically, teachers were taught how to identify and foster child interests, read interactively, and hold multi-turn conversations.

The professional development sessions emphasized integrating targeted language and literacy strategies (e.g. using child interests, providing additional small group readings, interactive reading sessions, and intentionally engaging in multi-turn conversations with individual children) with the existing OWL curriculum (Schickendanz, Dickinson & Charlotte-Mecklenburg, 2006). To inform and guide daily practice in the classrooms, teachers received weekly coaching from literacy coaches, and were asked to document children's conversations and participation in reading activities. Teachers were also provided with, and assisted in,

interpreting and recognizing the instructional implications of student pre-test results on language and literacy assessments.

To ensure intervention teachers were implementing the evidenced-based strategies targeted through professional development sessions, a variety of fidelity measures were implemented. Every week trained Literacy Coaches spent two to six hours in each intervention classroom. While in the classroom, Literacy Coaches provided intervention teachers and staff with coaching, feedback, and support on their implementation of strategies. Coaches also systematically reviewed logs of classroom activities kept by teachers. The Adult Child Interactive Reading Inventory (ACIRI; DeBruin-Parecki, 2007), a measure that assesses the quality of shared reading between adults and children, was also completed for all intervention teachers and teacher aides to assess their ongoing implementation of targeted strategies. Scores on the ACIRI were shared with intervention teachers and, when necessary, strategies to improve fidelity and the overall quality of shared reading interventions were discussed. Measures of fidelity were not completed for teachers and staff in comparison classrooms.

ERF Measures

To capture the effectiveness of *The Time is Now in Pre-K* intervention, standardized and non-standardized tests of language and literacy were administered to all preschool-aged students. All standardized measures administered had an internal consistency reliability of at least .75 (range .75 to .98), and concurrent validity of .66 or higher (range .66 to .92). Each measure is described in more detail below.

Vocabulary. Children's receptive vocabulary was assessed with the Peabody Picture Vocabulary Test – Fourth Edition (PPVT-IV; Dunn et al., 2006). This assessment required

children to select the picture out of a field of four that matched the target word spoken by the administrator. Raw scores were used to calculate standardized scores for each participant.

Oral Language. The Expressive Communication subtest of the Preschool-Language Scale – Fourth Edition (PLS-4; Zimmerman et al., 2002) was used to assess the expressive language skills of participating children. Children were asked to respond to pictures, answer questions, and tell stories about pictures, to demonstrate expressive vocabulary, semantic knowledge, syntactic knowledge, and ability to convey coherent concepts. Raw scores were used to calculate standard scores for each participant.

Alphabet Knowledge. Participants were asked to complete the Upper and Lower Case Letter Identification subtests of the Phonological Awareness Screening – Pre-K (PALS Pre-K; Invernizzi et al., 2001) measure. These subtests required children to name upper or lower case letters printed on a stimuli palate. As the administration sequence of the PALS Pre-K was developmentally constructed such that children only proceeded to successive subtests upon earning a passing score on the subtest prior, only participants able to correctly identify 16 or more letters on the Upper Case Letter subtest were asked to complete the Lower Case Letter subtest. Student performance on the Upper Case and Lower Case Letter Identification subtests was recorded as the number of letters correctly identified out of the 26 possible letters.

ERF Procedures

For both pre- and post-testing, a certified speech-language pathologist, special educator, or masters level speech-language pathology student administered all measures of child language and literacy. In Year 1, pre-testing was completed in the months of December and January after administrative factors delayed the start of the grant. In Years 2, pre-test measures were administered within four to six weeks of the beginning of the academic year. All Year 1 and 2

language and literacy-related post-test measures were administered within four to six weeks of the end of the academic year. All child participants were tested individually in a quiet room at their school, with testing requiring one to three 30-minute sessions.

ERF Results

Year 1. The influence of *The Time is Now in Pre-K* ERF project upon the language and literacy development of participating preschool-aged students differed across the first two years of the project. In Year 1, for which only four months of intervention was provided, pre-test standard scores on the PPVT-IV, a measure of receptive vocabulary skills, were significantly related to group membership, $F(1, 97) = 89.53$, $p < .05$, $r = .69$. After controlling for the effect of pre-test scores, no multivariate significant difference was found between the performance of students who participated in intervention and comparison classrooms on measures of language and literacy, $F(2,97) = 1.75$, $p > .05$. However, students in the intervention group significantly increased their performance from pre-test to post-test on the PPVT-IV, $t(46) = -4.17$, $p < .05$, $r = .52$ (pre-test $M = 88.74$, SE = 2.13; post-test $M = 95.26$, SE = 1.66). There was also a significant increase from pre-test to post-test in the number of students from intervention classrooms who displayed age-appropriate receptive vocabulary skills (i.e. standard scores of 85 and higher) and knowledge of alphabet letters at post-test. More specifically, of the 47 intervention students who completed both the pre-test and post-test version of the PPVT-IV, 72% (n=34) made growth as indicated by an increase in their standard score of four or more points. For the comparison group, 66% (n = 35) made growth on the PPVT-IV between pre-test and post-test.

Performance on the PALS Upper Case Letter Identification Subtest at pre-test was significantly related to group membership, $F(2,99) = 152.54$, $p > .05$, $r = .78$. After controlling

for pre-test performance, there was not a significant effect of the intervention on performance on the post-test PALS Upper Case Letter Identification Subtest, $F(2,99) = .08$, $p > .05$. Despite the lack of statistical significance between the groups, it is important to note that while only 28.8% of students in the intervention group met the federal standards of identifying 14 upper case letters at pre-test, 72.3% were able to do so at post-test. In contrast, 35.2% of the children in the comparison group could identify 14 or more upper case letters at pre-test and only 56.6% could identify 14 or more letters at post-test.

Finally, on the PLS-4, a small positive effect ($r = .27$) was noted for the expressive language skills of students in intervention classrooms. This positive effect was found despite students in the intervention group not scoring significantly higher at post-test ($M = 92.23$, SE = 19.15) than at pre-test ($M = 89.96$, SE = 16.69) and the performance of comparison students at post-test ($M = 93.55$, SE = 19.21) exceeding the performance of intervention students ($M = 92.23$, SE = 19.15). With these results, it is understandable that a significant difference on measures of language and literacy was not found between the intervention and comparison classrooms given the brief duration of the intervention and the measures employed.

Year 2. For Year 2 of *The Time is Now in Pre-K*, children in intervention and comparison classrooms performed similarly on pre-test measures of language and literacy skills. With this, while a significant difference was not found between the language and literacy performance of students who participated in intervention classrooms and comparison classrooms, $F(2,92) = 1.58$, $p > .05$, there was a significant increase in the number of students from intervention classrooms who displayed age-appropriate receptive vocabulary at post-test. Of those students in the intervention group who completed both the pre-test and post-test versions of the PPVT-IV, 74% displayed age-appropriate receptive vocabulary skills at post-test. Students in comparison

classrooms also significantly increased their language-related skills with 74% displaying age-appropriate receptive vocabulary skills at post-test.

On the PALS-PreK, there was not a significant difference between groups relative to the effect of the intervention on performance on the posttest PALS Upper Case Letter Identification Subtest, $F(2,85) = .18$, $p > .05$. However, children in the intervention group did score significantly higher on the PALS Upper Case Knowledge subtest at post-test ($M = 16.18$, SD = 8.78) than they did at pre-test ($M = 5.84$, SD = 7.40, $t(44) = -9.51$, $p < .05$, $r = .61$). This gain indicated significant growth in the ability of students in intervention classrooms to identify letters of the alphabet, a skill known to be an important predictor of conventional literacy. Children in comparison classrooms also scored higher on the PALS Upper Case Knowledge subtest at post-test ($M = 15.84$, SD = 9.41) than they did at pre-test ($M = 4.44$, SD = 6.05) indicating a level of growth similar to that of the intervention students.

Finally, on the Expressive Communication subtest of the PLS-4, children in both intervention (pre-test $M = 90.51$, SD = 17.61 ; post-test $M = 96.44$, SD = 18.75) and comparison classrooms (pre-test $M = 95.95$, SD = 12.86; post-test $M = 100.30$, SD = 18.20) increased their use of age appropriate expressive language from pre-test to post-test. Students in the intervention group scored significantly higher on the PLS Expressive Communication scale at posttest, $t(42) = -2.849$, $p > .05$).

While results from Years 1 and 2 individually did not reveal a significant difference in the development of language and literacy skills of students in intervention and comparison classrooms, individual groups of students in the intervention classrooms demonstrated significant gains. Combining the data across Year 1 and Year 2 revealed a significant main effect of participation in the intervention, $F(2,194) = 4.593$, p = .011, Wilk's l = .955, partial $e^2 = .045$.

This change in scores for students who participated in intervention classrooms supports the use of *The Hourglass Model* and other evidenced-based strategies utilized by classroom teachers to support student language and literacy development.

Participation in the intervention classrooms, fostered active participation in the preschool environment and, given our current understandings of the impact of early language and literacy interventions (National Center for Family Literacy, 2009), prepared students for the early stages of reading and formal schooling. The positive changes also demonstrated that students who received instruction that was child-directed and focused on small group and individual interactions and conversations between adults and children could make comparable progress in their skill acquisition to peers who received more traditional, skills-focused, teacher-directed instruction. Knowing the direct role oral language skills play in supporting students once they are able to decode words and are moving toward the comprehension of written texts (Dickinson et al., 2003; Storch & Whitehurst, 2001, 2002), it is expected that the benefits of participation in ERF intervention classrooms will be magnified as children progress through the primary grades and apply their early language and literacy skills to more sophisticated and conventional reading and writing tasks.

Conclusion

Research supports that language and literacy-related skills acquired by young children during the preschool period are crucial to later literacy acquisition. Specifically, young children must develop skills and knowledge related to alphabet knowledge, phonological awareness, writing, concepts about print and oral language, as such emergent literacy skills are known predictors of conventional literacy. Research also supports that for those children who attend preschool, emergent literacy skills are best developed through attendance at high-quality

preschool programs that offer explicit and systematic literacy instruction while providing frequent and positive adult-child verbal interactions that are structured around specific language facilitation techniques.

Despite understanding the impact that a high-quality preschool program can have upon young children's literacy development, many children who are at greatest risk of developing later academic difficulties attend preschool programs that do not provide high-quality literacy instruction. Therefore, to ensure that all children enter kindergarten with the language, cognitive and reading skills necessary for success in reading, the ERF Initiative was implemented to enhance teacher practices, instructional content, and preschool classroom environments. One such ERF grant, *The Time is Now in Pre-K* project, examined the impact of combining child interest, interactive reading, and multi-turn conversations with a prescriptive preschool literacy curriculum on children's oral language and literacy outcomes of preschool-aged children. Hypothesizing that the effects of the intervention would likely extend beyond the preschool period, the current study examined the effects of participation in *The Time is Now in Pre-K* project on kindergarten, first, and second grade language and literacy outcomes.

CHAPTER 3

Methods

The purpose of the study was to evaluate the effects of participation in *The Time is Now in Pre-K* Early Reading First (ERF) project on kindergarten, first, and second grade language and literacy outcomes. Secondary objectives of the study were to determine if the effects of participation in *The Time is Now in Pre-K* ERF project: (1) were associated with child demographic variables, (2) were associated with teacher or school assignment, and (3) changed after one or two years of literacy instruction in the primary grades.

Research Hypotheses

One primary and three secondary research questions drove this investigation. Based upon the hypothesis that students who participated in ERF intervention classrooms would demonstrate higher scores on language- and literacy-related measures in years following their participation in the ERF project than students who participated in comparison classrooms, the primary research question was:

1. What are the effects of participation in *The Time is Now in Pre-K* ERF project on kindergarten, first, and second grade language and literacy outcomes?

Two of the secondary research questions explored demographic and other factors that might have contributed to a difference between the language and literacy-related skills of the intervention and comparison students. These two secondary questions were:

2. For Year 1 participants, are the effects of participation in *The Time is Now in Pre-K* ERF project associated with or mediated by demographic variables?

3. Are the effects of participation in *The Time is Now in Pre-K* ERF project associated with or mediated by teacher or school assignment?

It was hypothesized that both student-level demographic variables (i.e., age, gender, race, language spoken, exceptionality, and condition) and environmental-level factors (i.e., teacher and school assignment) would have an effect on the outcomes of student's participation in *The Time is Now in Pre-K* ERF project.

Finally, as it was believed that a difference would be noted in the effects of participation in *The Time is Now in Pre-K* ERF project after one or two years of literacy instruction in school, the following secondary research question was asked:

4. Do the effects of participation in *The Time is Now in Pre-K* ERF project change after one or two years of literacy instruction in school?

Setting and Participants

The current study was conducted in a public school district, Richmond County Schools (RCS) in the south central area of North Carolina. It was a follow-up to *The Time is Now in Pre-K* intervention study conducted while the participants were in preschool. The students in the intervention group all participated in the ERF intervention based on the Hourglass Model during their preschool year. The students in the comparison group all received instruction based on each individual teacher's use of the Creative Curriculum (Dodge, Colker, & Heroman, 2002) and Opening the World of Learning (Schickendanz, Dickinson, & Charlotte-Mecklenburg, 2006). The data were collected over a period of four years spanning preschool through second grade.

Setting

Student participants attended all eight of the elementary schools located within the RCS district. During the 2010-2011 academic year, these eight elementary schools served 3472 students in grades kindergarten through fifth. The average number of overall children enrolled in kindergarten, first, and second grade classrooms at each of the eight schools is listed in Table 3.1. The school level numbers of students served at the elementary school level are in comparison to the district level average of 485 students and the state level average of 497 students. Although preschool children attended each elementary school listed, the average number of students enrolled in preschool classrooms was not included in formal reports. The school names are pseudonyms.

Table 3.1
School-level Numbers of Elementary Students Served

School	Kindergarten	First Grade	Second Grade	School Total
Cedar	N/A	N/A	N/A	80
Eucalyptus	23	19	23	595
Filbert	19	21	19	606
Linden	19	19	21	521
Magnolia	21	20	16	436
Mountainash	19	16	18	372
Walnut	21	21	23	504
Willow	18	18	20	358

Note. From Education First North Carolina School Report Cards. Retrieved on October 7, 2014 from: http://www.ncreportcards.org/src/search.jsp?pYear=2010-2011&pList=1&pListVal=770%3ARichmond+County+Schools&GO2=GO
Note. Other elementary schools that served students in the district during the 2007-2008 and 2008-2009 academic years included Redwood, Sycamore, Red Oak and Red Maple

The race and ethnicity of students served in each of the elementary schools varied in comparison to the school system and state averages. Ethnic representation data at the school,

district and state level, as reported on the school system and individual school web sites, is provided in Table 3.2

Student Participants

Kindergarten, first, and second grade students enrolled in Richmond Country Schools (RCS) for the 2010-2011 academic year who also participated in Years 1 (2007-2008) or 2 (2008-2009 of *The Time is Now in Pre-K* ERF project participated in the study. All students attended one of the following eight elementary schools: Cedar, Eucalyptus, Filbert, Linden, Magnolia, Mountainash, Walnut, Willow. Of the potential pool of student participants (N= 481) from *The Time is Now in Pre-K* ERF project, approximately two-thirds participated in an ERF intervention classroom while the other one-third participated in a comparison classroom.

Students were selected for inclusion based upon their current enrollment in RCS, and the availability of data for either the North Carolina K-2 Literacy Assessment (North Carolina Department of Public Instruction, 2009) or the Dynamic Indicators of Basic Early Literacy Screening (DIBELS; Good & Kaminski, 2002). Of the total number of potential students, 41 (Year 1 = 21 students; Year 2 = 20 students) were excluded after withdrawal from RCS, and 7 were excluded from the study due to missing data on both the North Carolina K-2 Literacy Assessment and the DIBELS (Year 1 = 4; Year 2 = 3). Students were not excluded on the basis of their gender, ethnicity, race, age, or primary language spoken.

Of the students included in the current investigation, 88 participated in Year 1 of *The Time is Now in Pre-K* ERF project. At the time of data collection, 81 were in second grade, 5 were in first grade and 2 were in kindergarten. An additional 81 students included in the current investigation participated in Year 2 of the ERF project. These 81 students included 77 in first grade and 4 who were in kindergarten at the time of the current data collection.

Table 3.2
Ethnic Representation for Richmond County School Sites Compared to County and State

Ethnicity	C%	EU%	FL%	LI%	MG%	MN%	WA%	WI%	County%	State%
American Indian	2.60	5.2	7.8	1.3	3.4	3.8	1.0	5.0	4.5	1.50
Asian	1.30	0.20	0.20	2.50	0.50	0.00	1.00	2.30	1.10	2.50
Hispanic	5.20	11.10	6.50	4.40	29.30	13.70	5.90	12.30	8.30	12.70
Black	46.80	25.10	32.30	36.60	31.60	54.50	43.00	26.40	38.30	26.40
White	41.60	54.60	50.80	51.30	32.70	27.20	46.40	51.00	45.50	53.10
Multi-Racial	2.60	3.50	2.20	3.80	2.50	0.50	2.80	2.90	2.20	--
Pacific Islander	--	0.30	0.30	--	--	0.30	--	--	-.10	--

Note. C = Cedar, EU= Eucalyptus, FL = Filbert, LI =Linden, MG =Magnolia, MN = Mountainash, WA = Walnut, WI = Willow

Note. School-level percentages are reported for kindergarten through fifth grade students; County-level percentages are reported for all schools in county serving kindergarten through twelfth grade students; State-level percentages are reported for all schools in state serving kindergarten through twelfth grade students. State percentage information retrieved on October 7, 2014 from: http://www.dpi.state.nc.us/docs/fbs/resources/data/factsfigures/2010-11figures.pdf

While student level demographic information was generated for all preschool Year 1 and Year 2 students who enrolled in the original *The Time is Now in Pre-K* ERF project (see Table 2.3), updated demographic data was generated for the sub-group of students included in this study. As depicted in Table 3.3, the average student age at the end of preschool was between 60 (i.e., 5 years old) and 62 (i.e., 5 years, 2 months old) months and a greater percentage of males (i.e., Year 1 = 56.82%; Year 2 = 60.26%) than females (i.e., Year 1 = 43.18%; Year 2 = 39.74%) participated in both years of the project. A majority of students were identified as White or African American and most students spoke English as their primary language. Additionally, 23.60% of Year 1 students and 2.60% of Year 2 students were identified as having a disability. It is believed that RCS' district-wide policy change regarding how students with identified disabilities were served is responsible for the noticeable decrease in the percentage of students with identified disabilities who participated in Year 2 of the ERF project. Rather than serving children with identified disabilities at numerous elementary schools across the district, children with multiple and/or significant needs were sent to a single location within the district.

Information pertaining to the number of students enrolled at each school and the percentage of students assigned to each teacher is located in Tables 3.4-3.11. For Year 1 students, school and teacher data is reported for preschool through second grade. As second grade data was not available for Year 2 students, only preschool through first grade school and teacher data is reported. As school and teacher data was not available for all students in all grades regardless of their participation in Year 1 or Year 2 of the project, the findings reported below only represent information that was available at the time of data collection.

Table 3.3
Demographic Characteristics of Year 1 and Year 2 Students

	Year 1 (%)	Valid (Missing)	Year 2 (%)	Valid (Missing)
Age (months)*		86(3)		78(0)
Mean	60.05		62.10	
St. Dev.	5.16		2.77	
Range	27		11	
Race		88(1)		78(0)
White	40(45.45)		33(42.86)	
Black/African American	28(31.81)		22(28.57)	
Hispanic	13(14.78)		12(15.58)	
American Indian/Native	4(4.54)		2(2.60)	
Other	2(2.27)		8(10.39)	
Asian/Asian Islander	1(1.14)		--	
Gender		88(1)		78(0)
Male	50(56.82)		47(60.26)	
Female	38(43.18)		31(39.74)	
Language Spoken (ELL)		88(1)		77(1)
English	76(86.37)		66(85.71)	
Spanish	12(13.63)		11(14.28)	
Exceptionality		89(0)		1(77)
Not Reported/Typically Developing	68(76.40)		--	
Developmental Delay	15(17.05)		--	
Speech Language Impairment	6(6.81)		--	
EC	--		1(1.30)	

Note. *Age in months at end of preschool year

Table 3.4
Frequencies for Year 1 and Year 2 Preschool Students by Teacher

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=47	Comparison (percent) n=41	Intervention (percent) n=44	Comparison (percent) n=35
$T1_9$	11(23.40)	--	10(22.70)	--
$T2_7$	6(12.80)	--	--	--
$T3_{10}$	1(2.10)	--	7(15.90)	--
$T4_{12}$	13(27.70)	--	12(27.30)	--
$T5_4$	15(31.90)	--	11(25.00)	--
$T17_6$	1(2.10)	--	--	--
$T11_{10}$	--	--	4(9.10)	--
$T6_9$	--	9(22.00)	--	8(22.90)
$T7_5$	--	12(29.30)	--	9(25.70)
$T8_9$	--	7(17.10)	--	6(17.10)
$T9_{10}$	--	2(4.90)	--	3(8.60)
$T10_{8,6}$	--	11(26.80)	--	9(25.70)
Missing	--	0(0.00)	0(0.00)	0(0.00)

Note. Numeric subscripts indicate school assignment for teacher with 1 = Cedar; 2 = Eucalyptus; 3 = Filbert; 4 = Linden; 5 = Magnolia; 6 = Mountainash; 7 = Redwood; 8 = Red Maple; 9 = Red Oak; 10 = Sycamore; 11 = Walnut; 12 = Willow

Table 3.5
Frequencies for Year 1 and Year 2 Preschool Students by School

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=47	Comparison (percent) n=41	Intervention (percent) n=44	Comparison (percent) n=35
Linden	15(31.90)	--	11(25.00)	--
Willow	13(27.70)	--	12(27.30)	--
Magnolia	--	12(29.30)	--	9(25.70)
Redwood	6(12.80)	--	--	--
Red Maple	--	11(26.80)	--	--
Mountainash	1(2.10)	--	--	9(25.70)
Red Oak	11(23.40)	16(39.00)	10(22.70)	14(40.00)
Sycamore	1(2.10)	2(4.90)	11(25.00)	3(8.60)
Missing	0(0.00)	0(0.00)	0(0.00)	0(0.00)

