THE RELATIONSHIP BETWEEN EARLY WORD READING AND READING COMPREHENSION GROWTH FOR LANGUAGE-MINORITY LEARNERS AND NATIVE-ENGLISH-SPEAKING STUDENTS: A SEVEN-YEAR LONGITUDINAL STUDY

Jackie Eunjung Relyea

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Education.

Chapel Hill
2015

Approved by:

Jill Fitzgerald

Steve J. Amendum

Robin Baker

Mollie W. Lloyd

William B. Ware

ABSTRACT

JACKIE EUNJUNG RELYEA: The Relationship between Early Word Reading and Reading Comprehension Growth for Language-Minority Learners and Native-English-Speaking Students: A Seven-Year Longitudinal Study
(Under the direction of Dr. Jill Fitzgerald)

The significant role of early word-reading ability in reading comprehension development for monolingual native-English-speaking (NE) children has long been theoretically and empirically recognized. Yet, whether this is the case for language-minority (LM) learners who learn to read in a second or additional language has yet to be thoroughly established in the research literature. The purpose of the present study was to examine whether the relationship between first-grade word reading and reading comprehension growth through eighth grade varied as a function of children's language status (i.e., LM learners and NE students). Using seven-year longitudinal data from a nationally representative sample of children from the Early Childhood Longitudinal Study–Kindergarten Class of 1998-1999, growth trajectories of English-reading comprehension proficiency for LM learners (n = 992) and NE students (n = 7,188) of differing initial English word-reading proficiency were examined. A series of Hierarchical Generalized Linear Modeling growth curve analyses was conducted.

The main conclusion was that children with initially high Word-Reading Proficiency demonstrated more growth than children with initially low Word-Reading Proficiency, but the effect of initial Word-Reading Proficiency was especially impactful for LM learners as compared to NE learners. Specifically, LM learners with initially high Word-Reading Proficiency had relatively lower Reading-Comprehension Proficiency than their NE peers with high Word-

Reading Proficiency in first grade, but Reading-Comprehension Proficiency growth trajectories of the two groups converged by the end of eighth grade. In contrast, LM learners with initially low Word-Reading Proficiency had a relatively lower Reading-Comprehension Proficiency in first grade and had significantly less growth as compared to NE students with low Word-Reading Proficiency, thereby leading to a large gap between the two groups by the end of eighth grade. Results emphasize enhanced instructional opportunities for LM learners that focus on promoting strong word-reading skills in first grade.

ACKNOWLEDGEMENTS

My dissertation completion would not have been possible without the generous help and support of many people in every phrase of the project. First and foremost, I would like to express my deepest gratitude to my advisor, Dr. Jill Fitzgerald, for her extraordinary mentorship and extensive support and patience through every stage of my academic development. She has provided me with insightful and priceless advice and innumerable opportunities for my professional and personal growth as a writer, researcher, and teacher. Her constant efforts and encouragement to ensure that the quality of my work reaches the highest possible level represent what it means to be a scholar, mentor, and educator.

I would like to extend my sincere appreciation to my committee members, Dr. Steve Amendum, Dr. Robin Baker, Dr. Mollie Lloyd, and Dr. William B. Ware, for their invaluable support, expertise, time, and insights that have greatly influenced my dissertation.

I must thank my mentors, colleagues, and dear friends: Dr. Soo-yong Byun, Dr. Claudia Cervantes-Soon, Dr. Ji-yeon Jo, Dr. Ki-hyun (Kelly) Ryoo, Dr. Marta Sanchez, Mina Lee, Thomas Bothwell, Hye-young Hwang, Jung-in Kim, Dong-soo Bang, and my undergraduate- and graduate-level students at UNC-Chapel Hill, who have been incredibly supportive in both my professional and personal growth. My special gratitude goes to my family for their steadfast involvement in my education. My parents have been a constant source of support and motivation throughout all of my educational endeavors. I am truly grateful for their love.

Finally, my most heart-felt love and never enough thanks go to my wonderful husband, Dennis Relyea.

TABLE OF CONTENTS

LIST OF TABLES

Table

LIST OF FIGURES

Figure

CHAPTER 1

INTRODUCTION AND RATIONALE

The purpose of the present study was to examine the association between word-reading proficiency in the spring of first grade and reading-comprehension proficiency growth across the spring of first, third, fifth, and eighth grades for language-minority (LM) learners and native-English-speaking (NE) students. The specific research question guiding the study was: Is the relationship between first-grade word-reading proficiency and reading-comprehension proficiency growth through eighth grade different for LM learners as compared to their NE peers? The current study was a secondary analysis of longitudinal data from a nationally representative sample of children of U.S. elementary schools from the Early Childhood Longitudinal Study Kindergarten Class of 1998-1999 (ECLS-K).