Table 3.6
Frequencies for Year 1 and Year 2 Kindergarten Students by Teacher

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=46	Comparison (percent) n=43	Intervention (percent) n=44	Comparison (percent) n=36
$T20_1$	--	1(2.30)	--	--
$T22_9$	2(4.30)	3(7.00)	6(13.60)	5(13.90)
$T25_3$	1(2.20)	--	--	--
$T29_3$	--	1(2.30)	--	--
$T26_3$	--	--	1(2.30)	--
$T31_4$	2(4.30)	2(4.70)	2(4.50)	--
$T32_4$	--	--	2(4.50)	--
$T33_4$	4(8.70)	--	4(9.10)	--
$T34_5$	1(2.20)	--	--	1(2.80)
$T35_5$	--	4(9.30)	1(2.30)	4(11.10)
$T37_9$	--	1(2.30)	--	--

$T36_5$	--	--	--	3(8.3)
$T38_{12}$	3(6.50)	--	2(4.50)	1(2.80)
$T39_6$	1(2.20)	2(4.70)	3(6.80)	3(8.30)
$T51_5$	--	5(11.60)	--	--
$T55_6$	--	--	--	4(11.10)
$T58_9$	2(4.30)	2(4.70)	3(6.80)	6(16.70)
$T85_9$	1(2.20)	2(4.70)	--	--
$T105_4$	1(2.20)	--	1(2.30)	1(2.80)
$T84_6$	1(2.20)	--	--	--
$T96_{11}$	1(2.20)	--	--	--
$T95_6$	--	2(4.70)	1(2.30)	2(5.60)
$T97_{11}$	1(2.20)	1(2.30)	1(2.30)	1(2.80)
$T98_{11}$	2(4.30)	--	--	--
$T101_{12}$	7(15.20)	--	3(6.80)	--
$T103_{12}$	5(10.90)	1(2.30)	--	--
$T105_4$	2(4.30)	1(2.30)	--	--
$T109_{11}$	1(2.20)	--	--	--
$T113_1$	2(4.30)	--	--	--
$T106_5$	--	4(9.30)	--	2(5.60)
$T10_8$	--	2(4.70)	--	--
$T111_{11}$	--	1(2.30)	--	--
$T114_{12}$	--	--	2(4.50)	1(2.80)
$T115_3$	--	1(2.30)	2(4.50)	--
$T116_4$	1(2.20)	--	3(6.80)	--
Missing	5(10.90)	7(16.30)	5(11.40)	2(5.60)

Note. Numeric subscripts indicate school assignment for teacher with 1 = Cedar; 2 = Eucalyptus; 3 = Filbert; 4 = Linden; 5 = Magnolia; 6 = Mountainash; 7 = Redwood; 8 = Red Maple; 9 = Red Oak; 10 = Sycamore; 11 = Walnut; 12 = Willow

Table 3.7
Frequencies for Year 1 and Year 2 Kindergarten Students by School

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=46	Comparison (percent) n=43	Intervention (percent) n=44	Comparison (percent) n=36
Cedar	2(4.30)	1(2.30)	--	--
Filbert	1(2.20)	2(4.70)	3(6.80)	--
Linden	11(23.90)	2(4.70)	12(27.30)	--
Willow	15(32.60)	1(2.30)	7(15.90)	2(5.60)
Magnolia	1(2.20)	13(30.20)	1(2.30)	10(27.80)
Mountainash	2(4.30)	5(11.60)	4(9.10)	9(25.00)
Eucalyptus	--	--	--	1(2.80)
Red Oak	7(15.20)	10(23.30)	8(18.20)	10(27.80)
Walnut	5(10.90)	4(9.30)	4(9.10)	2(5.60)
Missing	2(4.30)	5(11.60)	5(11.40)	2(5.60)

Table 3.8
Frequencies for Year 1 and Year 2 First Grade Students by Teacher

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=45	Comparison (percent) n=42	Intervention (percent) n=42	Comparison (percent) n=35
$T40_2$	1(2.20)	2(4.80)	4(9.50)	3(8.60)
$T41_2$	2(4.40)	4(9.50)	--	--
$T42_2$	1(2.20)	--	3(7.10)	1(2.90)
$T43_{2.3}$	--	1(2.40)	1(2.40)	6(17.10)
$T44_3$	--	1(2.40)	1(2.40)	2(5.70)
$T45_3$	--	--	1(2.40)	1(2.90)
$T46_3$	--	1(2.40)	1(2.40)	--
$T47_4$	3(6.70)	--	4(9.50)	--
$T48_4$	3(6.70)	--	4(9.50)	--
$T50_4$	2(4.40)	3(7.10)	3(7.10)	--

$T49_4$	3(6.70)	--	--	1(2.90)
$T51_5$	--	6(14.30)	2(4.80)	1(2.90)
$T55_6$	2(4.40)	--	1(2.40)	--
$T58_{11}$	1(2.20)	--	--	--
$T52_5$	--	2(4.80)	--	4(11.40)
$T53_5$	--	1(2.40)	--	1(2.90)
$T54_5$	--	2(4.80)	--	2(5.70)
$T56_6$	--		2(4.80)	4(11.40)
$T57_6$	--	2(4.80)	1(2.40)	1(2.90)
$T59_{11}$	1(2.20)	2(4.80)	--	--
$T60_{11}$	1(2.20)	1(2.40)	1(2.40)	2(5.70)
$T61_{11}$	--	--	1(2.40)	1(2.90)
$T62_{12}$	3(6.70)	--	3(7.10)	1(2.90)
$T63_{12}$	7(15.60)	1(2.40)	4(9.50)	--
$T64_{12}$	3(6.70)	2(4.80)	1(2.40)	--
$T71_6$	--	1(2.40)	--	--
$T82_5$	--	1(2.40)	--	--
$T102_9$	1(2.20)	1(2.40)	--	--
$T104_2$	--	1(2.40)	2(4.80)	4(11.40)
$T107_6$	1(2.20)	4(9.50)	--	--
$T110_{11}$	1(2.20)	--	--	--
$T112_{11}$	1(2.20)	1(2.40)	--	--
Missing	8(17.80)	2(4.80)	0(0.00)	0(0.00)

Note. Numeric subscripts indicate school assignment for teacher with 1 = Cedar; 2 = Eucalyptus; 3 = Filbert; 4 = Linden; 5 = Magnolia; 6 = Mountainash; 7 = Redwood; 8 = Red Maple; 9 = Red Oak; 10 = Sycamore; 11 = Walnut; 12 = Willow

Table 3.9
Frequencies for Year 1 and Year 2 First Grade Students by School

	Year 1 Students		Year 2 Students	
	Intervention (percent) n=45	Comparison (percent) n=42	Intervention (percent) n=42	Comparison (percent) n=35
Filbert	--	2(4.80)	3(7.10)	3(8.60)
Linden	11(24.40)	3(7.10)	11(26.20)	1(2.90)
Willow	13(28.90)	3(7.10)	8(19.00)	1(2.90)
Magnolia	--	12(28.60)	2(4.80)	8(22.90)
Mountainash	3(6.70)	7(16.70)	4(9.50)	5(14.30)
Eucalyptus	3(6.70)	2(4.80)	10(23.80)	14(40.00)
Red Oak	2(4.40)	7(16.70)	--	--
Walnut	5(11.10)	4(9.50)	4(9.50)	3(8.60)
Missing	8(17.80)	2(4.80)	0(0.00)	0(0.00)

Table 3.10
Frequencies for Year 1 Second Grade Students by Teacher

	Year 1 Students	
	Intervention (percent) n=36	Comparison (percent) n=36
$T1_6$	--	2(5.60)
$T48_4$	1(2.80)	--
$T70_2$	5(13.90)	2(5.60)
$T71_2$	4(11.10)	2(5.60)
$T72_2$	2(5.60)	3(8.30)
$T73_2$	--	1(2.80)
$T74_3$	--	1(2.80)
$T75_3$	--	1(2.80)
$T76_4$	--	1(2.80)
$T77_4$	3(8.30)	2(5.60)
$T78_4$	2(5.60)	--

$T79_4$	4(11.10)	--
$T80_5$	--	2(5.60)
$T81_5$	--	1(2.80)
$T82_5$	--	2(5.60)
$T83_5$	--	4(11.10)
$T84_6$	--	2(5.60)
$T85_6$	--	1(2.80)
$T86_{11}$	1(2.80)	3(8.30)
$T87_{11}$	2(5.60)	1(2.80)
$T88_{11}$	2(5.60)	--
$T89_{12}$	4(11.10)	3(8.30)
$T90_{12}$	4(11.10)	--
$T91_{12}$	2(5.60)	2(5.60)
Missing	0(0.00)	0(0.00)

Note. Numeric subscripts indicate school assignment for teacher with 1 = Cedar; 2 = Eucalyptus; 3 = Filbert; 4 = Linden; 5 = Magnolia; 6 = Mountainash; 7 = Redwood; 8 = Red Maple; 9 = Red Oak; 10 = Sycamore; 11 = Walnut; 12 = Willow

Table 3.11
Frequencies for Year 1 Second Grade Students by School

	Year 1 Students	
	Intervention (percent) n=36	Comparison (percent) n=36
Filbert	--	2(5.60)
Linden	10(27.80)	3(8.30)
Willow	10(27.80)	5(13.90)
Magnolia	--	9(25.00)
Mountainash	--	5(13.90)
Eucalyptus	11(30.60)	8(22.20)
Walnut	5(13.90)	5(13.90)
Missing	0(0.00)	0(0.00)

Procedures

All students who met the criteria of having participated in either Year 1 or 2 of *The Time is Now in Pre-K* ERF project and were enrolled in Richmond County Schools were considered potential participants for this study. As data for the proposed study was collected as part of RCS's general operating procedures and was readily available, a waiver of consent was granted by the Human Subjects Review Board of the University of North Carolina at Chapel Hill. Dr. Michael D. Perry, the Assistant Superintendent of RCS, also formally supported access to data, as the results will be used to inform local decisions regarding ongoing support of early intervention efforts like ERF.

Data Collection Procedures

To initiate the data collection effort, the NCWise data clerk from RCS determined the 2010-2011 attending school of each student who participated in Year 1 or Year 2 of *The Time is Now in Pre-K* ERF project. Once this information was determined, individual lists of children at each school were generated. These lists were then shared with two district-level personnel who worked on *The Time is Now in Pre-K* ERF project. These individuals were chosen to assist with the data collection process as they were employees of RCS, had participated on the project, and were familiar with the staff and students at each of the elementary school sites.

The primary researcher and two district-level personnel located and copied all data pertaining to the North Carolina K-2 Literacy Assessment for each child on each list. As delineated by the master schedule created by the primary researcher, two weeks were spent visiting each of the eight elementary schools where participants of *The Time is Now in Pre-K* ERF project attended. At each elementary school, the cumulative files for student participants were pulled from the file room and sorted for information pertaining to the measures required for

the current study, North Carolina K-2 Literacy Assessment and DIBELS, which are described in more detail in a subsequent section of this chapter. Paper copies were then made of the relevant assessment information, returned to the cumulative folder and re-filed in the file room. At the close of each day of data collection, the primary researcher checked all copies of data against the master list of students attending each school. In instances where data could not be located for students (e.g. the entire cumulative folder was missing), the NCWise data clerk was contacted and asked to confirm if the students in question had changed schools within the district or moved out of district. For students enrolled in RCS but attending a school other than the one originally listed, follow-up visits were made to secure the necessary student data. In addition to obtaining data related to the North Carolina K-2 Literacy Assessment and the DIBELS data for each student, onsite at each elementary school, the NCWise data clerk provided demographic and attendance data for each student who participated in *The Time is Now in Pre-K* ERF project. Student-level demographic data was necessary for secondary research questions that explored the influence of such variables upon student's language and literacy-related skills in the intervention and comparison classrooms.

All data gathered was first grouped by year of participation in *The Time is Now in Pre-K* ERF project and then organized by teacher and school. Each student participant was assigned an alphanumeric identifier to remove all personally identifying information from the data and the data were entered into spreadsheets. Once organized, cleaned and entered on the spreadsheets, original data were filed in a locked and secure area at the University of North Carolina, Chapel Hill. The master list of student alphanumeric identifiers was stored in a location separate from the hard copies of the data. Only the primary researcher and the faculty advisor had access to the master codes.

To increase the accuracy of data collected by the teachers, item level responses, sub-test scores and other summative scores on the North Carolina K-2 Literacy Assessment were double-checked by the primary researcher. Errors noted were classified as either minor or major scoring errors. Minor scoring errors were not observed to change the documented student score and were often related to decimal points and improper rounding. Major scoring errors were those that changed the documented student score and were often related to incorrect summation, subtraction or division of numbers. Through this process a total of 354 scoring errors were found for Year 1 Students. Of the 344 errors, 134 (i.e., 37.85%) were classified as minor mistakes and 220 (i.e., 62.15%) were classified as major errors. Similarly, of the 151 scoring errors noted for Year 2 student data on the North Carolina K-2 Literacy Assessment, 51 (i.e., 33.77%) were classified as minor errors, and 100 (i.e., 66.23%) were classified as major errors. For all major scoring errors that changed the nature of the data (i.e., documented student score), the data was revised to show the correct information. This revision was made on the hard copy of the data and in the spreadsheet of the data. The primary researcher kept a log of all minor and major errors found in the data and subsequent revisions made to the hard and electronic data. It should be noted that no corrections or revisions were made to the DIBELS data that is collected online via the mCLASS software and only subtest scores are reported. As such, it was not possible to check the accuracy of item-level data on this measure.

After data pertaining to the North Carolina K-2 Literacy Assessment data were checked for accuracy, the primary researcher entered the data into a data management system. Data entered for the North Carolina K-2 Literacy Assessment consisted of item-level data (i.e., student responses to each question contained within a subtest) as well as subtest scores (i.e., summative scores). Data entered for the DIBELS measure consisted of subtest scores only. Additionally,

demographic data and data related to the language and literacy performance of student's during their preschool year (i.e., data originally collected through *The Time is Now in Pre-K* ERF project) were entered. See Appendix A for a complete list of the variables for which data was collected for each student.

Preschool Assessment Measures

During preschool, all Year 1 and 2 students participating in *The Time is Now in Pre-K* intervention and comparison classrooms completed a battery of language and literacy measures. Children's receptive vocabulary was assessed with the Peabody Picture Vocabulary Test - Fourth Edition (PPVT-IV, Dunn et al., 2006), which required children to point to one of four pictures presented on the test stimulus that corresponds to the target spoken word. The Expressive Communication subtest of the Preschool-Language Scale - Fourth Edition (PLS-4; Zimmerman et al., 2002) was used to measure student expressive language skills. This measure required preschool children to respond to pictures, answer questions and tell stories about pictures they saw. Finally, participant's emergent literacy skills were assessed through the Upper Case and Lower Case Letter Identification subtests of the Phonological Awareness Literacy Screening – Pre-K (PALS Pre-K, Invernizzi et al., 2001). These subtests required children to name the letters they knew when presented with a stimuli palate of either all upper case or all lower case letters. A concise protocol for measures administered during the preschool period can be found in Table 3.12. Preschool-aged data obtained as part of the ERF program was collected under the direct supervision of the primary investigator of the current study. Scores on all the measures were carefully double-checked, cleaned, entered and subsequently rechecked by members of the research team.

Table 3.12
Preschool Assessment Measures

Component Area	Assessment	Subtest(s)
Alphabet Knowledge	PALS-PreK	Upper Case Letter Knowledge
		Lower Case Letter Knowledge
Receptive Vocabulary	PPVT-IV	Entire measure
Expressive Language	PLS-4	Expressive Communication

Elementary Assessment Measures

Language- and literacy-related data for elementary-aged students was collected as part of RCS's general operating procedures. Classroom teachers at each elementary school administered all measures. While teachers received training from the school system regarding the administration, use, and interpretation of the assessments, no system for monitoring the fidelity of test administration or checking the reliability of scoring was reported.

North Carolina K-2 Literacy Assessment

All children enrolled in kindergarten, first, and second grade in RCS were required to complete the North Carolina K-2 Literacy Assessment (North Carolina Department of Public Instruction, 2009). This assessment examined student's language- and literacy-related skills and included the following subtests (grade levels for each subtest indicated in parentheses): Letter and Sound Identification (K, 1, and 2 as needed), Book and Print Awareness (K, 1, and 2 as needed), Phonemic Awareness (K, 1, 2), Running Records (Quantitative and Qualitative Fluency) (K as needed, 1, 2), Oral Retell (K as needed, 1, 2), Spelling Inventory (K, 1, 2), and Writing (K, 1, 2). Classroom teachers administered the recommended subtests to all students at the beginning- (BOY), middle- (MOY) and end-of-the-year (EOY). Item-level responses, subtest scores, and total scores were collected for all students. Subtests of the North Carolina K-2

Literacy Assessment administered to students in grades kindergarten, first, and second are listed in Table 3.13. A detailed description of each subtest is provided below.

Letter and Sound Identification. The Letter and Sound Identification subtest was used to assess student's ability to recognize the printed form of letters and their sounds (North Carolina Department of Public Instruction, 2009). For the test, a stimulus sheet with upper case letters was placed in front of the student. The student was then asked to provide the name and sound for each letter. The process was repeated with a new stimulus palate that contained lower case letters. If students were able to name the sound for a letter on the upper case stimulus sheet, they were not asked to reproduce the sound on the lower case palate. After presenting both stimulus plates, the total number of letters (i.e., upper and lower case) and sounds correctly identified by the student were tallied and recorded. Once a student demonstrated the ability to correctly name all letters on the upper and lower case stimulus palates, the subtest was not re-administered.

Book and Print Awareness. The Book and Print Awareness subtest examined a student's foundational skills related to books and print that facilitate learning to read and write at the independent level (North Carolina Department of Public Instruction, 2009). For this subtest, students were asked to read a book, *No Sandwich*, with the examiner. Through the course of reading the book, students were asked to complete different tasks related to book and print awareness. Specific concepts and skills measured included identification of the different parts of a book (i.e., front, back, spine, pictures, text), identification of letters, words and punctuation on book pages, understanding that print carries meaning and other print-related conventions that aid readers. The entire subtest was administered to all students.

Phonemic Awareness. The Phonemic Awareness subtest assessed student's ability to recognize and manipulate sounds (North Carolina Department of Public Instruction, 2009). All

items on the subtest were presented orally with picture cards available as needed for some subtest. Students were asked to recognize and generate rhymes, identify and isolate initial and final sounds, blend and segment phonemes (i.e., the smallest unit of sound in the English language), and delete and substitute phonemes. As this subtest is developmental in nature, only certain items were recommended for administration at each grade level. Additionally, as soon as students were able to correctly answer items on the subtest, the items were considered mastered and were not included in successive administrations of the subtest.

Oral Retell. After reading each passage orally, students were asked to retell the passage to the examiner. The Oral Retell task assessed a student's approach to text and their ability to retell a text in their own words (North Carolina Department of Public Instruction, 2009). As students completed their retelling, the examiner utilized the Oral Retell Response Sheet to check for specific mention of the main idea, characters and setting, sequence of events, knowledge of the author's purpose, level of detail and making connections with other information and/or personal experiences. For each criteria point on the response sheet, the examiner scored the student's response as unaided (i.e. completed without any assistance from the examiner) or aided (i.e., completed with assistance from the examiner). A rubric with examples of fiction and nonfiction prompts that the examiner could provide for each criteria point on the response sheet was provided. Based upon how thoroughly and independently the student addressed the retelling criteria, a rating score ranging from 1 to 4 points (i.e., 1 = unable; 2 = some; 3 = sufficient; 4 = exceeds) was assigned to each criteria point.

Primary Spelling Inventory. The next subtest on the North Carolina K-2 Literacy Assessment was the Primary Spelling Inventory. The purpose of this subtest was to assess student's knowledge of letters and sounds in words (North Carolina Department of Public

Instruction, 2009). Unlike other subtests, the Primary Spelling Inventory was administered to either small groups of students or to the entire class. For this subtest, the teacher first said each target word and then used the word in a sentence. Students were asked to spell (i.e., write) each target word on a response sheet. Depending on the grade of the students, the teacher administered either a portion of the target words (i.e., kindergarten and first grade students) or the entire list of words (i.e., second grade students). For each item administered, a point was awarded for spellings that included targeted features of words (e.g., including the letters "dr" and "ea" in "dream") and an additional point was awarded for entire words that were spelled correctly.

Writing. The final subtest on the K-2 Literacy Assessment, writing, examined a student's ability to independently complete a written language sample (North Carolina Department of Public Instruction, 2009). In completing this subtest, students were encouraged to follow typical pre-writing procedures and were allowed to use word walls, word charts, dictionaries or any other writing support employed within the classroom for typical writing assignments. After the student completed their writing sample, the teacher used a holistic rubric of writing features to determine a stage for the student's writing abilities. The stages included on the rubric were Prewriting, Early Emergent, Emergent, Early Developing, Developing, Early Independent and Independent.

Table 3.13

Kindergarten, First and Second Grade Assessment Protocol for the North Carolina K-2 Literacy Assessment

	Kindergarten			First Grade			Second Grade	
Subtest	BOY	MOY	EOY	BOY	MOY	EOY	BOY	MOY
Letter and Sound Identification	X	X	If needed	If needed	If needed	--	If needed	If needed
Book and Print Awareness	X	X	If needed	If needed	If needed	If needed	If needed	If needed
Phonemic Awareness	X	X	X	X	X	X	X	X
Spelling Inventory	--	--	X	X	X	X	X	X
Writing	X	X	X	X	X	X	X	X

Note. BOY = Beginning-of-the-year; MOY = Middle-of-the-year; EOY = End-of-the-year

Dynamic Indicators of Basic Early Literacy Skills

Another instrument all children enrolled in kindergarten, first, and second grade in RCS were required to complete was the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002). As a common measure used in over 15,000 schools across the United States (University of Oregon Center on Teaching and Learning, 2012), this assessment examined early literacy skills and included the following subtests (grade levels for each subtest indicated in parentheses): Initial Sound Fluency (K), Letter Naming Fluency (K, 1), Phoneme Segmentation Fluency (K, 1), Nonsense Word Fluency (K, 1, 2), Oral Reading Fluency (1, 2), Retell Fluency (1, 2) and Word Use Fluency (K, 1, 2).

Classroom teachers administered the DIBELS subtests to all students in the fall, winter, and spring of students' kindergarten, first, and second grade years. Information specific to the administration sequence of the DIBELS subtests is contained in Table 3.14. Results for each student were entered electronically on a handheld mobile device using Wireless Generation's mCLASS: DIBELS Next early literacy assessment software. Moving away from the traditional paper and pencil presentation method, mCLASS: DIBELS Next facilitated teacher's collection of data and provided an instant summary of student performance. As data pertaining to the DIBELS subtests were entered into an online database through mCLASS, only subtest scores were available for each student.

Initial Sound Fluency. The Initial Sound Fluency (ISF) subtest, a timed measure of phonological awareness, assessed student's ability to recognize and produce the initial sound in an orally presented word (Kaminski & Good, 1998; Laimon, 1994). During the subtest, students were presented with a set of four pictures and the examiner named the item in each picture. Students were then asked to identify the picture that began with the target initial sound produced

by the examiner. Additionally, for one of the four pictures, students were asked to identify the beginning sound of the target item presented orally by the examiner. A score for this subtest was calculated by multiplying the number of correct responses by 60 and then dividing that number by the total number of seconds it took for students to respond after each subtest item was presented. On average, the ISF measure takes 3 minutes to administer.

Letter Naming Fluency. The Letter Naming Fluency (LNF) subtest provided a measure of student's recognition of and ability to name letters of the alphabet. For this task, students were presented with a page of upper- and lower-case letters arranged in a random order and asked to name as many letters as they could. A point was given for each letter correctly named in one minute.

Phoneme Segmentation Fluency. The Phoneme Segmentation Fluency (PSF) subtest measured student's ability to fluently segment three- and four-phoneme words into their individual phonemes. During this one-minute task, the examiner orally presented words of three to four phonemes. Students were required to verbally produce the individual phonemes for each word. A point was awarded for each phoneme in the target word a student identified correctly. The PSF measure takes about 2 minutes to administer and has been found to be a good predictor of later reading achievement (Kaminski & Good, 1996).

Nonsense Word Fluency. The DIBELS Nonsense Word Fluency (NWF) subtest was used to measure student's understanding of the alphabetic principle, including letter-sound correspondence and the ability to blend sounds into words. During this exercise, students were presented with randomly ordered vowel-consonant (VC) and consonant-vowel-consonant (CVC) nonsense words and asked to either verbally produce the individual sound of each letter or read the entire nonsense word. For each letter sound produced, a point was awarded. In instances

where students read the entire target VC or CVC nonsense word, a point was awarded for each letter sound in the word. A score was calculated by tallying the number of letter-sounds correctly produced. On average, the NWF measure takes 2 minutes to administer.

Oral Reading Fluency. The next DIBELS subtest, Oral Reading Fluency (ORF), measured student's accuracy and fluency with connected text. During this subtest, students were asked to read grade level passages aloud for one minute. Words omitted or substituted, and hesitations that lasted more than three seconds while attempting to decode words were scored as errors. Words self-corrected within three seconds were scored as accurate. The number of words read correctly by the student was tallied and recorded as the oral reading fluency rate for the passage.

Retell Fluency. In instances where students demonstrated the ability to correctly read ten or more words from the ORF passage, they were asked to complete the Retell Fluency (RF) subtest. Specifically, students were asked to retell, or repeat, as much of the passage they had just read as possible. At the end of one minute, a point was awarded for each word from the passage the student used in the retell. The total number of words correctly retold was tallied and recorded as the RF score for the passage.

Word Use Fluency. This final DIBELS subtest measured student's expressive vocabulary and oral language abilities. Specifically, over the course of a minute, students were asked to use target words in complete sentences. A point was awarded for each word used correctly in an utterance. A score was then calculated for the total number of words used by the student in each correct utterance.

With the regular and widespread use of the DIBELS in educational settings, the relationship between each of the subtests and the literacy-related skills and knowledge of

kindergarten, first and second grade students has been thoroughly examined and documented. In numerous instances, the Oral Reading Fluency (ORF) subtest has emerged as a strong predictor of performance on various standardized tests of reading achievement (Elliot, Lee, & Tollefson, 2001; Hintze, Ryan, & Stoner, 2002; Riedell, 2007; Speece, Mills, Ritchey, & Hillman, 2003). Additionally, the concurrent and predictive validity of the Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency subtests as measures of kindergarten-aged reading ability (Rouse & Fantuzzo, 2006) was supported.

Demographic Measures

To examine if the effects of participation in *The Time is Now in Pre-K* ERF project were associated with or mediated by demographic-related factors, student-level demographic data (i.e., age, gender, race, language spoken, and exceptionality) as well as teacher and school assignment was collected. All student, teacher-, and school-related demographic information was provided by RCS' central office as such data were maintained electronically as part of normal operating procedures within the school system. When available, student-, teacher-, and school-related demographic information was crosschecked and confirmed with data located in each student's permanent file.

Table 3.14

Kindergarten, First and Second Grade Assessment Protocol for the Dynamic Indicators of Basic Early Literacy Skills (DIBELS)

	Kindergarten			First Grade			Second Grade	
Subtest	BOY	MOY	EOY	BOY	MOY	EOY	BOY	MOY
Initial Sound Fluency	X	X	--	--	--	--	--	--
Letter Naming Fluency	X	X	X	X	--	--	--	--
Word Use Fluency	X	X	X	X	X	X	X	X
Phoneme Segmentation Fluency		X	X	X	X	--	--	--
Nonsense Word Fluency	--	X	X	X	X	X	X	--
Oral Reading Fluency	--	--	--	--	X	X	X	X
Retell Fluency	--	--	--	--	X	X	X	X

Note. BOY = Beginning-of-the-year; MOY = Middle-of-the-year; EOY = End-of-the-year

Inter-Rater Reliability

A licensed speech language pathologist who was a recent graduate of the Speech and Hearing Sciences doctoral program at the University of North Carolina, Chapel Hill assisted with secondary scoring. The primary investigator and secondary scorer met to discuss procedures related to the collection and entry of the data as well as assessments for which student data was collected. Once all the data was checked and entered by the primary researcher, the secondary scorer completed a point-by-point comparison between the data entered electronically and the data points recorded on the hard copies of the assessment measures. This reliability check was completed for 12% of all students who participated in Year 1 and 2 of *The Time is Now in Pre-K* ERF project. A random-number generator was employed to select 10 student files from the Year 1 cohort and another 19 files from the Year 2 cohort. Reliability was calculated by dividing the number of agreements between raters by the total number of agreements and disagreements and then multiplying by 100. The point-to-point agreement was 99.5% for the Year 1 cohort and 99.5% for the Year 2 cohort. All discrepancies were resolved through discussion and consensus prior to conducting analyses.

Data Analyses

Several statistical analyses were conducted to examine the primary and secondary questions posed by this research. Prior to conducting the planned analyses, a series of first-order analyses were performed. This included screening for missing data and outliers, and checking assumptions pertaining to normality of the sampling distribution, homogeneity of variance, and independence (Field, 2009). The analysis procedures that were employed are described below with reference to each hypothesis.

To examine the primary hypothesis that students who participated in ERF intervention classrooms would demonstrate higher scores on language- and literacy-related measures in kindergarten, first and second grade than students who participated in comparison classrooms, a series of independent samples t-tests were conducted. The data were grouped according to participation in the intervention or comparison condition and subtest scores on the North Carolina K-2 Literacy Assessment and the DIBELS were entered as the dependent variables. Needing to compare the mean performance between intervention and comparison students on literacy outcomes, the independent sample t-test was deemed the most appropriate procedure. SPSS 19.0 was used to complete these analyses.

The second hypothesis purported the effects of participation in *The Time is Now in Pre-K* ERF project for Year 1 students were associated with or mediated by demographic variables. To address this hypothesis, a series of multiple regression equations were conducted to examine the individual and combined predictive value of included predictors. Prior to completing the analyses, new variables were created by calculating the change in subtest scores on the North Carolina K-2 Literacy Assessment for each student from their end-of-year performance data from kindergarten to first grade. The new variables that provided a single score of student's change in performance over an academic year were then entered as dependent variables in separate multiple regression equations. Specific subtests analyzed included: Letter Sound Identification: Upper Case (LSI_UC), Letter Sound Identification: Lower Case (LSI_LC), Letter Sound Identification: Sounds (LSI_S), Book and Print Awareness (BPA), Oral Retell (OR_PCT), and Writing (W). Demographic information (i.e., age, gender, race, language spoken, exceptionality, condition) served as independent variables in each equation and a forced entry method was utilized. SPSS version 19.0 was used to complete these analyses.

Next, to examine the hypothesis that effects of participation in *The Time is Now in Pre-K* ERF project were associated with or mediated by assigned preschool teacher and school attended, Hierarchical Linear Modeling (HLM) was utilized. HLM was selected as it accounted for the nested design of *The Time is Now in Pre-K* project (i.e., students placed within different intervention and comparison classrooms located within one of the many elementary schools in the district). With this analysis, participant's scores on measures of language and literacy collected in preschool (i.e., Peabody Picture Vocabulary Test (PPVT); Phonological Awareness Literacy Screener: Upper Case (PALS_UC); Phonological Awareness Literacy Screener: Lower Case (PALS_LC); Preschool Language Scale: Expressive Communication (PLS_EC)) were entered as dependent variables. Teacher and school data were also coded as dummy variables for the purposes of the analysis. For each dependent variable, 2 two-level and 2 three-level models were constructed. The first two models (i.e., two-level), examined the singular effect of teacher and school assignment upon student language and literacy performance. In these two-level models, teacher assignment and school assignment served as covariates and assumed fixed effects. In the third model (i.e., three-level) a nested term was created to examine the combined effect of teacher and school assignment upon student language and literacy performance. As with the prior two models, the effects were fixed to examine the exact results for the data set. For the fourth model (i.e., three-level), the nested term created for the third model was re-entered but the effects were set to random to account for any other teacher and school-level variables that may have impacted student's performance but were not directly measured. This sequence of four models was repeated for all four dependent variables. Full maximum likelihood estimation was employed for all HLM analyses as the number of students assigned to each teacher and the

number of teachers in each school was not equivalent. SPSS 19.0 was used to complete these analyses.

Finally, to examine the hypothesis that a difference would be noted in the effects of participation in *The Time is Now in Pre-K* ERF project after one or two years of literacy instruction in school, a series of paired-samples t-tests were conducted. For the analyses, the data was grouped according to participation in the intervention or comparison condition. North Carolina K-2 Literacy Assessment subtests for which kindergarten and first grade end-of-year data was available were selected and paired as dependent variables in separate t-tests. SPSS version 19.0 was used to complete these analyses.

Summary

The current study examined the effects of participation in *The Time is Now in Pre-K* Early Reading First (ERF) project on kindergarten, first, and second grade language and literacy outcomes. The study also aimed to determine if the effects of participation in the ERF project were associated with student demographic variables, teacher, school, and/or year of participation, and if participation effects changed after one or two years of literacy instruction in the primary grades. Preschool-aged data utilized in the study consisted of information gathered during student's participation in Year 1 or 2 of the ERF project. School-aged data for students in kindergarten, first and second grade consisted of information gathered on language- and literacy-related measures collected as part of the school system's general operating procedures and demographic-related information. Using a combination of independent samples t-tests, multiple regressions, HLM and paired samples t-tests, the four central hypotheses were tested.

CHAPTER 4

Results

The primary purpose of this investigation was to determine the effects of participation in *The Time is Now in Pre-K* Early Rearing First (ERF) project on kindergarten, first, and second grade language and literacy outcomes. Secondary purposes included exploring the impact student-level demographics, classroom teacher, school and/or year of participation had on the language and literacy-related skills of the intervention and comparison students. Additionally, this study examined if the effects of participation in *The Time is Now in Pre-K* ERF project changed after one or two years of literacy instruction in school.

The study examined the performance of 170 students (Year 1= 89 students; Year 2= 81 students) on measures of language and literacy in kindergarten, first and second grade. Analyses included first-order analyses (i.e., descriptive statistics), independent sample t-tests, multiple linear regressions, Hierarchical Linear Modeling (HLM), and paired-samples t-tests to answer one primary and three secondary research questions. The primary research question was:

1. What are the effects of participation in *The Time is Now in Pre-K* ERF project on kindergarten, first, and second grade language and literacy outcomes?

The secondary research questions were:

2. For Year 1 participants, are the effects of participation in *The Time is Now in Pre-K* ERF project associated with or mediated by demographic variables?

3. Are the effects of participation in *The Time is Now in Pre-K* ERF project associated with or mediated by teacher or school assignment?

4. Do the effects of participation in *The Time is Now in Pre-K* ERF project change after one or two years of literacy instruction in school?

Language and literacy data collected for each student consisted of raw and standardized scores on a variety of quantitative measures. Demographic information (i.e., age, gender, race, language spoken, exceptionality, condition, teacher assignment, school assignment) included both qualitative and quantitative scores, and dummy coding was employed to convert all qualitative data to quantitative scores for purposes of analysis. Additionally, for the second research question that examined if participation in *The Time is Now in Pre-K* ERF project was associated with or mediated by demographic variables, new variables were created by calculating the change in subtest scores on the North Carolina K-2 Literacy Assessment for each student from their end-of-year kindergarten performance to their end-of-year first grade performance. These new variables provided a single score that captured student change in performance over an academic year and allowed for a series of multiple regression equations to be completed to address the question.

Descriptive Statistics

Global screening of the data was performed by examining univariate descriptive statistics for each subtest utilized in the planned analyses. Information pertaining to mean, standard deviation, and minimum and maximum scores for each assessment completed during participation in *The Time is Now in Pre-K* ERF project are provided for Year 1 preschool students in Table 4.1.

Table 4.1
Descriptive Statistics for Year 1 Students: Post-test Preschool Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
PPVT	87	93.70(12.99)	58	121	83	90.22(18.82)	33	121
PALS_UC	89	13.03(9.72)	0	26	83	13.24(9.84)	0	26
PALS_LC	39	18.95(5.14)	4	26	36	19.56(4.85)	7	26
PLS_EC	88	95.59(14.76)	50	122	79	94.35(17.77)	50	126

Note. PPVT, Peabody Picture Vocabulary Test- Fourth Edition; PALS_UC, Phonological Awareness Literacy Screener- Preschool, *Upper Case Letter Identification*; PALS_LC, Phonological Awareness Literacy Screener – Preschool, *Lower Case Letter Identification*; PLS_EC, Preschool Language Scale – Fourth Edition, *Expressive Communication*

Descriptive statistics for assessments completed during kindergarten for students who participated in the ERF program are reported in Table 4.2. All kindergarten data followed expected patterns for means, minimums and maximums, although small sample sizes were observed for some variables. Descriptive statistics for assessments completed during first grade for students who participated in Year 1 of the project are reported in Table 4.3. Although all first grade data followed expected means, minimums and maximums, some subtests had small samples sizes, which may have impacted subsequent analyses.

Finally, descriptive statistics for assessments completed in second grade are reported for students who participated in Year 1 of the ERF project in Table 4.4. As with the preschool, kindergarten, and first grade data, expected means, minimums and maximums were observed for all subtests.

Table 4.2
Descriptive Statistics for Year 1 Students: Post-test Kindergarten Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
LSI_UC	36	24.89(3.67)	5	26	35	24.57(4.60)	1	26
LSI_LC	36	24.75(4.45)	4	28	35	24.63(5.91)	0	28
LSI_S	5	19.60(10.46)	1	26	5	16.60(11.10)	4	26
BPA	27	17.89(3.20)	5	20	24	16.92(3.51)	8	20
OR_PCT	38	.78(.18)	0	1	37	.73(.24)	0	1
PA1	5	5.20(1.34)	3	6	4	5.50(.57)	5	6
PA2	5	4.40(2.51)	0	6	5	5.00(1.23)	3	6
PA3	5	4.60(2.61)	0	6	5	6.00(.00)	6	6
PA4	5	5.40(.89)	4	6	5	6.00(.00)	6	6
W	36	3.25(.84)	2	6	37	3.03(.96)	1	5
SI	6	14.17(10.69)	1	28	5	19.00(4.64)	13	25

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; W, Writing; SI, Primary Spelling Inventory

Table 4.3
Descriptive Statistics for Year 1 Students: Post-test First Grade

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
LSI_UC	5	26.00(.00)	26	26	15	25.40(1.68)	20	26
LSI_LC	5	26.00(.00)	26	26	15	25.00(2.00)	20	26
LSI_S	5	25.80(.447)	25	26	15	22.60(4.97)	9	26
BPA	2	16.00(2.82)	14	18	4	17.75(1.89)	15	19
OR_PCT	19	.76(.08)	0	1	28	.67(.21)	0	1
SI	19	39.53(13.80)	22	64	29	40.90(20.52)	7	82
W	29	4.52(.87)	3	7	33	4.61(.966)	1	6

PA1	14	5.86(.36)	5	6	16	5.63(.81)	3	6
PA2	14	5.44(.94)	3	6	15	5.73(.59)	4	6
PA3	14	5.93(.27)	5	6	17	5.94(.24)	5	6
PA4	14	5.79(.42)	5	6	17	5.76(.56)	4	6
PA5	16	5.88(.34)	5	6	25	5.96(.20)	5	6
PA6	16	5.56(1.50)	0	6	26	5.73	3	6
PA7	19	5.79(.42)	5	6	28	5.64(.62)	4	6
PA8	3	5.33(1.16(	4	6	16	5.13(1.31)	1	6
PA9	19	4.11(1.67)	1	6	26	4.81(1.58)	0	6
PA10	19	5.47(.96)	3	6	26	5.73(.72)	3	6
PA11	19	5.53(.77)	4	6	26	5.54(.71)	4	6

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; PA5, Phonological Awareness #5; PA6, Phonological Awareness #6; PA7, Phonological Awareness #7; PA8, Phonological Awareness #8; PA9, Phonological Awareness #9; PA10, Phonological Awareness #10; PA11, Phonological Awareness #11; W, Writing; SI, Primary Spelling Inventory.

Table 4.4
Descriptive Statistics for Year 1 Students: Post-test Second Grade Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
NWF_PCT	34	52.29(28.46)	2	98	34	47.85(28.45)	1	92
WUF_PCT	32	59.94(27.28)	7	99	35	43.54(29.64)	1	99
ORF_PCT	34	50.09(31.56)	1	95	35	47.60(31.77)	0	95

Note. NWF_PCT, Nonsense Word Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy
Note. Scores reported are middle-of-year

Tables 4.5 to 4.7 provide the descriptive statistics for students who participated in Year 2 of the ERF project on assessments completed in preschool, kindergarten, and first grade. No second grade data is available for this cohort because they had not completed second grade at the time of this investigation.

Table 4.5
Descriptive Statistics for Year 2 Students: Post-test Preschool Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
PPVT	66	95.32(14.15)	61	128	55	89.96(14.68)	53	119
PALS_UC	63	11.48(9.74)	0	26	53	10.60(9.51)	0	26
PALS_LC	25	17.84(5.47)	6	26	20	18.05(5.55)	8	26
PLS_EC	60	99.10(13.29)	71	133	55	97.15(13.60)	52	126

Note. PPVT, Peabody Picture Vocabulary Test- Fourth Edition; PALS_UC, Phonological Awareness Literacy Screener- Preschool, *Upper Case Letter Identification*; PALS_LC, Phonological Awareness Literacy Screener – Preschool, *Lower Case Letter Identification*; PLS_EC, Preschool Language Scale – Fourth Edition, *Expressive Communication*

Table 4.6
Descriptive Statistics for Year 2 Students: Post-test Kindergarten Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
LSI_UC	30	25.53(1.14)	21	26	33	25.03(3.30)	9	26
LSI_LC	30	24.33(2.60)	15	26	33	24.09(3.94)	5	26
LSI_S	25	22.72(4.16)	10	26	29	22.38(4.03)	9	26
BPA	25	17.44(2.99)	10	20	28	16.21(3.21)	5	20
OR_PCT	26	.66(.26)	0	1	32	.59(.28)	0	1
PA1	8	5.38(.74)	4	6	18	5.33(.91)	3	6
PA2	16	3.94(2.14)	0	6	23	4.48(2.06)	1	6
PA3	26	5.69(.62)	4	6	29	5.66(.86)	2	6
PA4	26	5.46(.76)	3	6	29	5.38(.94)	2	6
W	37	3.24(.72)	1	5	31	2.97(.66)	1	4
SI	25	18.00(8.10)	3	33	32	16.34(6.81)	3	32

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; W, Writing; SI, Primary Spelling Inventory

Table 4.7
Descriptive Statistics for Year 2 Students: Post-test First Grade Measures

	Intervention				Comparison			
Measure	N	Mean(SD)	Min	Max	N	Mean(SD)	Min	Max
LNF_PCT	42	51.24(26.23))	6	94	32	45.00(30.61)	1	98
NWF_PCT	42	49.62(25.13)	2	98	33	41.88(30.12)	2	99
PSF_PCT	42	52.90(28.94)	3	91	33	42.42(27.16)	1	94
ORF_PCT	42	51.19(28.04)	4	98	32	39.25(23.77)	7	94
WUF_PCT	42	46.83(27.24)	1	96	32	44.87(28.32)	4	96

Note. LNF_PCT, Letter Naming Fluency Accuracy; NWF_PCT, Nonsense Word Fluency Accuracy; PSF_PCT, Phoneme Segmentation Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy
Note. Scores reported are middle-of-year

Next, each variable was reviewed in regard to measures of skewness and kurtosis. Information pertaining to the preschool, kindergarten, first and second grade performance of Year 1 students is located in Table 4.8, Table 4.9, Table 4.10, and Table 4.11. For Year 1 intervention and comparison students, scores on most preschool, kindergarten and first grade subtests exceeded the critical range of +/-1.0 for skewness and +/-3.0 for kurtosis (Bulmer, 1979). Many measures were negatively skewed with low kurtotic values. The presence of negatively skewed scores indicated that a majority of students scored high on measures with only a small portion of scores being low and in the tails of the distribution. Low kurtotic values (i.e., kurtosis < 3.0) indicated that the distribution of scores was platykurtic with more scores falling around the central peak (i.e., mean) than in the tails. High kurtotic values (i.e., kurtosis > 3.0, leptokurtic distribution) were observed for kindergarten intervention and comparison students on Letter Sound Identification: Upper Case (i.e., K_LSI_UC), Letter Sound Identification: Lower Case (i.e., K_LSI_LC) and for intervention students on Book and Print Awareness (i.e., K_BPA) and Oral Retelling accuracy (i.e., K_OR_PCT). For first grade, high kurtotic values occurred for both intervention and comparison students on Phonological Awareness #3 and #6 measures (i.e., 1_PA3 and 1_PA6) as well as for comparison students on the Phonological Awareness #1, #5, #8 and #10 measures (i.e., 1_PA1, 1_PA5, 1_PA8, 1_PA10). Comparison students also had high kurtotic values on the Letter Sound Identification: Upper Case measure (i.e., 1_LSI_UC). For these leptokurtic distributions, more student scores fell in the tails of the distribution than around the mean (i.e., central peak). Only the score for kindergarten intervention students on the Phonological Awareness #3 measure (i.e., K_PA3) approached a normal distribution (i.e., kurtosis = 3.0, mesokurtic distribution).