The current chapter begins with the rationale for the present study. Then, significance of the study and hypothesis are presented. Finally, definitions for key terms are provided.

Rationale

The number of school-age LM learners has increased immensely over the past decades. LM learners refers to children who come from home and community in which a language other than English is spoken (August & Shanahan, 2006). There were approximately two million LM learners in public schools in 1990, but the number grew to nearly 11 million in 2009, representing 1 of every 21 school-age students in the United States (U.S. Department of Education, 2011). LM learners, typically classified as English language learners (ELLs), come from more than 480 different language backgrounds (Kindler, 2002). Nearly 80% of LM learners come from Spanish-speaking backgrounds, and Asian-language-speaking (e.g., Vietnamese, Hmong, Cantonese, Korean, and Khmer) children make up most of the rest of the LM population (Goldenberg, 2011). With a burgeoning influx of LM learners who are learning English as a new language in the United States, issues concerning their English-language academic performance have received unprecedented attention from educators, researchers and policy makers across the nation (e.g., August & Hakuta, 1997; August & Shanahan, 2006; Goldenberg, 2011; National Clearinghouse of English Language Acquisition [NCELA], 2007). According to results of the 2013 *What's Hot, What's Not* survey polled by the International Reading Association (Cassidy & Grote-Garcia, 2012), ELLs/English as a second language (ESL) was rated as one of the "hot" topics and *should* be a very hot issue in literacy education.

Of particular concern is that LM learners encounter considerable difficulties with reading and understanding complex text written in English (Carlo, August, McLaughlin, Snow, Dressler, Lippman, Lively, & White, 2004; Lesaux & Siegel, 2003). According to the recent National Assessment of Educational Progress (NAEP) reading assessment, fourth-grade LM learner's reading performance was significantly lower than their native English-speaking peers (National Center for Education Statistics [NCES], 2011), and large and persistent gaps consistently exist between LM learners and native English-speaking children in reading achievement performance over the course of the school years. Moreover, LM learners who achieve below the basic English-reading comprehension level are at substantial risk for difficulties in almost all subject content areas and behavioral and social success in school, and are more likely to drop out than are native English-speaking students (Fry, 2007; Genesee, Lindholm-Leary, Saunders, & Christian, 2006; Kaufman, Alt, & Chapman, 2001; Reardon, 2003; Ruiz-de-Velasco & Fix, 2000; Snyder, Dillow, & Hoffman, 2007). Thus, fostering LM learners' English-reading growth is a vital goal of formal reading education among educators and researchers at the local and nation levels (August & Shanahan, 2006).

Despite the pressing need to serve this ever-growing population, there is a limited scope of sound empirical work needed to inform educational practice and policy. A major issue is that little is known about the developmental pattern of LM learners' reading comprehension. Although the number is increasingly sharply, only a handful of researchers have modeled LM learners' English-reading growth, and very little research has provided insight into the growth trajectories of their English-reading comprehension over time or into early predictors of that comprehension growth. The approach to examining a componential reading sub-skill and its relationship to long-term reading-ability growth is particularly important to understanding the complexity and difficulty inherent in LM learners' second-language reading development (Lesaux, 2006; McCardle, Mele-McCarthy, Cutting, Leos, & D'Emilio, 2005).

In addition, while a great deal of large-scale research and intervention funding projects that support LM learners' English-reading development have focused on those at primary grade levels, relatively less attention has been paid to those beyond the primary grades (e.g., August & Shanahan, 2006; Bailey, 2007; RAND Reading Study Group, 2002; Snow & Uccelli, 2009). Furthermore, few studies have examined early factors that might be associated with LM learners' developmental change in English-reading comprehension. It is thus unclear whether and to what extent early reading-related skills contribute to LM learners' success or struggles in reading comprehension growth over short or lengthy time periods.