Table 4.8
Skewness and Kurtosis for Year 1: Post-test Preschool Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
PPVT	-.38	-.56	-.22	.23
PALS_UC	-.03	.06	-1.59	-1.64
PALS_LC	-.72	-.63	.28	-.28
PLS_EC	-1.05	-.82	1.35	.63

Note. PPVT, Peabody Picture Vocabulary Test- Fourth Edition; PALS_UC, Phonological Awareness Literacy Screener- Preschool, *Upper Case Letter Identification*; PALS_LC, Phonological Awareness Literacy Screener – Preschool, *Lower Case Letter Identification*; PLS_EC, Preschool Language Scale – Fourth Edition, *Expressive Communication*

Table 4.9
Skewness and Kurtosis for Year 1: Post-test Kindergarten Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
LSI_UC	-4.92	-4.42	26.20	21.34
LSI_LC	-3.35	-2.95	13.75	9.68
LSI_S	-2.17	-.57	4.79	-3.25
BPA	-2.89	-1.23	10.02	.72
OR_PCT	-2.30	-2.14	8.75	4.89
PA1	-1.71	.00	2.66	-6.00
PA2	-2.02	-1.36	4.23	2.00
PA3	-2.09	-2.09	4.42	4.42
PA4	-1.26	-1.26	.31	.31
W	1.01	-.26	2.27	.39
SI	.01	.08	-1.75	-.73

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; W, Writing; SI, Primary Spelling Inventory

Table 4.10
Skewness and Kurtosis for Year 1: Post-test First Grade Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
LSI_UC	-1.73	-2.92	2.46	8.39
LSI_LC	-.63	-1.92	-.20	2.47
LSI_S	-2.25	-1.93	5.21	3.56
BPA	--	-1.66	--	2.62
OR_PCT	.14	-2.45	-.11	6.06
SI	.75	.81	-.86	-.43
W	.47	-1.98	1.28	5.25
PA1	-2.30	-2.6	3.79	7.65
PA2	-1.72	-2.27	2.50	4.79
PA3	-3.74	-4.12	14.00	17.00
PA4	-1.57	-2.47	.50	5.84
PA5	-2.51	-5.00	4.90	25.00
PA6	-3.83	-2.79	14.94	6.86
PA7	-1.55	-1.59	.42	1.57
PA8	-1.73	-2.29	--	6.35
PA9	-.51	-1.65	-.75	2.41
PA10	-1.58	-2.95	1.16	8.67
PA11	-1.31	-1.26	.17	.31

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; PA5, Phonological Awareness #5; PA6, Phonological Awareness #6; PA7, Phonological Awareness #7; PA8, Phonological Awareness #8; PA9, Phonological Awareness #9; PA10, Phonological Awareness #10; PA11, Phonological Awareness #11; W, Writing; SI, Primary Spelling Inventory

Table 4.11
Skewness and Kurtosis for Year 1: Post-test Second Grade Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
NWF_PCT	-.18	-.34	-1.08	-1.36
WUF_PCT	-.60	.43	-.83	-.69
ORF_PCT	-.08	.06	-1.59	-1.38

Note. NWF_PCT, Nonsense Word Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy
Note. Scores reported are middle-of-year

Skewness and kurtosis information for Year 2 students in preschool, kindergarten, and first grade is located in Table 4.12, Table 4.13 and Table 4.14. Most preschool and kindergarten scores were negatively skewed. As with Year 1 students, many scores were high with a fewer number of students receiving low scores on subtests. High kurtotic values, which indicated leptokurtic distributions, were noted for kindergarten intervention and comparison students on the Letter Sound Identification: Upper Case (i.e., K_LSI_UC) and Letter Sound Identification: Lower Case subtests (i.e., K_LSI_LC). High kurtotic values were also noted for kindergarten comparison students on the Phonological Awareness #3 and #4 measures (i.e., K_PA3 and K_PA4). These high kurtotic values indicated leptokurtic distributions with high, sharp central peaks and many scores falling in the tails of the distributions.

Although skewness and kurtosis values exceeded the critical ranges for a majority of the preschool, kindergarten, and first grade measures, planned analyses were continued for Year 1 and Year 2 students as the performance of the intervention and comparison groups were similar. This decision was also supported as many of the inflated skewness and kurtotic values were attributed to students reaching the ceiling (i.e., top) scores on subtests of the North Carolina K-2 Literacy Assessment.

Table 4.12
Skewness and Kurtosis for Year 2: Post-test Preschool Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
PPVT	-.24	-.47	.16	.07
PALS_UC	.31	.48	-1.60	-1.45
PALS_LC	-.28	-.31	-.62	-.93
PLS_EC	.69	-.83	.48	1.56

Note. PPVT, Peabody Picture Vocabulary Test- Fourth Edition; PALS_UC, Phonological Awareness Literacy Screener- Preschool, *Upper Case Letter Identification*; PALS_LC, Phonological Awareness Literacy Screener – Preschool, *Lower Case Letter Identification*; PLS_EC, Preschool Language Scale – Fourth Edition, *Expressive Communication*

Table 4.13
Skewness and Kurtosis for Year 2: Post-test Kindergarten Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
LSI_UC	-2.88	-4.26	8.76	18.96
LSI_LC	-2.24	-4.05	5.30	18.19
LSI_S	-1.66	-1.99	2.40	4.02
BPA	-1.32	-1.66	.65	4.42
OR_PCT	-2.14	-1.54	3.65	.71
PA1	-.82	-1.30	-.15	1.08
PA2	-.56	-.99	-1.21	-.81
PA3	-1.92	-3.27	2.72	12.02
PA4	-1.63	-2.24	3.13	5.94
W	-.41	-.72	1.94	1.94
SI	-.39	-.42	-.17	.02

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; W, Writing; SI, Primary Spelling Inventory

Table 4.14
Skewness and Kurtosis for Year 2: Post-test First Grade Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
LNF_PCT	-.17	.26	-.85	-1.22
NWF_PCT	.40	.40	-.45	-1.02
PSF_PCT	-.33	.33	-1.28	-.97
ORF_PCT	.14	.67	-1.08	-.43
WUF_PCT	.12	.33	-1.07	-1.03

Note. LNF_PCT, Letter Naming Fluency Accuracy; NWF_PCT, Nonsense Word Fluency Accuracy; PSF_PCT, Phoneme Segmentation Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy
Note. Scores reported are middle-of-year

In addition to examining measures of skewness and kurtosis, boxplots were generated for all Year 1 and Year 2 intervention and comparison students on all preschool, kindergarten, first and second grade measures. Although outliers were noted for some of the subtests, individual inspection of each outlier revealed that it was not due to incorrect data entry or missing data. Instead, analyses of all outliers revealed that scores were within the expected range for each subtest and were a reflection of either high or low student scores. As this level of performance variation is typical of the diverse population of preschool-age children included in the project, all outliers were retained for further analyses.

Independent Samples T-Tests

A primary aim of this investigation was to examine the effects of participation in *The Time is Now in Pre-K* ERF project on kindergarten, first, and second grade language and literacy outcomes. It was hypothesized that students who participated in ERF intervention classrooms would demonstrate higher scores on language and literacy measures in kindergarten, first and second grade than students who participated in comparison classrooms. To accomplish this aim, a series of independent samples t-tests were conducted. All independent samples t-tests were

based on the combined performance of Year 1 (n=89) and Year 2 (n=81) students. The grouping variable was based on participation in the intervention (n=92; Year 1=46; Year 2= 46) or comparison (n=78; Year 1=43; Year 2=35) classrooms during their preschool year.

Prior to completing the planned analyses, data were screened at the univariate level to ensure they met the required assumptions. Additional screening of the data was warranted as this research question examined the overall effect of participation in the ERF project for students in intervention or comparison classrooms and the combined performance of Year 1 and Year 2 students. As depicted in Table 4.15 through Table 4.17, combined Year 1 and Year 2 scores had skewness values that exceeded the critical range of +/-1.0 and kurtosis values that exceeded the range of +/-3.0 (Dover, 1979). Except for DIBELS subtests in first and second grade, most subtests of the North Carolina K-2 Literacy Assessment were highly negatively skewed (i.e., skewness <1.0) with inflated kurtotic values (i.e., kurtosis >3.0, leptokurtic distribution). Only first grade Letter Sound Identification: Sounds (i.e., 1_LSI_S) and Book and Print Awareness (i.e., 1_BPA) approximated a normal distribution (i.e., kurtosis = 3.0, mesokurtic distribution). With the observed levels of skewness and kurtosis, it was acknowledged that the results of all independent sample t-tests may be biased and should therefore be interpreted with caution.

Table 4.15
Skewness and Kurtosis for Year 1 and Year 2: Kindergarten Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
LSI_UC	-4.96	-3.96	29.79	15.87
LSI_LC	-2.63	-3.16	7.99	11.51
LSI_S	-2.47	-2.03	6.95	3.50
BPA	-2.12	-1.34	5.17	2.07
OR_PCT	-3.70	-2.06	12.08	2.32
W	.45	-.32	2.04	.95
PA_1	-1.59	-1.47	2.45	2.39
PA_2	-1.31	-1.42	.44	.69
PA_3	-3.75	-3.57	16.41	14.41
PA_4	-1.48	-2.46	2.19	7.13
SI	-.37	-.49	-.57	.17

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; SI, Primary Spelling Inventory

Table 4.16
Skewness and Kurtosis for Year 1 and Year 2: First Grade Measures

	Skewness		Kurtosis	
Subtests	Intervention	Comparison	Intervention	Comparison
LSI_UC	-1.53	-2.52	.94	5.32
LSI_LC	-.17	-1.38	1.34	1.11
LSI_S	-2.00	-1.85	4.00	3.20
BPA	--	-1.66	--	2.62
OR_PCT	.15	-.27	-2.14	-2.06
SI	-.08	.63	-.82	-.30
W	-1.11	-2.16	.35	5.38

PA_1	-3.56	-2.64	13.16	7.65
PA_2	-2.36	-2.96	5.97	9.40
PA_3	-3.71	-4.12	13.99	17.00
PA_4	-3.44	-2.47	12.48	5.84
PA_5	-3.80	-5.00	14.95	25.00
PA_6	-2.54	-2.79	5.18	6.86
PA_7	-3.86	-1.70	15.97	2.28
PA_8	-2.53	-2.62	7.14	8.50
PA_9	-.60	-1.85	-.58	3.18
PA_10	-2.38	-3.14	6.25	9.97
PA_11	-2.81	-1.36	9.19	.53
LNF_PCT*	-.01	.26	-.85	-1.15
NWF_PCT*	.37	.50	-.53	-.88
PSF_PCT*	-.23	.46	-1.21	-.95
ORF_PCT*	.25	.68	-.89	-.53
WUF_PCT*	.13	.24	-1.01	-1.04

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; SI, Primary Spelling Inventory; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; PA5, Phonological Awareness #5; PA6, Phonological Awareness #6; PA7, Phonological Awareness #7; PA8, Phonological Awareness #8; PA9, Phonological Awareness #9; PA10, Phonological Awareness #10; PA11, Phonological Awareness #11; LNF_PCT, Letter Naming Fluency Accuracy; NWF_PCT, Nonsense Word Fluency Accuracy; PSF_PCT, Phoneme Segmentation Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy
Note. *Year 2 students only

Table 4.17
Skewness and Kurtosis for Year 1 and Year 2: Second Grade Measures

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
NWF_PCT	-.15	-.50	-.91	-1.17
WUF_PCT	-.38	.67	-1.12	-.46
ORF_PCT	.15	.08	-1.46	-1.46

Note. NWF_PCT, Nonsense Word Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy
Note. Scores reported are middle-of-year
Note. *Year 1 students only

Combined group mean and standard deviations were then computed for ERF Year 1 and Year 2 students according to group participation (i.e., intervention or comparison). The resulting sample statistics for ERF Year 1 and 2 students by grade are displayed in Table 4.18, Table 4.19 and Table 4.20. During kindergarten, except for the measures Phonological Awareness #2, #3, and #4 (i.e., K_PA2, K_PA3, K_PA4), students who participated in ERF intervention classrooms achieved higher average scores with less variation (i.e., standard deviation) on subtests of the North Carolina K-2 Literacy Assessment than students in comparison classrooms. In first grade, comparison students outperformed intervention students on most subtests of the North Carolina K-2 Literacy Assessment while intervention students outperformed comparison students on DIBELS subtests. The scores of intervention students had greater variability than comparison students on the Phonological Awareness subtests of the North Carolina K-2 Literacy Assessment but generally less variation on the DIBELS subtests. Finally, in second grade, intervention and comparison students performed similarly on the Nonsense Word Fluency (i.e., 2_NWF_PCT) and Oral Reading Fluency subtests (i.e., 2_ORF_PCT) of the DIBELS. Comparison students did outperform intervention students on the Word Use Fluency (i.e., 2_WUF_PCT) subtest.

With these results, it is important to note the possible ceiling effect for both intervention and comparison students on the two Letter Sound Identification subtests (Upper Case and Lower Case). The narrow score range and negative skew of the data indicated that many students approached the maximum score for both subtests by the end of kindergarten and were therefore not able to demonstrate progress in first grade.

Table 4.18
Sample Statistics for ERF Year 1 and Year 2 Students: Kindergarten Measures

	Intervention				Comparison			
Subtest	N	Mean	Range*	Std. Deviation	N	Mean	Range*	Std. Deviation
LSI_UC	76	25.01	5-26	2.94	70	24.47	1-26	4.87
LSI_LC	30	24.13	4-28	4.34	70	24.24	0-28	4.97
LSI_S	52	22.20	1-26	5.55	34	21.53	4-26	5.75
BPA	64	17.67	5-20	3.08	52	16.54	5-20	3.34
OR_PCT	73	.94	.00-1.00	.24	69	.86	.00-1.00	.35
W	31	3.25	1-6	.78	68	3.00	1-5	.83
PA1	31	5.48	3-6	.77	38	5.47	3-6	.73
PA2	31	4.55	0-6	1.95	38	4.79	1-6	1.73
PA3	31	5.52	0-6	1.18	34	5.71	2-6	.80
PA4	31	5.45	3-6	.77	34	5.47	2-6	.90
S	31	17.26	1-33	8.60	37	16.70	3-32	6.57

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; SI, Primary Spelling Inventory
Note. *Minimum and maximum scores reported

Table 4.19
Statistics for ERF Year 1 and Year 2 Students: First Grade Measures

	Intervention				Comparison			
Subtest	N	Mean	Range*	Std. Deviation	N	Mean	Range*	Std. Deviation
LSI_UC	14	25.57	24-26	.76	20	25.20	19-26	2.07
LSI_LC	14	25.86	24-28	1.03	20	25.25	20-28	2.22
LSI_S	4	16.00	25-26	.50	14	22.36	9-26	5.06
BPA	2	16.00	14-18	2.83	4	17.75	15-19	1.89
OR_PCT	28	.46	.00-1.00	.51	32	.56	.00-1.00	.50
W	35	3.74	0-7	1.90	34	4.44	0-6	1.24
SI	25	30.04	0-64	20.97	30	39.53	0-82	21.50
PA1	15	5.47	0-6	1.55	16	5.63	3-6	.81
PA2	15	5.07	0-6	1.67	16	5.44	1-6	1.32
PA3	15	5.53	0-6	1.55	17	5.94	5-6	.24
PA4	15	5.40	0-6	1.55	17	5.76	5-6	.56
PA5	17	5.53	0-6	1.47	25	5.96	5-6	.20
PA6	17	5.24	0-6	1.99	26	5.73	3-6	.78
PA7	20	5.50	0-6	1.36	27	5.70	4-6	.54
PA8	20	5.20	0-6	1.51	27	5.37	1-6	1.12
PA9	20	3.90	0-6	1.86	25	4.88	0-6	1.56
PA10	20	5.20	0-6	1.54	25	5.84	4-6	.47
PA11	20	5.25	0-6	1.45	25	5.56	4-6	.71

LNF_PCT*	51	49.33	4-94	26.10	38	45.84	1-98	29.67
NWF_PCT*	51	48.29	2-98	25.31	39	39.69	2-99	29.23
PSF_PCT*	51	52.20	3-96	28.21	39	40.33	1-94	27.38
ORF_PCT*	51	50.33	4-98	26.53	38	39.16	7-94	23.70
WUF_PCT*	51	45.82	1-96	27.07	38	44.26	3-96	28.15

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; SI, Primary Spelling Inventory; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; PA5, Phonological Awareness #5; PA6, Phonological Awareness #6; PA7, Phonological Awareness #7; PA8, Phonological Awareness #8; PA9, Phonological Awareness #9; PA10, Phonological Awareness #10; PA11, Phonological Awareness #11; LNF_PCT, Letter Naming Fluency Accuracy; NWF_PCT, Nonsense Word Fluency Accuracy; PSF_PCT, Phoneme Segmentation Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy
*Minimum and maximum scores reported
Note. *Year 2 students only

Table 4.20
Sample Statistics for ERF Year 1 and Year 2 Students: Second Grade Measures

	Intervention				Comparison			
Subtest	N	Mean	Range*	Std. Deviation	N	Mean	Range*	Std. Deviation
NWF_PCT*	27	49.85	0-98	28.94	27	50.59	1-92	27.20
WUF_PCT*	26	54.05	0-99	30.27	28	39.39	1-99	30.33
ORF_PCT*	27	45.15	0-93	31.18	28	46.61	0-94	31.92

Note. NWF_PCT, Nonsense Word Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy
Note. Scores reported are middle-of-year
Note. *Year 1 students only

A series of independent samples t-tests were then conducted for subtests of the North Carolina K-2 Literacy Assessment and the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to evaluate whether children in ERF intervention classrooms performed significantly better on measures of language and literacy than students in comparison classrooms. As documented in Table 4.21, no statistically significant difference was found for kindergarten student scores on the Book and Print Awareness (i.e., K_BPA), $t(102) = -1.80$, $p = .08$, and the Writing subsets (i.e., K_W), $t(139) = -1.82$, $p = .07$; however, for each subtest, intervention students obtained higher mean scores than comparison students.

As displayed in Table 4.22, a statistically significant difference was found between the first grade performance of intervention and comparison students on the Phoneme Segmentation Fluency (i.e., 1_PSF_PCT), $t(88) = -2.00$, $p = .05$, and the Oral Reading Fluency (i.e., 1_ORF_PCT), $t(87) = -2.06$, $p = .04$, subtests. For both subtests, students in intervention classrooms achieved higher average scores than students in comparison classrooms. Statistical significance was also approached on the Writing (i.e., 1_W), $t(58.61) = 1.82$, $p = .08$, the Phonological Awareness #9 (i.e., 1_PA9), $t(43) = 1.92$, $p = .06$, and the Phonological Awareness #10 (i.e., 1_PA10), $t(21.86) = 1.79$, $p = .09$, subtests. Interestingly, for these subtests, comparison students achieved higher mean scores than intervention students.

Table 4.21
Independent Samples T-Tests for Combined ERF Intervention and Comparison Students: Kindergarten Measures

Subtest	*F*	Sig.	*t*	*df*	Sig. (2-tailed)
LSI_UC	3.04	.08	-.82	144	.41
LSI_LC	.13	.72	.14	144	.89
LSI_S	.02	.89	-.47	62	.64
BPA	.52	.47	-1.80	102	.08
OR_PCT	10.34	.00	-1.57	121.08	.12[a]
W	.73	.39	-1.82	139	.07
PA1	.06	.81	-.06	67	.96
PA2	.68	.41	.55	67	.59
PA3	1.44	.24	.77	63	.45
PA4	.02	.90	.09	63	.93
SI	2.39	.13	-.30	66	.76

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; SI, Primary Spelling Inventory
Note. X[a] = Equal variances not assumed

Table 4.22
Independent Samples T-Tests for Combined ERF Intervention and Comparison Students: First Grade Measures

Subtest	*F*	Sig.	*t*	*df*	Sig. (2-tailed)
LSI_UC	3.18	.08	-.64	32	.53
LSI_LC	5.11	.03	-.95	32	.35
LSI_S	2.82	.11	-1.31	16	.21
BPA	.65	.47	.93	4	.40
OR_PCT	.15	.70	.75	58	.46
SI	.06	.80	1.65	53	.11
W	4.30	.04	1.82	58.61	.08[a]

PA1	.69	.41	.36	29	.72
PA2	.49	.49	.69	29	.50
PA3	4.73	.04	1.00	14.60	.33[a]
PA4	2.37	.13	.91	30	.37
PA5	7.95	.00	1.21	16.41	.25[a]
PA6	5.71	.02	.98	19.25	.34[a]
PA7	1.91	.17	.71	45	.48
PA8	.86	.36	.45	45	.66
PA9	1.94	.17	1.92	43	.06
PA10	14.30	.00	1.79	21.86	.09[a]
PA11	2.83	.10	.94	43	.35
LNF_PCT*	1.86	.18	-.59	87	.56
NWF_PCT*	1.80	.18	-1.49	88	.14
PSF_PCT*	.38	.54	-2.00	88	**.05**
ORF_PCT*	.53	.47	-2.06	87	**.04**
WUF_PCT(	.30	.59	-2.26	87	.79

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; Letter Sound Identification, *Sounds*, BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy; SI, Primary Spelling Inventory; W, Writing; PA1, Phonological Awareness #1; PA2, Phonological Awareness #2; PA3, Phonological Awareness #3; PA4, Phonological Awareness #4; PA5, Phonological Awareness #5; PA6, Phonological Awareness #6; PA7, Phonological Awareness #7; PA8, Phonological Awareness #8; PA9, Phonological Awareness #9; PA10, Phonological Awareness #10; PA11, Phonological Awareness #11; LNF_PCT, Letter Naming Fluency Accuracy; NWF_PCT, Nonsense Word Fluency Accuracy; PSF_PCT, Phoneme Segmentation Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy
Note. X[a] = Equal variances not assumed
Note. *Year 2 students only

Finally, no statistically significant differences were found for measures in second grade. However, on the Word Use Fluency (i.e., 2_WUF_PCT), $t(52) = -1.78$, $p = .08$, subtest, the intervention students achieved higher average scores than the comparison group (see Table 4.23).

Table 4.23
Independent Samples T-Tests for Combined ERF Intervention and Comparison Students: Second Grade Measures

Subtest	*F*	Sig.	*t*	*df*	Sig. (2-tailed)
NWF_PCT*	.00	.95	.10	52	.92
WUF_PCT*	.17	.68	-1.78	52	.08
ORF_PCT*	.02	.89	.17	53	.87

Note. NWF_PCT, Nonsense Word Fluency Accuracy; WUF_PCT, Word Use Fluency Accuracy; ORF_PCT, Oral Reading Fluency Accuracy
Note. Year 1 students only

Summary of Independent Samples T-Tests

The primary purpose of this series of analyses was to examine the effects of participation in *The Time is Now in Pre-K* ERF project on kindergarten, first, and second grade language and literacy outcomes. It was hypothesized that students who participated in ERF intervention classrooms would demonstrate higher scores on language and literacy measures in kindergarten, first, and second grade than students who participated in comparison classrooms. Descriptive statistics were generated to screen the data and determine existing relationships between kindergarten, first, and second grade data. A series of independent samples t-tests were then examined to determine if a significant difference existed between the mean performance of ERF intervention and comparison students.

It was concluded that intervention students performed statistically significantly better than comparison students in first grade on the Phoneme Segmentation Fluency (i.e., 1_PSF_PCT) and the Oral Reading Fluency (i.e., 1_ORF_PCT) subtests. In kindergarten, intervention students scored higher than comparison students on the Book and Print Awareness (i.e., K_BPA) and Writing (i.e., K_W) subtests, but the difference was not statistically significant. In first grade, comparison students performed better than intervention students on the

Writing (i.e., 1_W) subtest as well as the Phonological Awareness #9 and #10 (i.e., 1_PA9, 1_PA10) subtests, but once again, the differences were not statistically significant.

Multiple Regression Analyses

A secondary aim of this research was to examine if the effects of participation in *The Time is Now in Pre-K* ERF project for Year 1 students were associated with or mediated by demographic variables. It was hypothesized that student-level demographic variables (i.e. age, gender, race, language spoken, exceptionality, and condition) would have an effect on Year 1 students' participation in *The Time is Now in Pre-K* ERF project. To examine this hypothesis, multiple regression analyses with forced entry were used to examine the individual and combined predictive value of selected predictors on subtests of the North Carolina K-2 Literacy Assessment. The same full, six-variable model (i.e., age, gender, race, language, exceptionality, and condition) was used with all subtests of the North Carolina K-2 Literacy Assessment. Due to changes in data collection procedures across the school system after Year 2 students entered kindergarten (i.e., implementation of DIBELS rather than North Carolina K-2 Literacy Assessment) and the limited availability of data for Year 2 students (i.e., available sample sizes less than 10 students), multiple regression analyses were only conducted for Year 1 students on subtests of the North Carolina K-2 Literacy Assessment.

Letter Sound Identification: Upper Case. A full model containing all six predictor variables (i.e., age, gender, race, language spoken, exceptionality, and condition) was constructed to examine the impact of student level demographic variables upon Year 1 student performance on the Letter Sound Identification: Upper Case subtest of the North Carolina K-2 Literacy Assessment. As shown in Table 4.24, the full model resulted in an equation that was not significant and did not strongly predict student change on kindergarten and first grade

performance on the Letter Sound Identification: Upper Case subtest (R = .28, p = .436). Collectively, the combination of six predictors only accounted for a small portion of student variation on the Letter Sound Identification: Upper Case subtest, R^2 = .080, F(6, 69) = .995, p = .436. These results indicate that 8% of the variance in student identification of upper case letters can be explained by the linear combination of student demographic variables. It is important to note that of all the predictor variables, Condition (t = -1.866, p = .066) and Language Spoken (i.e., ELL_A) (t = -1.154, p = .253) had the largest impact upon student performance variability on the Letter Sound Identification: Upper Case subtest. While both effects were negative, only the condition variable approached significance (see Table 4.25). The resulting full, six variable model for Letter Sound Identification: Upper Case is represented by the following equation:

K1_LSI_UC = .139CAY + .040RACE_A + .079GENDER_A - .156ELL_A -

.007EXCEPTIONALITY_A - .225CONDITION

Table 4.24
Multiple Regression for Full, Six-Variable Model for Letter Sound Identification: Upper Case Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.282(a)	.080	.000	2.468

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Table 4.25
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for Letter Sound Identification: Upper Case Subtest

Measure	Standardized Coefficient (Beta)	*t*	Sig.
CAY	.139	1.148	.255
RACE_A	.040	.304	.762
GENDER_A	.079	.662	.510
ELL_A	-.156	-1.154	.253
EXCEPTIONALITY_A	-.007	-.061	.952
CONDITION_A	-.225	-1.866	.066

Note. CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Letter Sound Identification: Lower Case. The full model containing all six predictor variables (i.e., age, gender, race, language spoken, exceptionality, and condition) examined the impact of student level demographic variables upon Year 1 student performance. As documented in Table 4.26, the full model did not strongly predict student change from kindergarten to first grade performance on the Letter Sound Identification: Lower Case subtest (R = .303, p = .337) and was not statistically significant. The combination of six predictors only accounted for 9% of student variation on the Letter Sound Identification: Lower Case subtest, R^2 = .092, F(6, 69) = 1.161, p = .337. Within this model, Condition (t = -1.828, p = .072) and Language Spoken (i.e., ELL_A) (t = -1.536, p = .129) had the largest impact upon student performance, with both effects being negative. Chronological Age in Years (t = 1.486, p = .142) and Race (t = 1.021, p = .311) also had noticeable positive effects on the variability of student performance (see Table 4.27). The resulting six variable model for Letter Sound Identification: Lower Case is represented by the following equation:

K1_LSI_LC = .178CAY + .135RACE_A + .048GENDER_A - .207ELL_A -

.002EXCEPTIONALITY_A - .219CONDITION

Table 4.26
Multiple Regression for Full, Six-Variable Model for Letter Sound Identification: Lower Case Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.303(a)	.092	.013	2.939

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Table 4.27
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for Letter Sound Identification: Lower Case Subtest

Measure	Standardized Coefficient (Beta)	*t*	Sig.
CAY	.178	1.486	.142
RACE_A	.135	1.021	.311
GENDER_A	.048	.407	.685
ELL_A	-.207	-1.536	.129
EXCEPTIONALITY_A	.002	.018	.986
CONDITION_A	-.219	-1.828	.072

Note. CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Letter Sound Identification: Sounds. As documented in Table 4.28, the full, six-predictor model did not strongly predict student change from kindergarten to first grade performance on Letter Sound Identification: Sounds (R = .311, p = .789). The combination of six predictors accounted for 9% of the variance in student identification of sounds on the subtest, R^2 = .097, $F(6, 29)$ = .519, p = .789. Within this model, Chronological Age in Years (t = 1.051, p = .302) had the greatest effect upon the variability of student performance, but Gender (t = -.732, p =

.470) and Condition (*t* = -.892, p = .380) also had negative effects (see Table 4.29). It is important to note that unlike other subtests of the North Carolina K-2 Literacy Assessment with sample sizes of at least 75 students available for analyses, the Letter Sound Identification: Sounds subtest only consisted of 36 students and outcomes of the analysis should be interpreted with caution. The resulting six variable model for Letter Sound Identification: Sounds is represented by the following equation:

K1_LSI_S = .212CAY + .054RACE_A - .147GENDER_A - .046ELL_A +

.109EXCEPTIONALITY_A - .173CONDITION

Table 4.28
Multiple Regression for Full, Six-Variable Model for Letter Sound Identification: Sounds Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.311(a)*	.097	-.090	4.002

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition
Note. * n=36

Table 4.29
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for Letter Sound Identification: Sounds Subtest

Measure	Standardized Coefficient (Beta)	*t*	Sig.
CAY	.212	1.051	.302
RACE_A	.054	.256	.800
GENDER_A	-.147	-.732	.470
ELL_A	-.046	-.207	.837
EXCEPTIONALITY_A	.109	.503	.619
CONDITION_A	-.173	-.892	.380

Note. CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Book and Print Awareness. For the next subtest of the North Carolina K-2 Literacy Assessment, Book and Print Awareness, Table 4.30 shows that the full, six variable model did not strongly predict student change in performance from kindergarten to first grade (R = .271, p = .492). The combination of six predictors accounted for 7% of the variance in student demonstration of print concepts and book awareness, R^2 = .073, $F(6, 69)$ = .911, p = .492. Examining the model, Gender (t = 1.622, p = .109) had the largest impact upon the variability of student performance and Condition (t = -1.220, p = .227) had the largest negative impact upon student performance (see Table 4.31). The resulting six variable model for Book and Print Awareness is represented by the following equation:

K1_BPA = .058CAY + .033RACE_A + .193GENDER_A + .059ELL_A +

.012EXCEPTIONALITY_A - .148CONDITION

Table 4.30
Multiple Regression for Full, Six-Variable Model for Book and Print Awareness Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.271(a)	.073	-.007	1.897

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Table 4.31
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for Book and Print Awareness Subtest

Measure	Standardized Coefficient (Beta)	*t*	Sig
CAY	.058	.481	.632
RACE_A	.033	.246	.806
GENDER_A	.193	1.622	.109
ELL_A	.059	.434	.665
EXCEPTIONALITY_A	.012	.104	.918
CONDITION_A	-.148	-1.220	.227

Note. CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Oral Retell. For the Oral Retell subtest, the full model containing all six predictor variables (Table 4.32) did not strongly predict student change from kindergarten to first grade performance on the Oral Retell subtest (R = .155, p = .945). The combination of six predictors only accounted for 2% of variation in student oral retelling performance, R^2 = .024, $F(6, 68)$ = .280, p = .945. Within this model, it is important to note that all variables except for Race (t = 1.72, p = .864) had a negative impact upon the variability in student performance (see Table 4.33). The resulting six variable model for Oral Retelling is represented by the following equation:

K1_OR_PCT = -.030CAY + .024RACE_A - .090GENDER_A - .055ELL_A - .070EXCEPTIONALITY_A - .099CONDITION

Table 4.32
Multiple Regression for Full, Six-Variable Model for Oral Retell Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.155(a)	.024	-.062	.158

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Table 4.33
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for Oral Retell Subtest

Measure	Standardized Coefficient (Beta)	*T*	Sig.
CAY	-.030	-.236	.814
RACE_A	.024	.172	.864
GENDER_A	-.090	-.732	.467
ELL_A	-.055	-.393	.696
EXCEPTIONALITY_A	-.070	-.566	.574
CONDITION_A	-.099	-.789	.433

Note. CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Writing. For the final subtest of the North Carolina K-2 Literacy Assessment, the full, six-predictor model (i.e., age, gender, race, language spoken, exceptionality, and condition) examined the impact of student level demographic variables upon Year 1 student performance on the Writing subtest. Unlike the other subtests explored, the full model did strongly predict student change in performance from kindergarten to first grade (R = .492, p = .003) and was statistically significant (see Table 4.34). The combination of six predictors accounted for 24% of variation on the subtest, R^2 = .242, $F(6, 69)$ = 3.679, p = .003. Within this model, Chronological Age in Years (t = 3.088, p = .003) and Language Spoken (i.e., ELL) (t = 2.237, p = .029) had the

largest, statistically significant, positive effects. Race (t = -1.399, p = .166) and Exceptionality (t = -1.280, p = .205) had the next largest effects upon student performance, but had a negative effect upon students (see Table 4.35) and neither reached statistical significance. The resulting six variable model for Writing is represented by the following equation:

K1_Writing = .339CAY - .169RACE_A + .022GENDER_A + .275ELL_A - .138EXCEPTIONALITY_A - .043CONDITION

Table 4.34
Multiple Regression for Full, Six-Variable Model for Writing Subtest

R	R Square	Adjusted R Square	Std. Error of the Estimate
.492(a)	.242	.177	.987

Note. a. Predictors: (Constant) CAY, Chronological Age in Years; RACE_A, Race Adjusted; GENDER_A, Gender Adjusted; ELL_A, Language Spoken; EXCEPTIONALITY_A, Exceptionality Adjusted; CONDITION, Condition

Table 4.35
Predictor Characteristics for Multiple Linear Regression using the Full, Six-Variable Model for the Writing Subtest

Measure	Standardized Coefficient (Beta)	*t*	Sig.
CAY	.339	3.088	**.003**
RACE_A	-.169	-1.399	.166
GENDER_A	.022	.200	.842
ELL_A	.275	2.237	**.029**
EXCEPTIONALITY_A	-.138	-1.280	.205
CONDITION_A	-.043	-.397	.693

Summary of Multiple Regression Analyses

Multiple regression analyses were used to examine the individual and combined effects of predictor variables (i.e., age, gender, race, language spoken, exceptionality, and condition) upon student performance on subtests of the North Carolina K-2 Literacy Assessment. The same

full, six-variable model was used with each regression analysis conducted. Although the first five analyses conducted did not significantly predict student variance in performance, the full, six-variable model did significantly predict student performance on the Writing subtest. The variable Condition emerged as having the largest negative impact upon student performance on the Letter Sound Identification subtests (Upper Case, Lower Case and Sounds) and the Book and Print Awareness subtest. Language Spoken (i.e., ELL) also had a negative impact upon the Upper Case and Lower Case Letter Sound Identification subtests and Race, Gender and Exceptionality each had negative impacts upon a single subtest (i.e., Writing, Letter Sound Identification: Sounds, and Writing, respectively).

Hierarchical Linear Modeling

Hierarchical Linear Modeling (HLM) was employed to examine if the effects of participation in *The Time is Now in Pre-K* ERF project were associated with or mediated by teacher or school assignment. It was hypothesized that environmental-level factors (i.e. teacher and school assignment) would have an effect on Year 1 student performance. HLM was selected as the most appropriate analysis as it accounted for the nested design of *The Time is Now in Pre-K* project design (i.e., students placed within an intervention or comparison classroom located within an elementary school in the participating school district).

For these analyses, student scores on the Peabody Picture Vocabulary Tests (PPVT), the Phonological Awareness Literacy Screener: Upper Case (PALS_UC), the Phonological Awareness Literacy Screener: Lower Case (PALS_LC) and the Preschool Language Scale: Expressive Communication (PLS_EC) were used as dependent variables. For each dependent variable, 2 two-level and 2 three-level models were constructed. The first two models (i.e., two-level), examined the singular effect of teacher and school assignment upon student language and

literacy performance. In these two-level models, teacher assignment and school assignment served as covariates and assumed fixed effects. In the third model (i.e., three-level), a nested term examined the combined effect of teacher and school assignment upon student language and literacy performance. As with the prior two models, the effects were fixed to examine the exact results for the data set. For the fourth model (i.e., three-level), the nested term created for the third model was re-entered, but the effects were set to random to account for any other teacher and school-level variables that may have impacted student's performance but were not directly measured. This sequence of four models was repeated for all four dependent variables. Full maximum likelihood estimation was employed for all HLM analyses as the number of students assigned to each teacher and the number of teachers in each school was not equivalent (Raudenbush & Bryk, 2002).

Peabody Picture Vocabulary Test (PPVT). The results of the 2 two-level and the 2 three-level models built to examine the effect of environmental-level factors (i.e., teacher and school assignment) upon student PPVT scores are displayed in Table 4.36. Overall, neither of the two-level models supported the hypothesis that environmental factors would have a statistically significant impact upon student PPVT scores. In the first two-level model, although teacher assignment did not have a statistically significant impact upon student PPVT scores, there was practical significance in that teacher assignment had a negative effect upon student performance (B = -10.97, Std. Er = 8.66, p = .21). However, the intercept (F(1, 292) = 10.32, p = .00) (B = 182.59, St. Er = 56.83, p = .00) and the residual error (B = 200680.58, St. Er = 16608.44, p = .00) were both statistically significant, which indicated that factors beyond teacher assignment significantly impacted student performance on the PPVT.

Similar findings emerged for the second two-level model as school assignment had a negative practical impact upon student performance (B = -4.66, Std. Er = 10.32, p = .65) despite a lack of statistical significance. Beyond the covariate of school assignment, the intercept (F(1, 292) = 3.20, p = .08) (B = 156.36, St. Er = 87.48, p = .08) approached statistical significance and the residual error (B = 201643.35, St. Er =16688.12, p = .00) reached statistical significance. Again, these results indicated that factors beyond school assignment significantly impacted student performance.

The third model with nested variables assuming fixed effects demonstrated statistical significance for the combined effect of teacher and school assignment upon student PPVT scores (F(12, 291) = 3.84, p = .00). As with the single covariate models, the intercept (F(1, 291) = 5803.70, p = .00) (B = 91.53, St. Er = 2.19, p = .00) and residual error (B = 206.58, St. Er = 17.13, p = .00) were statistically significant, which highlighted the influence of factors beyond teacher and school assignment upon student performance. The estimated effects for different teacher and school combinations (i.e., nested terms) are provided in Table 4.37.

For the final model with nested variables assuming random effects, statistical significance was not demonstrated (*Wald-Z*(1.43), p = .15). However, the intercept (F(1, 6.62) = 1807.50, p = .00) (B = 92.25, St. Er = 2.17, p = .00) and residual error (B = 219.11, St. Er = 18.92, p = .00) were statistically significant. When moving from the third model with fixed effects to the fourth model with random effects, there was a slight increase in the -2 log likelihood (i.e., AIC_3 = 2405.06, AIC_4 = 2420.94). This change in the goodness of fit estimate did not reach the χ^2critical values for df = 11 (i.e., 19.68 for p <.05 and 24.72 for p <.01), but this goodness of fit measure takes into account how many parameters have been estimated (Field, 2009) and generally, the smaller the value the better. Therefore, the increase in Akaike's Information

Criterion (AIC) from the fixed effects to the random effects model, while not significantly different, suggests that the change decreased the fit of the model.

Table 4.36
HLM Analyses of the Effects of Teacher and School Assignment on PPVT

Model	*F*	*Wald-Z*	*B*	S.E.	p-value
Fixed Effects: Teacher	--	--	-10.97	8.66	.21
Fixed Effects: School	--	--	-4.66	10.32	.65
Fixed Effects: Teacher(School)	3.84	--	--	--	**.00**
Random Effects: Teacher(School)	--	1.43	11.52	1.28	**.00**

Table 4.37
HLM Analyses of the Fixed Effects of Teacher and School Assignment on PPVT

Outcome Measure	Nested Term	*B*	S.E.	p-value
PPVT	T5(S4)	91.54	3.22	.38
	T7(S5)	.55	3.25	.87
	T10(S6)	2.07	4.31	.63
	T17(S6)	16.47	10.40	.11
	T2(S7)	-2.72	4.86	.58
	T10(S8)	.94	3.82	.81
	T1(S9)	2.22	3.25	.50
	T6(S9)	.22	3.36	.95
	T8(S9)	-1.60	3.42	.64
	T3(S10)	7.47	4.86	.13
	T9(S10)	-28.68	5.86	**.00**
	T11(S10)	14.47	5.05	**.00**

Note. For Nested Terms TX(SX), T, Teacher; S, School, X, random code assigned to teacher or school variable

Phonological Awareness Literacy Screener: Upper Case (PALS_UC). For the second student language and literacy measure, PALS_UC, the results of the 2 two-level and the 2 three-level models that examined the effect of environmental-level factors (e.g., teacher and school

assignment) are displayed in Table 4.38. In the first two-level model, teacher assignment did not have a statistically significant impact upon student PALS_UC scores, but a slight negative effect (*B* = -.02, St. Er = .19) was noted. The intercept (*F*(1, 288) = 97.20, p = .00) (*B* = 12.42, St. Er = 1.25, p = .00) and residual error (*B* = 94.26, St. Er = 7.85, p = .00) were both statistically significant which indicated that factors other than teacher assignment had an impact upon student PALS_UC performance.

For the second two-level model, school assignment had a statistically significant impact upon student PALS_UC scores with a slight negative practical impact upon student performance (*B* = -.95, St. Er = .22). The intercept (*F*(1, 288) = 116.51, p = .00) (*B* = 19.97, St. Er = 1.85, p = .00) and the residual error (*B* = 88.47, St. Er = 7.37, p = .00) were both statistically significant. This means that external factors other than school assignment had a statistically significant impact upon student PALS_UC performance.

The third model with nested variables assuming fixed effects found statistical significance for the combined effect of teacher and school assignment upon student PALS_UC scores (*F*(12, 288) = 5.10, p = .00). As with the two-level models, the intercept (*F*(1,288) = 228.43, p = .00) (*B* = 8.93, St. Er = 1.36, p = .00) and residual error (*B* = 77.75, St. Er = 6.48, p = .00) were statistically significant. The estimated effects for different teacher and school combinations are provided in Table 4.39. It is important to note that some of the teacher and school pairings had a negative impact upon student performance (i.e., T2(S7) and T9(S10)).

For the final model with nested variables assuming random effects, statistical significance was found which suggested that the combined effect of teacher and school assignment had a significant effect upon student PALS_UC scores (*Wald-Z*(1.84), p =.07). With the final model, the intercept (*F*(1, 11.15) = 81.70, p = .00) (*B* = 11.52, St. Er = 1.28, p = .00) and the residual

error (*B* = 81.50, St. Er = 6.96, p = .00) reached statistical significance. As with the three other models, these results highlighted the influential role of external factors upon student performance. Examination of the -2 log likelihoods for the third and fourth models (i.e., AIC_3 = 2099.11, AIC_4 = 2110.56) revealed an increase of 11.45. This change in the goodness of fit estimate did not reach the χ^2 critical values for *df* = 11 (i.e., 19.68 for p <.05 and 24.72 for p <.01), but does suggest that the fixed effects third model had a slightly better fit than the random effects fourth model.

Table 4.38
HLM Analyses of the Effects of Teacher and School Assignment on PALS_UC

Model	*F*	*Wald-Z*	*B*	S.E.	p-value
Fixed Effects: Teacher	--	--	-.02	.19	.91
Fixed Effects: School	--	--	-.95	.22	**.00**
Fixed Effects: Teacher(School)	5.10	--	--	--	**.00**
Random Effects: Teacher(School)	--	1.84	11.52	1.28	**.00**

Table 4.39
HLM Analyses of the Fixed Effects of Teacher and School Assignment on PALS_UC

Outcome Measure	Nested Term	*B*	S.E.	p-value
PALS_UC	T5(S4)	7.61	1.99	**.00**
	T7(S5)	6.44	2.01	**.00**
	T10(S6)	8.46	2.80	**.00**
	T17(S6)	2.07	6.38	.75
	T2(S7)	-6.10	2.89	**.04**
	T10(S8)	4.88	2.36	**.04**
	T1(S9)	7.51	2.03	**.00**
	T6(S9)	1.19	2.07	.56
	T8(S9)	1.90	2.10	.37
	T3(S10)	1.65	2.89	.57
	T9(S10)	-7.43	3.40	**.03**
	T11(S10)	1.07	3.10	.73

Note. For Nested Terms TX(SX), T, Teacher; S, School, X, random code assigned to teacher or school variable

Phonological Awareness Literacy Screener: Lower Case (PALS_LC). For the third student language and literacy measure, PALS_LC, the results of the 2 two-level and the 2 three-level models that examined the effect of teacher and school assignment are displayed in Table 4.40. In the first two-level model, teacher assignment did not have a statistically significant impact upon student PALS_LC performance (*B* =.02, St. Er = .15). Both the intercept (*F*(1, 120) = 344.74, p = .00) (*B* = 18.62, St. Er = 1.00, p = .00) and the residual error (*B* = 26.52, St. Er = 3.42, p = .00) reached statistical significance and indicated that external influences outside of teacher assignment impacted student performance.

In the second two-level model, school assignment approached statistical significance and had a negative impact upon student PALS_LC scores (*B* = -.35, St. Er = .19). As with teacher

assignment, the intercept ($F(1, 120) = 218.97$, p= .00) (B = 21.27, St. Er = 1.44, p = .00) and covariance (B = 25.70, St. Er = 3.33, p = .00) reached statistical significance.

The third model with nested variables assuming fixed effects did not demonstrate a statistically significant impact ($F(11, 120) = 1.62$, p =.10) for the combined effect of teacher and school assignment upon student PALS_LC scores. Statistical significance was found for the intercept ($F(1, 120) = 605.39$, p= .00) (B= 16.67, St. Er = 1.60, p = .00) and the residual error (B = 23.10, St. Er = 2.98, p = .00), which highlighted the influence of external variables upon student PALS_LC performance. The estimated effects for different teacher and school combinations are documented in Table 4.41. Of the total pairings, only one teacher and school combination, T10(S6), had a statistically significant impact upon student performance.

Table 4.40
HLM Analyses of the Effects of Teacher and School Assignment on PALS_LC

Model	*F*	*Wald-Z*	*B*	S.E.	p-Value
Fixed Effects: Teacher	--	--	.02	.15	.88
Fixed Effects: School	--	--	-.35	.19	.07
Fixed Effects: Teacher(School)	1.62	--	--	--	**.00**
Random Effects: Teacher(School)	--	1.17	18.66	.53	**.00**

Table 4.41
HLM Analyses of the Fixed Effects of Teacher and School Assignment on PALS_LC

Outcome Measure	Nested Term	*B*	S.E.	p-value
PALS_LC	T5(S4)	2.37	1.89	.21
	T7(S5)	3.08	1.93	.11
	T10(S6)	4.89	2.27	**.03**
	T17(S6)	3.33	5.07	.51
	T2(S7)	-6.67	5.07	.19
	T10(S8)	3.23	2.21	.15
	T1(S9)	3.23	1.93	.10
	T6(S9)	.78	2.27	.73
	T8(S9)	-1.12	2.16	.61
	T3(S10)	1.08	2.89	.71
	T9(S10)	--	--	--
	T11(S10)	-1.00	3.20	.76

Note. For Nested Terms TX(SX), T, Teacher; S, School, X, random code assigned to teacher or school variable

For the final model with nested variables assuming random effects, statistical significance was not found (*Wald-Z*(1.17), p = .24. As with the prior 2 two-level models, the intercept (*F*(1, 120) = 605.39, p = .00) (*B* = 16.67, St. Er = 1.60, p = .00) and residual error (*B* = 23.10, St. Er = 2.98, p = .00) were statistically significant. Examination of the -2 log likelihoods for the third and fourth models (i.e., $AIC_3 = 743.33$, $AIC_4 = 739.73$) revealed a decrease of 3.6. Although the change indicated an improvement in the goodness of fit estimate, it did not reach the χ^2critical values for *df* = 10 (i.e., 18.31 for p <.05 and 23.21 for p <.01).

Preschool Language Scale: Expressive Communication (PLS_EC). The results of the final set of 2 two-level and the 2 three-level models built to examine the hypothesis regarding the effect teacher and school assignment on the final student language and literacy measure, PLS_EC, are displayed in Table 4.42. For the first two-level model, teacher assignment did not

have a statistically significant impact upon student PLS_EC scores (*B* = -.19, St. Er = .30). Both the intercept (*F*(1, 282) = 2298.08, p = .00) (*B* = 95.16, St. Er = 1.99, p = .00) and the residual error (*B* = 229.65, St. Er = 19.34, p = .00) reached statistical significance indicating that external influences outside teacher assignment impacted student performance.

The second two-level model for school assignment did not have a statistically significant impact upon student PLS_EC scores but a slight negative impact (*B* = -.16, St. Er = .35) was observed. The intercept (*F*(1, 282) = 1055.01, p = .00) (*B* = 97.56, St. Er = 3.00, p = .00) and residual error (*B* = 229.83, St. Er = 19.36, p = .00) were statistically significant and stressed the impact of external factors upon student PLS_EC performance.

The third model with nested variables assuming fixed effects demonstrated statistical significance for the combined effect of teacher and school assignment upon student PLS_EC scores (*F*(12, 282) = 5.51, p = .00). The intercept (*F*(1, 282) = 6762.39, p = .00) (*B* = 97.32, St. Er = 2.08, p = .00) and residual error (*B* = 186.30, St. Er = 15.69, p =. 00) also demonstrated statistical significance suggesting that variables outside the combined effect of teacher and school assignment impacted student PALS_LC performance. The estimated effects for different teacher and school combinations are provided in Table 4.43. Two teacher and school pairings had a statistically significant and negative impact upon student performance (i.e., T2(S7) and T9(S10)).

For the final model with nested variables set to random effects, although statistical significance was not found (*Wald-Z*(1.91), p = .06, the model did approach significance. As with the three prior models for PLS_EC, the intercept (*F*(1, 10.19) = 1459.36, p = .00) (*B* = 94.77, St. Er = 2.48, p = .00) and residual error (*B* = 196.08, St. Er = 16.99, p = .00) were statistically significant. Examination of the -2 log likelihoods for the third and fourth models (i.e., AIC_3

=2302.40, AIC_4 =2320.18) revealed an increase of 17.78. This change in the goodness of fit estimate did not reach the did not reach the χ^2critical values for *df* = 11 (i.e., 19.68 for p <.05 and 24.72 for p <.01), but suggests that the fit of the third model was slightly better than the fourth model.

Table 4.42
HLM Analyses of the Effects of Teacher and School Assignment on PLS_EC

Model	*F*	*Wald-Z*	*B*	S.E.	p-value
Fixed Effects: Teacher	--	--	-.19	.30	.52
Fixed Effects: School	--	--	-.16	.35	.66
Fixed Effects: Teacher(School)	5.51	--	--	--	**.00**
Random Effects: Teacher(School)	--	1.91	94.77	2.48	**.00**

Table 4.43
HLM Analyses of the Fixed Effects of Teacher and School Assignment on PLS_EC

Outcome Measure	Nested Term	*B*	S.E.	p-value
PLS_EC	T5(S4)	.67	3.08	.83
	T7(S5)	.04	3.16	.99
	T10(S6)	1.14	4.09	.78
	T17(S6)	1.17	9.87	.91
	T2(S7)	-17.24	4.46	**.00**
	T10(S8)	2.62	3.69	.48
	T1(S9)	2.55	3.22	.43
	T6(S9)	-4.04	3.22	.21
	T8(S9)	2.41	3.25	.46
	T3(S10)	-2.24	4.46	.62
	T9(S10)	-30.58	5.26	**.00**
	T11(S10)	7.12	5.00	.16

Note. For Nested Terms TX(SX), T, Teacher; S, School, X, random code assigned to teacher or school variable

Summary of Hierarchical Linear Modeling Analyses

Hierarchical Linear Modeling (HLM) examined if the effects of participation in *The Time is Now in Pre-K* ERF project were associated with or mediated by teacher or school assignment. HLM was selected as it accounted for the nested design of *The Time is Now in Pre-K* project design (i.e., students placed within an intervention or comparison classroom located within a school). For each dependent variable (i.e., PPVT, PALS_UC, PALS_LC and PLS_EC), 2 two-level and 2 three-level models were constructed. The first two-level models examined the singular effect of teacher and school assignment upon student language and literacy performance and assumed fixed effects. In the third model (i.e., three-level), a nested term assuming fixed effects examined the combined effect of teacher and school assignment upon student language and literacy performance. For the fourth model (i.e., three-level), the nested term created for the third model was re-entered but random effects were assumed. This sequence of four models was repeated for all four dependent variables and revealed different patterns of effects.

For the first dependent variable, PPVT performance, both the third and fourth model with nested terms assuming fixed and random effects demonstrated statistical significance for the combined effect of teacher and school assignment. Moving to PALS_UC scores, school assignment as well as the nested terms for the combined effect of teacher and school assignment assuming fixed and random effects all had statistically significant impacts upon student performance. Examination of the third dependent variable, PALS_LC, revealed that both models with nested terms reached statistical significance, and the model measuring the effect of school assignment approached statistical significance. For the final dependent variable, PLS_EC, the nested terms again reached statistical significance, which indicated the combined effect of teacher and school assignment upon student performance. With these results, it is pertinent to

mention that the intercepts and residuals of the four models reached statistical significance for all the dependent variables. This indicated that external factors other than teacher and school assignment had a significant impact upon student performance.

Paired Samples T-Tests

The final secondary analysis of this investigation examined if effects of participation in *The Time is Now in Pre-K* ERF project changed after one (kindergarten) or two years (first grade) of literacy instruction in school. It was hypothesized that preschool-aged students who participated in the intervention classrooms would continue to perform higher than children in comparison classrooms on measures of literacy in kindergarten and first grade. This hypothesis was based on the assumption that the improved language outcomes achieved by intervention participants in preschool would accelerate their progress in the primary grades.

Prior to completing the planned analyses, the data were screened at the univariate level to ensure they met the required assumptions. Although univariate screening completed for all data included in the ERF project revealed inflated indices of skewness and kurtosis, additional screening of the targeted paired samples was warranted given the relatively small sample sizes included in these analyses. As depicted in Table 4.44 and Table 4.45, both Year 1 and Year 2 variables had skewness values that exceeded the critical range of +/-1.0 and kurtosis values that exceeded the range of +/-3.0 (Dover, 1979). Except for the first grade Oral Retell subtest (i.e., I_OR_PCT) for Year 1 intervention students, all kindergarten and first grade scores obtained on subtests of the North Carolina K-2 Literacy Assessment for Year 1 intervention and comparison students were negatively skewed (i.e., skewness <1.0). Regarding kurtosis, only scores for Year 1 comparison students on Letter Sound Identification: Sounds (i.e., K_LSI_S or 1_LSI_S) and Book and Print Awareness (i.e., K_BPA or 1_BPA) approximated a normal distribution (i.e.,

kurtosis = 3.0, mesokurtic distribution). All other scores obtained by Year 1 intervention and comparison students on kindergarten and first grade subtests had either high (i.e., kurtosis >3.0, leptokurtic distribution) or low kurtotic values (i.e., kurtosis <3.0, platykurtic distribution).

For Year 2 intervention and comparison students, scores obtained on subtests of upper case and lower case letter identification (i.e., PALS_UC, K_LSI_UC, PALS_LC, K_LSI_LC) in preschool and kindergarten were negatively skewed (i.e., skewness <1.0). Preschool scores were moderately negatively skewed (i.e., between -1.0 and -.50 or between +.50 and +1.0) and kindergarten scores were highly negatively skewed (i.e., less than -1.0). Regarding kurtosis, intervention and comparison preschool scores had low kurtotic values (i.e., kurtosis <3.0, platykurtic distribution) while kindergarten scores had high kurtotic values (i.e., kurtosis >3.0, leptokurtic distribution).

Table 4.44
Skewness and Kurtosis for Year 1 Student Paired Samples

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
Kindergarten				
LSI_UC	-5.05(38)	-3.47(37)	27.68(38)	11.68(37)
LSI_LC	-3.28(38)	-2.91(37)	13.52(38)	9.70(37)
LSI_S	-2.17(5)	-.57(5)	4.79(5)	-3.25(5)
BPA	-2.89(27)	-1.23(24)	10.02(27)	.72(24)
OR_PCT	-6.17(38)	-3.20(37)	38.00(38)	8.71(37)
First Grade				
LSI_UC	2.50(16)	-2.52(20)	4.87(16)	5.32(20)
LSI_LC	-.17(14)	-1.38(20)	1.34(14)	1.11(20)
LSI_S	-2.00(4)	-1.85(14)	4.00(4)	3.20(14)
BPA	--	-1.66(4)	--	2.62(4)
OR_PCT	.15(28)	-.27(32)	-2.14(28)	-2.06(32)

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; LSI_S, Letter Sound Identification, *Sounds*; BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy
Note. Sample size for each paired sample noted in parentheses

Table 4.45
Skewness and Kurtosis for Year 2 Student Paired Samples

	Skewness		Kurtosis	
Subtest	Intervention	Comparison	Intervention	Comparison
Preschool				
PALS_UC	-.64(32)	-.50(27)	-1.14(32)	-1.37(27)
PALS_LC	-.50(21)	-.34(18)	.40(21)	-1.13(18)
Kindergarten				
LSI_UC	-2.84(38)	-4.26(33)	8.49(38)	18.96(33)
LSI_LC	-2.21(38)	-3.94(33)	4.70(38)	17.50(33)

Note. PALS_UC, Phonological Awareness Literacy Screener, *Upper Case Letter Identification*; PALS_LC, Phonological Awareness Literacy Screener, *Lower Case Letter Identification*; LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*
Note. Sample size for each paired sample noted in parentheses

Group mean and standard deviations were computed for ERF Year 1 and Year 2 students. Due to changes in the school system's data collection protocol and limited availability of data, analyses compare student performance between one (i.e., preschool to kindergarten) and two years (i.e., kindergarten to first grade) post participation in the project. The resulting paired samples statistics for ERF Year 1 and 2 students are displayed in Table 4.46 and Table 4.47. For Year 1, except for two paired samples (i.e., Book and Print Awareness and Oral Reading Percent), students who participated in ERF intervention classrooms achieved higher average scores in kindergarten and first grade on subtests of the North Carolina K-2 Literacy Assessment than students in comparison classrooms. There was also less variation (i.e., standard deviation) in the performance of intervention students than comparison students on the subtests Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case. With these comparisons, it is important to note two limiting factors. The first is that all pairs have sample sizes smaller than n=30, which violates the Central Limit Theorem. The next limitation is that

student scores on both the Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case subtests in kindergarten approached the maximum score possible. This suggested a possible ceiling effect and allowed for minimal growth between grades. Because of these two conditions, the following results should be interpreted with caution.

Table 4.46
Paired Sample Statistics for ERF Year 1 Students

Subtest	N	Mean	Range*	Std. Deviation
K_LSI_UC				
Intervention	14	25.79	5-26	.43
Comparison	16	23.5	1-26	6.62
1_LSI_UC				
Intervention	14	25.57	24-28	.76
Comparison	16	25.44	19-26	1.63
K_LSI_LC				
Intervention	14	24.43	4-28	1.87
Comparison	16	23.06	0-28	8.12
1_LSI_LC				
Intervention	14	25.86	24-28	1.03
Comparison	16	25.19	20-28	2.07
K_LSI_S				
Intervention	0	--	1-26	--
Comparison	2	4.50	4-26	.71
1_LSI_S				
Intervention	0	--	25-26	--
Comparison	2	20.00	9-26	8.49
K_BPA				
Intervention	2	16.00	5-20	5.68
Comparison	3	12.00	8-20	4.58
1_BPA				
Intervention	2	16.00	14-18	2.83

Comparison	3	17.33	15-19	2.08
K_OR_PCT				
Intervention	23	1.00	.00-1.00	.00
Comparison	27	.89	.00-1.00	.32
1_OR_PCT				
Intervention	23	.57	.00-1.00	.51
Comparison	27	.59	.00-1.00	.50

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*, LSI_S, Letter Sound Identification, *Sounds*; BPA, Book and Print Awareness; OR_PCT, Oral Retell Accuracy
Note. *Minimum and maximum scores are reported for each measure

Table 4.47
Paired Sample Statistics for ERF Year 2 Students

Subtest	N	Mean	Range*	Std. Deviation
K_LSI_UC				
Intervention	24	25.13	16-26	2.29
Comparison	26	25.19	9-26	3.34
K_LSI_LC				
Intervention	17	24.76	8-28	2.77
Comparison	17	25.18	5-26	1.19

Note. LSI_UC, Letter Sound Identification, *Upper Case*, LSI_LC, Letter Sound Identification, *Lower Case*
Note. *Minimum and maximum scores are reported for each measure

A series of paired-samples t-tests were then conducted for selected subtests on the North Carolina K-2 Literacy Assessment to evaluate whether children in intervention and comparison classrooms significantly increased their performance on language and literacy measures between one and two years post participation in the ERF project. Note that this analysis compared performance within the group of students who participated in the intervention or comparison classrooms, as no comparison between the groups was possible. As documented in Table 4.48, Oral Retell scores for both the intervention and comparison ERF Year 1 students significantly

decreased between the end of kindergarten and the end of first grade. On the Letter Sound Identification: Upper Case, Letter Sound Identification: Lower Case, and Book and Print Awareness subtests, students in the comparison classrooms outperformed students in intervention classrooms as reflected by positive increases in scores from kindergarten to first grade. With these increases however, standard deviations for students in comparison classrooms were larger than those for students in intervention classrooms. Except for the Oral Retell subtest, all other results should be interpreted with caution due to small sample sizes (i.e., $n < 30$).

Table 4.48
Paired Samples Tests for ERF Year 1 Students: Paired Differences

			95% Confidence Interval of the Difference			
Subtest*	Mean	Standard Deviation	Lower	Upper	*t*	Significance (2-tailed)
LSI_UC						
Intervention (n =14)	-.21	.80	-.68	.25	-1.00	.34
Comparison (n = 16)	2.19	5.08	-.52	4.89	1.72	.11
LSI_LC						
Intervention (n = 14)	-.43	2.48	-1.00	1.86	.65	.53
Comparison (n = 16)	2.13	6.41	1.29	5.54	1.33	.20
OR_PCT						
Intervention (n = 23)	-.4348	.5069	.6540	.2156	-4.11	**.00**
Comparison (n = 27)	-.2963	.6086	.5370	.0556	-2.53	**.02**

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*; OR_PCT, Oral Retell Accuracy
Note. *All comparisons examined performance from end of kindergarten to end of first grade

For ERF Year 2 students, limited availability of data precluded analyses between kindergarten and first grade; however, data regarding student identification of upper and lower case letters between the end of preschool (i.e., PALS_UC, PALS_LC) and the end of kindergarten (i.e., K_LSI_UC, K_LSI_LC) were available for comparison. While both measures

assessed student alphabet knowledge, the preschool and kindergarten subtests were taken from different assessment batteries. In preschool, students were administered the Upper Case Letter Identification and Lower Case Letter Identification subtests of the Phonological Awareness Literacy Screener (PALS Pre-K, Invernizzi et al., 2001). In kindergarten, students were administered the Letter Sound Identification: Upper Case subtest of the North Carolina K-2 Literacy Assessment (North Carolina Department of Public Instruction, 2009). While the procedures for administering the two assessments differed slightly, both yielded a raw score reflecting the number of upper case letters identified correctly.

As documented in Table 4.49, ERF Year 2 students in both intervention and comparison classrooms performed significantly better at the end of kindergarten (i.e., K_LSI_UC, K_LSI_LC) than at the end of preschool (i.e., PALS_UC, PALS_LC) on measures of upper and lower case letter identification. It is possible that the results of these paired sample analyses reflect a ceiling effect on the Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case Letter subtests. By the time children finished kindergarten, 77.46% (55 out of 71) of Year 1 students and 80.95% (51 out of 63) of Year 2 students reached the maximum score on the Letter Sound Identification: Upper Case subtest. Additionally, 57.75% (41 out of 71) of Year 1 students and 39.68% (25 out of 63) of Year 2 students reached the maximum score on the Letter Sound Identification: Lower Case subtest. This ceiling effect for Year 1 and Year 2 student scores is visible in the Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case histograms.

Table 4.49
Paired Samples Tests for ERF Year 2 Students: Paired Differences

Subtest*	Mean	Standard Deviation	95% Confidence Interval of the Difference		t	Significance (2-tailed)
			Lower	Upper		
LSI_UC						
Intervention (n = 24)	6.71	7.58	3.51	9.91	4.33	**.00**
Comparison (n = 26)	8.89	8.19	5.58	12.19	5.54	**.00**
LSI_LC						
Intervention (n = 17)	6.06	5.03	3.48	8.65	4.97	**.00**
Comparison (n = 17)	6.71	5.65	3.80	9.61	4.89	**.00**

Note. LSI_UC, Letter Sound Identification, *Upper Case*; LSI_LC, Letter Sound Identification, *Lower Case*
Note. *All comparisons examined performance from end of preschool to end of kindergarten

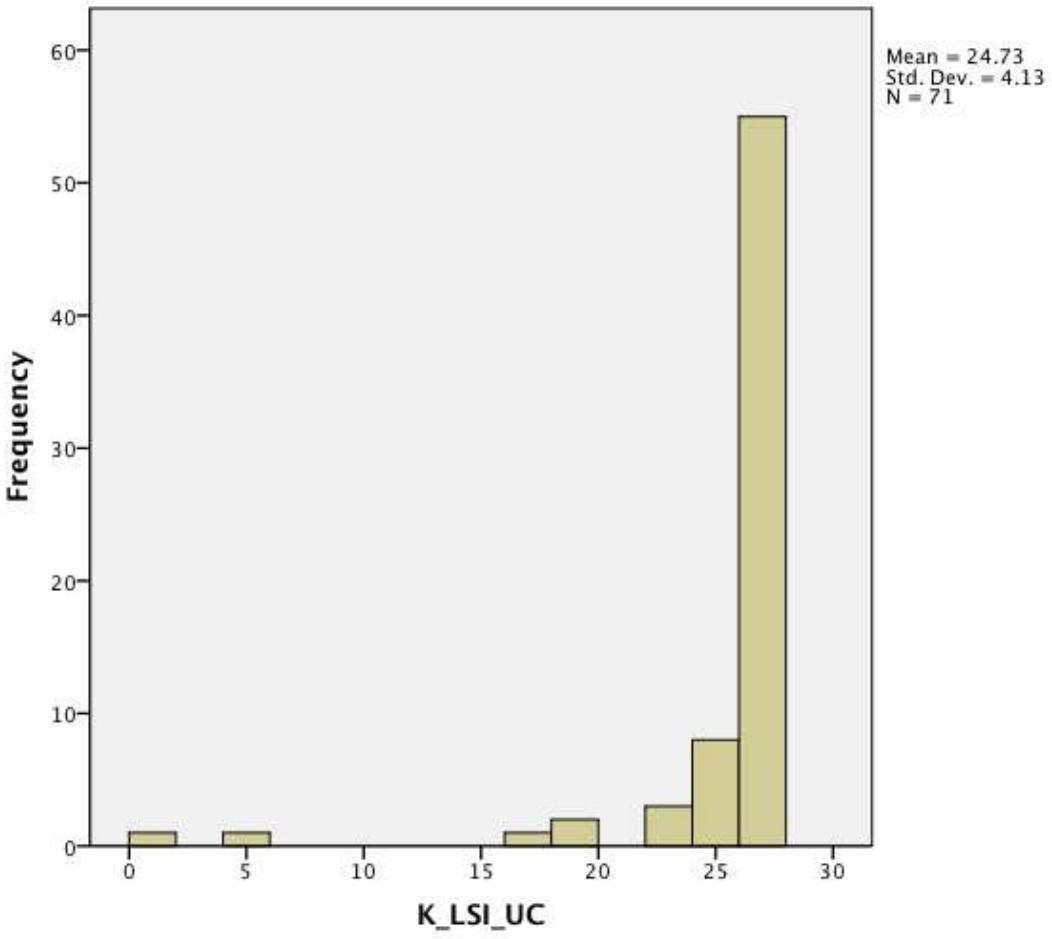

Figure 4.1 *Ceiling Effect for Year 1 Intervention and Comparison Students: Letter Sound Identification: Upper Case*

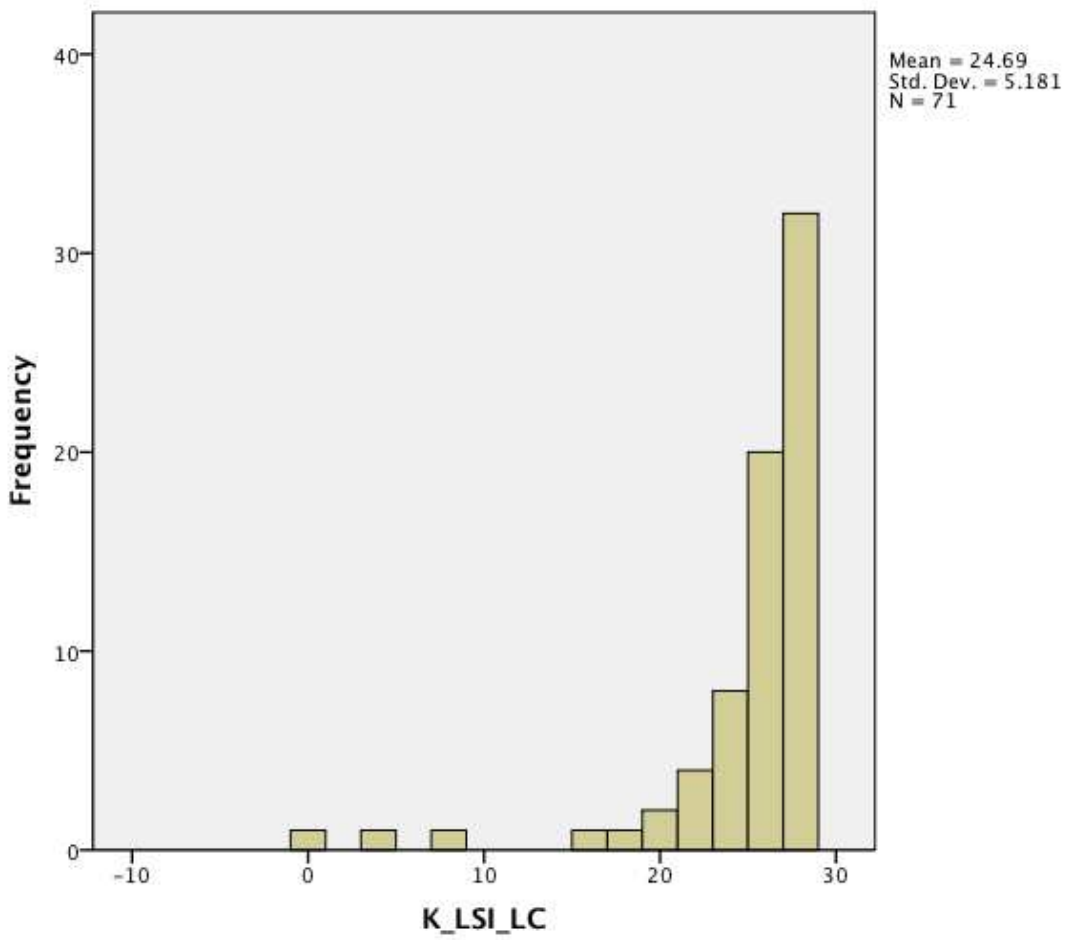

Figure 4.2 *Ceiling Effect for Year 1 Intervention and Comparison Students: Letter Sound Identification: Lower Case*

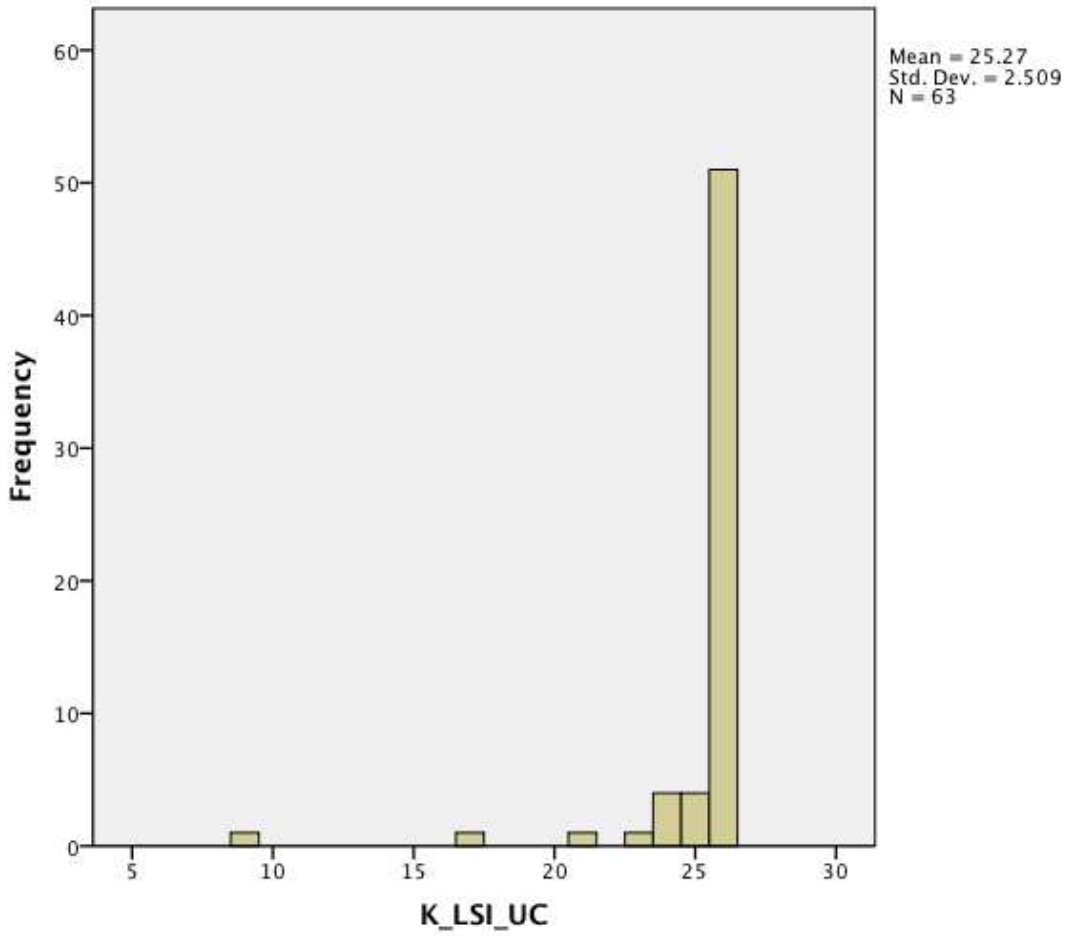

Figure 4.3 *Ceiling Effect for Year 2 Intervention and Comparison Students: Letter Sound Identification: Upper Case*

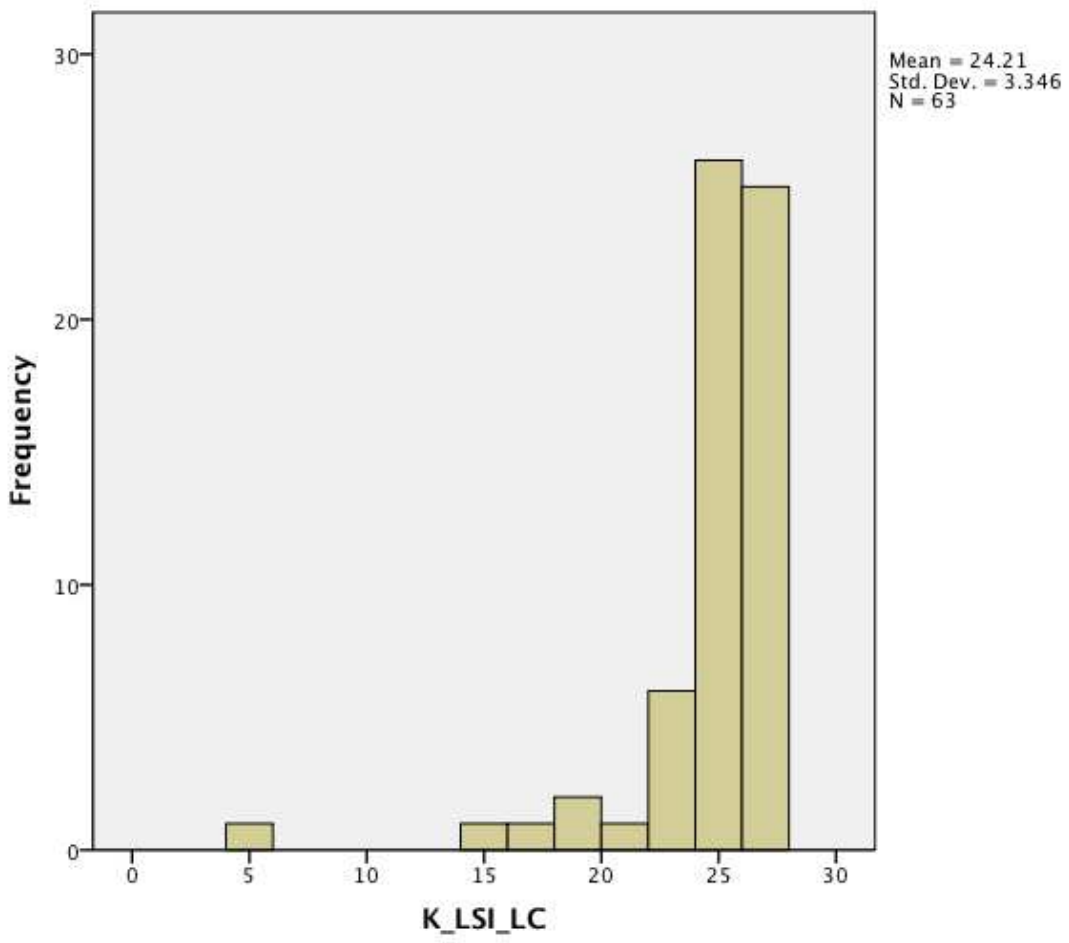

Figure 4.4 *Ceiling Effect for Year 2 Intervention and Comparison Students: Letter Sound Identification: Lower Case*

Summary of Paired Samples T-Test Analyses

This final set of analyses examined if effects of participation in *The Time is Now in Pre-K* ERF project changed after one or two years of literacy instruction in school. It was hypothesized that preschool-aged students who participated in the intervention classrooms would continue to perform higher than children in comparison classrooms on measures of literacy in kindergarten and first grade. After examining the means, standard deviations, skewness and kurtosis for all included variables, a series of paired sample t-tests were performed and the hypothesis did not consistently hold true.

For Year 1 students, Oral Retelling scores for both intervention and comparison students significantly decreased between the end of kindergarten and the end of first grade. On the Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case subtests, students in the comparison classrooms outperformed students in intervention classrooms as reflected by positive increases in scores from kindergarten to first grade. With these increases, however, standard deviations for students in comparison classrooms were larger than those for students in intervention classrooms. Except for the Oral Retelling subtest, all other results should be interpreted with caution secondary to small sample sizes (i.e., $n < 30$).

For Year 2, limited availability of data precluded analyses between kindergarten and first grade. Inclusion of preschool data did allow for a comparison of student's upper case and lower case letter identification between the end-of-year preschool performance (i.e., PALS_UC, PALS_LC) and end-of-year kindergarten performance (i.e., K_LSI_UC, K_LSI_LC). With this, Year 2 students in both intervention and comparison classrooms performed significantly better at the end of kindergarten than at the end of preschool on measures of upper and lower case letter identification. It is possible that the results of these paired samples analyses reflect a ceiling

effect on the Letter Sound Identification: Upper Case and Letter Sound Identification: Lower Case Letter subtests as many students achieved or approached the maximum score.

Summary

The primary aim of this investigation was to examine the effects of participation in *The Time is Now in Pre-K* ERF project on kindergarten, first, and second grade literacy outcomes. It was hypothesized that students who participated in ERF intervention classrooms would demonstrate higher scores on literacy measures in kindergarten, first and second grade than students who participated in comparison classrooms. It was determined that intervention students performed statistically significantly better than comparison students in first grade on the Phoneme Segmentation Fluency (i.e., 1_PSF_PCT) and the Oral Retelling Fluency (i.e., 1_ORF_PCT) subtests. In kindergarten, statistical significance was approached with intervention students performing better than comparison students on the Book and Print Awareness (i.e., K_BPA) and Writing (i.e., K_W) subtests. In first grade, statistical significance was also approached with comparison students performing better than intervention students on the Writing (i.e., 1_W) subtest as well as the Phonological Awareness #9 and #10 (i.e., 1_PA9, 1_PA10) subtests.

A series of multiple regression equations determined the individual and combined effects of predictor variables (i.e., age, gender, race, language spoken, exceptionality, and condition) upon student performance on subtests of the North Carolina K-2 Literacy Assessment. Although the first five analyses conducted did not significantly predict student variance in performance, the full, six-variable model did significantly predict student performance on the Writing subtest. The variable Condition emerged as having the largest negative impact upon student performance on the Letter Sound Identification subtests (Upper Case, Lower Case and Sounds) and the Book

and Print Awareness subtest. Language Spoken (i.e., ELL) also had a negative impact upon the Upper Case and Lower Case Letter Sound Identification subtests and Race, Gender and Exceptionality each had negative impacts upon a single subtest (i.e., Writing, Letter Sound Identification: Sounds, and Writing, respectively).

Hierarchical Linear Modeling was used to determine if the effects of participation in *The Time is Now in Pre-K* ERF project were associated with or mediated by teacher or school assignment. Both the third and fourth models with nested terms assuming fixed and random effects demonstrated statistical significance for the combined effect of teacher and school assignment on PPVT performance. School assignment, as well as the nested terms for the combined effect of teacher and school assignment assuming fixed and random effects, all had statistically significant impacts upon student performance on the PALS_UC subtest. Examination of PALS_LC revealed that both models with nested terms reached statistical significance and the model measuring the effect of school assignment approached statistical significance. For the final dependent variable, PLS_EC, the nested terms again reached statistical significance, which indicated the combined effect of teacher and school assignment upon student performance.

The final set of analyses comprised of paired samples t-tests examined the effects of participation in *The Time is Now in Pre-K* ERF project after one or two years of literacy instruction in school. For Year 1 students, Oral Retelling scores (i.e., K_OR_PCT, 1_OR_PCT) for both intervention and comparison students significantly decreased between the end of kindergarten and the end of first grade. On the Letter Sound Identification: Upper Case (i.e., K_LSI_UC, 1_LSI_UC), Letter Sound Identification: Lower Case (i.e., K_LSI_UC, 1_LSI_LC), and Book and Print Awareness (i.e., K_BPA, 1_BPA) subtests, students in the comparison

classrooms outperformed students in intervention classrooms as reflected by positive increases in scores from kindergarten to first grade. For Year 2, limited availability of data precluded analyses between kindergarten and first grade but inclusion of preschool data did allow for a comparison of student upper case and lower case letter identification between the end-of-year preschool performance (i.e., PALS_UC, PALS_LC) and end-of-year kindergarten performance (i.e., K_LSI_UC, K_LSI_LC). With this, Year 2 students in both intervention and comparison classrooms performed significantly better at the end of kindergarten than at the end of preschool on measures of upper and lower case letter identification.

CHAPTER 5

Discussion

This study sought to examine the effects of participation in *The Time is Now in Pre-K* Early Reading First (ERF) project on kindergarten, first, and second grade language and literacy outcomes. Secondary objectives of the study were to determine if the effects of participation in *The Time is Now in Pre-K* ERF project: (a) were associated with student-level demographic variables, (b) were associated with teacher or school assignment, and (c) changed after one or two years of literacy instruction in the primary grades. Overall, the findings are mixed across group and time. Specific results from the independent samples t-tests, multiple regressions, Hierarchical Linear Modeling, and paired samples t-tests will be discussed in relation to educational practice, policy, research, and future research.

Participation in High-Quality Preschool Classrooms

Given the roles that language and emergent literacy play in the development of full, conventional reading and writing abilities, it is important to evaluate the impact of preschool programs on language and emergent literacy. The ERF project provided an opportunity to conduct such an evaluation because the ERF intervention was a prescriptive literacy curriculum that combined several evidence based practices including addressing child interests, employing interactive readings, and promoting multi-turn conversations. It was hypothesized that students who participated in ERF intervention classrooms would demonstrate higher scores on language- and literacy-related measures in kindergarten, first and second grade. Findings of a series of independent samples t-tests provided support for this hypothesis.

After examining performance on the North Carolina K-2 Literacy Assessment, it was concluded that students who participated in *The Time is Now in Pre-K* ERF intervention classrooms performed significantly better than comparison students in first grade on the Phoneme Segmentation Fluency and the Oral Reading Fluency subtests. As the intervention provided to students in *The Time is Now in Pre-K* ERF project specifically included evidence-based strategies that supported preschool children's development of oral language, the fact that intervention students demonstrated superior performance on these measures in kindergarten and first grade is consistent with previous research (Kendeou, van den Broek, & White, 2009; NICHD, 2005). Beginning in preschool, oral language skills predict 48% of the variance in code-related skills such as phoneme segmentation, oral reading fluency, print awareness and writing (NICHD, 2005), and therefore help explain the superior performance of intervention students on these measures. Interestingly, the findings from other measures in first grade did not support the hypothesis that participating in the ERF intervention would lead to improved language and literacy outcomes in the primary grades.

In reviewing this set of findings, it is important to note factors that may have impacted, and potentially limited the results. First, missing data and variability in teacher scoring eliminated the possibility of completing a MANCOVA, which would have been a more powerful analysis than the series of t-tests. Had there been enough control over the completion of child measures in the primary grades to result in a more complete data set, it is possible that findings may have been different because the total number of data points would have increased dramatically. Another potentially confounding factor was the level of skewness and kurtosis in the combined Year 1 and Year 2 scores that were used as dependent variables for this set of analyses. The observed levels of skewness and kurtosis may have biased the results of all

independent samples t-tests as extreme levels indicate a non-normal distribution of scores and violate the assumption of normality, which is a required assumption of independent t-tests. It is important to note though that without a complete data set, it is not possible to determine if the data were truly lacking normality or if factors related to the missing data altered the normality of the distributions.

Finally, consistent with the levels of skewness and kurtosis levels, ceiling effects were noted for student performance on two subtests of the North Carolina K-2 Literacy Assessment: (a) Letter Sound Identification: Upper Case and (b) Letter Sound Identification: Lower Case. The intervention and comparison students all reached or approached the maximum scores for these subtests in kindergarten. As a result, students had little opportunity for growth between kindergarten and first grade. While there was practical significance in students reaching the ceiling scores for identification of upper and lower case letters, statistical significance between the performance of intervention and comparison students was not demonstrated as a result of the ceiling effects.

Student Level Demographics

The second aim of this investigation was to determine if the effects of participation in *The Time is Now in Pre-K* ERF project were associated with student-level demographic variables such as chronological age, gender, race, language spoken, exceptionality and participation in a preschool intervention versus comparison classroom. Understanding this relationship is important given that poverty, minority status, and low rates of maternal education are all established risk factors for academic difficulties (see LoCasale-Crouch et al., 2007; Pianta et al., 2005). At the time of the ERF project, all students were living in a county that was identified as one of the poorest counties in the country and faced “at risk” conditions such as living in

poverty, being English Language Learners and having identified disabilities. In Year 1, 54.55% of the families of students identified themselves as belonging to an ethnic group other than White/Caucasian (i.e., Black/African American = 31.81% and Hispanic = 14.78) and 13.63% of students' families spoke Spanish as their primary language. In Year 2, an even greater number of families identified their children as belonging to a heterogeneous mix of ethnic backgrounds with 57.14% belonging to a group other than White/Caucasian (i.e., African American = 28.57%, Hispanic = 15.58%, Other = 10.39%) and 14.28% speaking Spanish. Considering the diverse representation of students, it was hypothesized that student-level demographic variables would have an effect on student participation in *The Time is Now in Pre-K* ERF project; however, limited support for this hypothesis was found.

A series of multiple regressions using the same full, six-variable model (i.e., age, gender, race, language spoken, exceptionality, and condition) were used to examine the impact of student-level demographics upon performance on the North Carolina K-2 Literacy Assessment. The model predicted student performance on the Writing subtest at significant levels and condition emerged as having the largest negative impact upon student performance on the Book and Print Awareness and Upper and Lower Case Letter Sound Identification subtests. These findings indicate that student-level demographics and characteristics can be used to reliably predict student writing performance and both awareness of book and print conventions and identification of upper and lower case letters are negatively impacted by whether or not a student participated in *The Time is Now in Pre-K* ERF project. Language spoken (i.e., ELL), race, gender, and disability status each had smaller, but still negative, impacts upon student performance, but did not reliably predict student outcomes on subtests of the North Carolina K-2 Literacy Assessment.

In reviewing the findings pertaining to the impact of student-level demographics, it is important to note that the data available for students in kindergarten, first and second grade limited the analyses that could be completed. As Richmond Country Schools (RCS) changed their data collection procedures between the academic years of 2008-2009 and 2009-2010, the language and literacy data gathered for Year 2 students in kindergarten and first grade differed from the kindergarten and first grade data collected for Year 1 students. This change in data collection only allowed for a comparison of ERF Year 1 student performance between kindergarten and first grade and precluded all Year 2 analyses.

In addition to RCS' change in data collection, another pattern of missing data emerged. While directions for the North Carolina K-2 Literacy Assessment recommended that all kindergarten students be administered the first four items on the Phonological Awareness subtest at the beginning and middle of the academic year, RCS teachers did not consistently adhere to this recommendation. This lack of adherence to the protocol prevented the analysis of phonological awareness skill development between kindergarten and first grade and limited the breadth of literacy-related skills examined.

Another potential limitation with this series of multiple regression analyses is the small sample size and subsequent reduced power of subtests analyzed. Of most concern is the Letter Sound Identification: Sounds subtest on the North Carolina K-2 Literacy Assessment. With a sample size of 36 and six independent variables, only R^2 values of at least 23% and above were likely detected (Cohen, Cohen, West & Aiken, 2002). Therefore, the results of the multiple regression analyses may be limited and not necessarily representative of the true influence of student-level demographics upon literacy-related performance.

Teacher and School Assignment

Wanting to better understand the potential impact of both teacher and school assignment upon student performance, the third aim of this investigation examined if participation in *The Time is Now in Pre-K* ERF intervention was associated with or mediated by teacher or school assignment. Exploring the effect of such environmental level factors is important as research indicates that preschool teacher's limited use of evidenced-based strategies associated with language development and a lack of explicit and systematic classroom-level instruction has a negative impact upon student development of language- and literacy-related skills (Dickinson, 2006; Girolametto & Weitzman, 2002; Justice, Mashburn, Hamre, & Pianta, 2008; McKeown & Beck, 2006; NICHD ECCRN, 2005). As *The Time is Now in Pre-K* ERF project utilized the *Hourglass Model* (Pierce, 2005), an instructional framework that connected early literacy instructional strategies with conventional literacy outcomes through scientific research and evidenced-based practices, it was hypothesized that environmental-level factors (i.e. teacher and school assignment) would have an effect on Year 1 student participation in the ERF project. Findings from Hierarchical Linear Modeling (HLM) provided support for this hypothesis.

HLM was selected because it accounted for the nested project design (i.e., students placed within an intervention or comparison classroom located within an elementary school in the participating school district). Specifically, the HLM analyses examined the singular effect of teacher and school assignment upon student language and literacy performance as well as the combined effect of teacher and school assignment upon student language and literacy performance. Both the singular and combined effects were analyzed assuming fixed and random effects. Using HLM to address this secondary aim both parceled out and incorporated the two sources of variation in student language and literacy outcomes (i.e., variation between teachers

and variation between schools) in the analyses. This allowed for an error term at each level (i.e., teacher and school) and resulted in a more accurate standard error for the regression coefficients.

The HLM approach revealed statistically significant results for all dependent variables examined. This suggests that when combined, teacher and school assignment had a significant impact upon student's receptive vocabulary, identification of upper case letters and expressive language skills in both intervention and comparison classrooms. School assignment also had a significant impact upon Year 1 student identification of upper case letters in intervention and comparison classrooms. With these results, the intercepts and residuals of the four models also reached statistical significance for all the dependent variables. This indicated that external factors other than teacher and school assignment also had a significant impact upon student performance, but the analysis does not reveal the source of those external factors.

Knowing that teachers and schools impacted student outcomes for *The Time is Now in Pre-K* ERF project is not surprising. Following the instructional framework of the *Hourglass Model*, intervention teachers regularly offered preschool students multiple opportunities for extended conversations through positive adult-child interactions and utilized shared-reading and other language enhancement interventions known to significantly increase children's oral language skills (National Institute for Literacy, 2009). Use of evidenced-based strategies associated with language development and offering positive adult-child verbal interactions is "critical to children's language growth" (Chapman, 2000, p. 43) and moves beyond the reading- and writing-related benefits that children receive from attendance at high-quality preschool programs. The results also suggest that the intervention was resilient to slight variations in implementation across teachers and settings.

Change in Literacy-Related Performance after One Year of Elementary Instruction

The goal of early intervention is to produce positive effects that continue beyond the intervention period and have a long-term impact upon children's learning and later achievement. This is of particular importance for interventions offered during the preschool period as the development of language- and literacy-related skills during this period predicts achievement when students are exposed to formal reading instruction in elementary school (Dickinson & McCabe, 2001; Lonigan, Allan & Lerner, 2011; Lonigan, Burgess, & Anthony, 2000; Storch & Whitehurst, 2002). To determine whether or not *The Time is Now in Pre-K* ERF project achieved this goal, the final aim of this investigation was to determine if the effects of participation changed after one or two years of literacy instruction in elementary school. It was hypothesized that preschool-aged students who participated in the intervention classrooms would gain more than children in comparison classrooms from kindergarten to first grade on literacy measures.

The results of paired-samples t-tests provided limited support for this hypothesis. For Year 1, both intervention and comparison student scores on the Oral Retelling subtest decreased from kindergarten to first grade. This decrease in scores on the Oral Retelling subtest may be attributed to different factors. The first factor is that the end of year benchmark requirements for kindergarten and first grade significantly increase in that students are required to read more challenging texts and an increased number of words correctly. Additionally, the Oral Retelling subtest of the North Carolina K-2 Literacy Assessment is one of the more difficult to administer as teachers are required to record all errors made by students when reading. As students read increasingly challenging and longer texts, the process of noting student errors when reading becomes more difficult and prone to administrator errors.

It is important to note that all pairs included in the analyses violated the Central Limit Theorem by having sample sizes smaller than 30. This decreased the chance of identifying

significant differences even if a true difference exists. Furthermore, a majority of Year 1 kindergarten and first grade subtest scores were negatively skewed with either low or high kurtotic values. While negatively skewed scores on Upper Case and Lower Case Letter Sound Identification subtests were likely the result of a ceiling effect as a majority of intervention and comparison students were able to identify all or almost all upper and lower case letters of the alphabet at the end of kindergarten, skewness and kurtosis values outside the critical value range indicated non-normal score distributions and reduced the power of the analyses even further.

For Year 2 students, limited availability of data precluded analyses between kindergarten and first grade; however, a comparison of student performance between preschool and kindergarten was possible. Year 2 students in both intervention and comparison classrooms performed significantly better at the end of kindergarten than at the end of preschool on measures of upper and lower case letter identification. Not being able to directly compare the performance of intervention students with that of comparison students though, it cannot be determined if there was a significant difference in gains achieved between the two groups and whether the presence or absence of *The Time is Now in Pre-K ERF* intervention contributed to that difference.

The fact that *The Time is Now in Pre-K* ERF project did not produce significantly better results in kindergarten and first grade does not mean there are no overall lasting effects of the intervention. In early grades (i.e., kindergarten and first), differences in oral language skills are not directly related to improved outcomes, but rather indirectly feed into skills such as print knowledge, phonological awareness and writing, skills which in turn form the foundation for early reading success (Storch & Whitehurst, 2001, 2002; Whitehurst & Lonigan, 1998). Therefore, it is possible that when students from *The Time is Now in Pre-K* ERF project advance

to successive grades where reading skills progress to comprehending units of text beyond individual words, oral language skills will become increasingly important and the effects of the intervention will become apparent in student reading comprehension skills (see Kendeou, van den Broek, & White, 2009; Mason, 1992; Nation & Snowling, 1998; Roth, Speece, & Cooper, 2002; Senéchal et al., 2001; Storch & Whitehurst, 2002; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001; Westerveld, Gillon, & Moran, 2008).

In conclusion, findings from analyses conducted support the value of providing high-quality preschool instruction to students with identified at-risk factors for later academic failure. At the student level, participation in a high-quality preschool intervention classrooms had the ability to overcome the negative impacts associated with student chronological age in years, race, gender, language spoken, exceptionality and intervention condition. On an environmental level, participation in a high-quality preschool intervention impacted student performance as those teachers who participated in the intervention condition had a more positive effect upon student development of receptive language, identification of upper case letters and expressive language. Findings also supported the provision of a rich oral language classroom environment, extended conversations between adults and students, regular opportunities for shared storybook reading, and wide access to books and writing tools for purposeful writing.

Additional support was found for the value of providing preschool instruction that targets and develops oral language skills. As oral language skills are known to predict code-related skills in kindergarten and first grade (Kendeou, van den Broek, & White, 2009; NICHD, 2005) and intervention students performed significantly better than comparison students on measures of phoneme segmentation fluency and oral reading fluency, support exists for the oral-language rich instruction and evidence-based strategies employed in intervention classrooms. Without the

numerous instances of missing data in kindergarten, first and second grade, it is likely that additional support would have been found to connect later literacy development with preschool-aged oral language skills had the data set been more complete.

Limitations

As already discussed, there are many limitations to the analyses conducted for this investigation. In addition to issues with missing data and the potential risk of variability in teacher scoring, some variables included in the study had small sample sizes and inflated skewness and kurtosis values. Both of these latter factors violate assumptions of the analyses conducted and limit study findings. Another limitation included Richmond County Schools' unexpected change in their data collection procedures between the academic years of 2008-2009 and 2009-2010 from the North Carolina K-2 Literacy Assessment to the Dynamic Indicators of Basics Early Literacy Skills (DIBELS). This prevented comparisons between first and second grade for Year 1 students and between kindergarten and first grade for Year 2 students. Additionally, further review of the data revealed that some teachers of kindergarten and first grade students did not follow the recommended subtest administration schedule for the North Carolina K-2 Literacy Assessment, thus limiting the number of comparisons that could be made between intervention conditions, grades and years of the project.

Beyond limitations specific to analyses conducted, other, more global, limitations of the investigation existed. The first is that the original *The Time is Now in Pre-K* ERF project called for an experimental design with true random assignment of teachers and students to intervention and control classrooms. After implementation of the project, it was revealed that the administration of RCS actually assigned teachers to the two intervention conditions of the project rather than employing random assignment, thus changing the project design to quasi-

experimental. The rationale behind RCS' assignment of teachers to the intervention or comparison condition was never formally revealed and no obvious pattern for assignment could be determined, but intentional assignment to intervention and comparison clearly influences the overall rigor of any intervention. Secondary to this decrease in design rigor, the quality of the research conducted and the findings of the project were limited.

A second global limitation is that the original design of this investigation involved examining the performance of students in Years 1, 2 and 3 of *The Time is Now in Pre-K* ERF project. Upon examining the data available for students in kindergarten, first and second grade, it was noted that only kindergarten data from the DIBELS was available for Year 3 students. As kindergarten data for Year 1 and 2 students was collected using the North Carolina K-2 Literacy Assessment, it was no longer possible to make a meaningful comparison of kindergarten performance across Years 1, 2 and 3 of the ERF project. Because of this, the decision was made to only include Year 1 and Year 2 students in the current investigation.

Another factor that potentially limited differences in student performance across grades was intervention bleed. Secondary to the nested design of the project, intervention and comparison preschool teachers were often located within the same school. This colocation allowed intervention and comparison teachers to visit each other's classrooms and obtain ideas regarding how to utilize classroom materials purchased through the project. This classroom level access contradicted the project's design of only providing support and coaching to intervention teachers regarding how purchased materials could be utilized to support student learning. Additionally, intervention and comparison teachers jointly attended annual district-level (i.e., hosted and required by RCS) professional development activities where evidence-based strategies and other educationally relevant information were shared and discussed. While these

sessions did not intentionally highlight the interventions featured in the ERF intervention, it is likely the content would have overlapped.

A second potential limitation for student performance across grades involved preschool fadeout (Manguson et. al., 2007). Although intervention children in Year 1 and Year 2 of the project made significant gains from pre-test to post-test on preschool measures of receptive vocabulary, upper case letter identification and expressive language, these short-term gains were not evident across all kindergarten, first and second grade literacy measures collected. This finding is not surprising as intervention fadeout often begins in kindergarten where teachers must focus their attention on the students who arrive with lower skills. As this happens, children with higher level skills acquired through attendance at high quality preschool programs slowly lose the advantage they once held over their peers. Without fidelity measures for primary (i.e., kindergarten, first and second) grades, it is unknown how instruction offered and evidence-based strategies employed may have sustained, further developed, or halted student language and literacy growth.

Another limitation of the investigation design involved Year 1 data. Secondary to the delayed awarding of the Early Reading First grant, *The Time is Now in Pre-K* project began in December of 2007 rather than the anticipated September start. With this delayed start, two specific problems arose. The first was that students in intervention classrooms only received four months of the *Hourglass Model* intervention instead of the intended eight months. Additionally, with the abbreviated timeline, pre-test and post-test data was collected for students with less than the recommended twelve months between assessment administrations. Because of these factors, it is possible that Year 1 student results do not fully capture the potential instructional impact of the *Hourglass Model*.

A final limitation of the investigation involved not being able to access student language and literacy data beyond second grade, which subsequently limited the ability to examine the impact of oral language skills upon later literacy development and academic success. As the intervention provided to students in the original *The Time is Now in Pre-K* ERF project focused on developing preschool student's oral language and early literacy skills, it is possible that the true effects of this intervention were not fully captured through the design of this investigation. Knowing that oral language skills in preschool have a direct relationship with third and fourth grade reading comprehension (Kendeou, van den Broek, & White, 2009; Roth, Speece, & Cooper, 2002; Senéchal et al., 2001; Storch & Whitehurst, 2002; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001; Westerveld, Gillon, & Moran, 2008) when reading focuses on comprehending units of text larger than individual words, it is possible that the true benefit of *The Time is Now in Pre-K* intervention was not captured. Direct assessment of students in third grade and beyond would allow for a detailed investigation of the contribution of oral language skills upon student academic performance and development of conventional literacy skills.

Implications

Despite the limitations acknowledged, this study offers valuable information regarding educational practices and future research related to the development of language- and literacy-related skills in young children. One such contribution of this investigation was that it allowed for a multi-year examination of student performance following participation in an Early Reading First project. Similar to other projects and research efforts, the original *The Time is Now in Pre-K* project only explored the effects of participation in intervention classrooms on the language and literacy development of preschool students. This investigation, which followed students from the original ERF project into kindergarten, first and second grade, allowed for an examination of

how a preschool intervention rich in oral language and emergent literacy opportunities impacted student's literacy success in primary grades. As student oral language skills are a known predictor of early literacy skills in kindergarten and first grade, as well as of reading comprehension in second grade and beyond (see Dickinson et al., 2003; Roth, Cooper, & de la Paz, 1999; Storch & Whitehurst, 2001, 2002; Vellutino, Tunmer, Jaccard, & Chen, 2007; Whitehurst & Lonigan, 1998), this investigation provided a much needed opportunity to examine the lasting effects of participation in an ERF intervention classroom.

Another valuable finding of this investigation is that it examined the effect of participation in ERF classrooms upon a relatively heterogeneous population across an entire school district. While many early interventions have been effective in small scale studies of relatively homogenous populations, this investigation answered the call to conduct research on larger scale preschool programs that significantly improve student oral language and literacy skills while accommodating the heterogeneity of students (McDonald, Keesler, Kauffman, & Schneider, 2006). Although the findings of the investigation were mixed, there were indicators of lasting improvement upon student literacy development. Additionally, by examining if the effects of participation in *The Time is Now in Pre-K* project were associated with student-level demographics such as chronological age, gender, race, language spoken and exceptionality, this investigation attempted to answer for whom value-added impacts were achieved through participation in an ERF intervention (see McDonald, Keesler, Kauffman, & Schneider, 2006).

A final contribution of this investigation is that it offers valuable information to RCS about the impact of *The Time is Now in Pre-K* ERF project, and their preschool educational practices. Looking specifically at the children who participated in the ERF program, RCS can evaluate whether meaningful gains related to language and literacy development were achieved.

Beyond student participants, RCS can evaluate whether the immense amount of resources dedicated to the implementation of the project (i.e., curricula chosen, staff trained and professional development provided) were worthwhile investments for ensuring the future language and literacy success of students.

Future Research Directions

While this investigation revealed many important findings about the impact of *The Time is Now in Pre-K* ERF project upon the language and literacy development of kindergarten, first and second grade students, important questions still remain. Of primary importance is the unanswered impact of an oral rich preschool intervention upon the oral language and literacy development of students beyond second grade. Knowing that oral language skills in preschool have a direct relationship with third and fourth grade reading comprehension (Kendeou, van den Broek, & White, 2009; Roth, Speece, & Cooper, 2002; Senéchal et al., 2001; Storch & Whitehurst, 2002; Vernon-Feagans, Hammer, Miccio, & Manlove, 2001; Westerveld, Gillon, & Moran, 2008), it is logical to expect that intervention students may have experienced benefits from participation in the project that have yet to be measured.

To fully explore the language and literacy development of students who participated in the original ERF project, the investigator intends to collaborate with RCS to obtain information pertaining to student performance on end-of-grade measures in third grade and beyond. Similar to this investigation, such a study would utilize data collected by the school district as part of their general operating procedures as it allows access to as many participants as possible. While there would still be potential issues with attrition, use of an end-of-grade measure would increase the likelihood of having a single measure that all Year 1 and Year 2 participants completed. It is

also less likely that instances of missing data would be present, as schools are required to report end-of-grade data for all students.

Beyond this investigation, there are other important points for future studies to consider when examining the contribution of preschool oral language skills upon the literacy development of students in elementary grades. Primarily, future studies should look to create sustainable interventions that offer a true experimental design and an increased level of rigor. A true experimental design would increase control and allow researchers to more clearly understand the relationship between student outcomes and independent variables examined even if the nested nature of school-based research were to require a nested design (e.g., Hierarchical Linear Modeling). Additionally, although utilizing data collected by schools as part of their general operating procedures can combat the potentially limited resources of research projects (e.g., time, personnel, finances), future studies should incorporate fidelity measures into the design of the project. Such measures could include more training for staff and administration responsible for student data collection, assessment of how accurately teachers deliver targeted strategies and interventions, data checks on an increased portion of data collected, and utilizing more independent data collection measures of student language and literacy development.

Another direction for future studies of student literacy development is to expand the breadth of oral and literacy measures collected. As reading in later elementary grades requires students to focus more on comprehension and less on the decoding of text, students become more reliant upon higher-order language-related skills (see Bishop & Snowling, 2004; Catts, Adlof & Weismer, 2006). In later elementary school, students also rely upon other complex processes that involve understanding written text, developing and interpreting meaning, and using meaning as appropriate to type of text, purpose and situation (National Center for Educational Statistics,

2005). By utilizing an assessment protocol that incorporates a more diverse range of oral language and literacy measures, researchers would have an increased ability to understand the specific contributions of oral language upon student literacy development and how those contributions change over time.

Finally, with knowledge of the relationship between teacher responsiveness and student oral language growth (see Chapman, 2000), future studies of language and literacy development could consider incorporating measures of teacher responsivity. Although this investigation provided support for the combined effect of teacher and school assignment upon student literacy outcomes, it did not identify the specific qualities of teachers that most impacted student learning. Being able to identify such information would encourage teachers to more systematically incorporate evidenced-based strategies into their classroom.

Conclusions

The primary aim of this study was to examine the effects of participation in *The Time is Now in Pre-K* project on kindergarten, first, and second grade language and literacy outcomes. As hypothesized, students who participated in intervention classrooms performed better than students in comparison classrooms on measures of first grade Phoneme Segmentation Fluency and Oral Reading Fluency. In kindergarten, intervention students performed better than comparison students on the Book and Print Awareness and Writing subtests, but the differences were not statistically significant.

Secondary aims of the study were to examine whether the effects of the ERF intervention were associated with or mediated by student-level demographic variables or environmental factors as well as if the effects of participation in intervention classrooms changed after one year of literacy instruction in the primary grades. Support was found for the hypothesis that student-

level demographics impacted student language and literacy performance as the intervention condition emerged as having the largest negative impact upon student book and print awareness and letter identification of upper and lower letters. Language spoken (i.e., ELL), race, gender, and exceptionality each had smaller negative impacts upon student performance, but did not reliably predict student outcomes on subtests of the North Carolina K-2 Literacy Assessment. For the hypothesis that examined the impact of environmental factors, support was also found as the combined effect of teacher and school assignment consistently predicted student performance on measures of receptive vocabulary, identification of upper case letters and expressive language skills. School assignment also had a significant impact upon Year 1 student identification of upper case letters. Moving to the final hypothesis, limited support was found for the lasting effects of *The Time is Now in Pre-K* project after one year of primary instruction. While intervention students often had more stable performance on the literacy measures assessed, Year 1 comparison students outperformed intervention students on subtests pertaining to book and print awareness and identification of upper and lower case letters. For Year 2 students, both intervention and comparison groups performed significantly better at the end of kindergarten than at the end of preschool on measures of upper- and lower-case letter identification.

Findings from this investigation made valuable and necessary contributions to research examining the impact of preschool-based interventions upon student language and literacy development. Nationally, study findings contributed toward the body of research on the impact of the ERF Initiative and specific interventions provided in ERF classrooms. Locally, study results provided an increased understanding of whether a school district's financial- and personnel-related investments led to improved and lasting student outcomes for their heterogeneous group of students that faced multiple conditions that made them at-risk for later

academic failure. Such efforts are necessary to move closer toward the goal of providing high-quality instruction to all preschool-aged children and determining the venues for how this may be accomplished.

APPENDIX A

Variables Analyzed

Kindergarten Code	**Variable Name**
K_LSI_UC	Letter Sound Identification: Upper Case Letters
K_LSI_LC	Letter Sound Identification: Lower Case Letters
K_LSI_S	Letter Sound Identification: Sounds
K_BPA	Book and Print Awareness
K_OR_PCT	Oral Retell Percentage Correct
K_PA1	Phonological Awareness 1
K_PA2	Phonological Awareness 2
K_PA3	Phonological Awareness 3
K_PA4	Phonological Awareness 4
K_SI	Spelling Inventory
K_W	Writing
First Grade Code	**Variable Name**
1_LSI_UC	Letter Sound Identification: Upper Case Letters
1_LSI_LC	Letter Sound Identification: Lower Case Letters
1_LSI_S	Letter Sound Identification: Sounds
1_BPA	Book and Print Awareness
1_OR_PCT	Oral Retell Percentage Correct
1_SI	Spelling Inventory
1_W	Writing
1_PA1	Phonological Awareness 1

1_PA2	Phonological Awareness 2
1_PA3	Phonological Awareness 3
1_PA4	Phonological Awareness 4
1_PA5	Phonological Awareness 5
1_PA6	Phonological Awareness 6
1_PA7	Phonological Awareness 7
1_PA8	Phonological Awareness 8
1_PA9	Phonological Awareness 9
1_PA10	Phonological Awareness 10
1_PA11	Phonological Awareness 11
1_LNF	Letter Naming Fluency
1_NWF	Nonsense Word Fluency
1_PSF	Phoneme Segmentation Fluency
1_ORF	Oral Reading Fluency
1_WUF	Word Use Fluency
Second Grade Code	**Variable Name**
2_NWF	Nonsense Word Fluency
2_WUF	Word Use Fluency
2_ORF	Oral Reading Fluency

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