Early word-reading ability is widely recognized as one of the most salient predictors of reading comprehension success for monolingual English-speaking children (e.g., Adam, 1990; Cain, 2006; Francis, Fletcher, Catts, & Tomblin, 2005; Kintsch, 2004; National Reading Panel, 2000; Perfetti, 2007; Stanovich, 2000). The relationship between word reading and ability to comprehend text has been theoretically and empirically established in various ways for monolinguals (e.g., Baumann, 2005; Beck & McKeown, 2007; Beck, Perfetti, & McKeown, 1982; Davis, 1994; Juel, Griffith, & Gough, 1986; Nagy, Anderson, & Herman, 1987; Snow, Burns, & Griffin, 1998; Stanovich, Cunningham, & Freeman, 1984; Tannenbaum, Torgesen, & Wagner, 2006). Not only does a strong correlation exist between the two constructs, but causal evidence indicates that word reading plays a critical role in increasing text comprehension ability (e.g., Anderson & Freebody, 1981; Blanchard, 1980; Cunningham & Stanovich, 1997; Herman, 1985; Lesgold, Resnick, & Hammond, 1985; McKeown, Beck, Omanson, & Pople, 1985; Scarborough, 2001; Stanovich, 1985). For instance, readers with well-developed automatic word recognition competence do not focus unduly on lower-level processing skills (e.g., word identification), and, consequently, more attention can be paid to integration of new information with background knowledge and critical evaluation of the information being read (e.g., Beebe, 1980; Biemiller, 1970; Cain, Oakhill, & Bryant, 2000; Calfee & Piontkowsky, 1981; Juel, 1991; Lomax, 1983; Stanovich, 1991). Moreover, early word reading influences text comprehension in a cumulative manner (Chall, Jacobs, & Baldwin, 1990; Stahl & Nagy, 2006). The more words children recognize and understand, the more opportunity they have to spend time engaged with texts, to learn about the world and new words, and to understand richer texts. Thus, reading comprehension competence at upper grade levels is likely to hinge upon the accumulated knowledge from early experiences with words (Cunningham & Stanovich, 1997; RAND Reading Study Group, 2002).

Nevertheless, whether this is the case for LM-learner population has yet to be thoroughly established in the research literature. Cross-sectional studies to date on LM learners have documented that while LM learners often perform on a par with monolingual English-speaking students in English word-level reading in the primary grades, the great majority of LM learners underperform their monolingual English-speaking peers on English-reading comprehension in the upper elementary and middle grades (Lesaux, Koda, Siegel, & Shanahan, 2006, for a review; NCES, 2007). However, far less is known as to whether early English-word reading is an essential prerequisite to LM learners' long-term development of English-reading comprehension, and whether early English word-reading ability contributes to the persistence of reading comprehension success or difficulties across upper elementary and middle grades.

The use of a longitudinal research design rather than cross-sectional design is particularly essential in the study of LM learners' reading development. Although the snapshot approach provides a basic understanding about reading achievement levels at one or two points in time, it does not address critical questions about LM learners' English-reading growth that occurs in a slow and gradual manner, nor does it reveal their developmental pattern over long periods of time (Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou, & Snow, 2011; Mancilla-Martinez & Lesaux, 2010). Longitudinal research findings accomplished with sound methodology will help to provide a more in-depth perspective on the reading developmental process of LM learners who typically make the transition from learning-to-read to reading- to-learn stages in a slow and gradual manner over time.

The analysis of LM learners' developmental trajectories in reading comprehension using precursor reading skills could serve as a primary source of identifying and diagnosing students at risk for reading difficulties (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996). The existing reading research with monolingual English-speaking students has established the importance of early identification of risk factors associated with difficulties in learning to read skills (e.g., Lyon, 1998; Satz & Fletcher, 1988; Schenck, Fitzimmons, Bullard, Taylor, & Satz, 1980; Strag, 1972). Early screening and detection could be the key to providing preventive and sound instruction before students experience serious failure throughout the school years (e.g., Fuchs & Fuchs, 2006; Snow et al., 1998; Torgesen & Burgess, 1998).

What is Known about LM Learners' English-Reading Growth?

Monolingual native English-speaking children's reading growth trajectories tend to demonstrate quadratic developmental patterns that have steeper ascending slopes in the earlier phases, followed by decelerating growth rates, reaching a plateau at older ages (e.g., Catts, Bridges, Little, & Tomblin, 2008; Francis et al, 1996; Williamson, Fitzgerald, & Stenner, 2014). Similar developmental patterns have also been found in LM learner studies. For instance, from preschool through fifth grade, Spanish-speaking LM learners' English vocabulary, verbal short-term language memory, and word reading accelerated rapidly originally, and then decelerated (e.g., Mancilla-Martinez & Lesaux, 2011; Nakamoto, Lindsey, & Manis, 2007).

Among the handful of studies that have modeled reading growth of LM learners, only a few researchers have investigated the association of reading-related predictor variables with initial status and growth rates of global reading achievement and specific reading sub-skills. While LM learners' English-reading growth rates have been studied in relation to several predictive factors such as socioeconomic status (SES; D'Angiulli, Siegel, & Maggi, 2004; Kieffer, 2008), initial English oral proficiency (e.g. Fitzgerald, Amendum, Relyea, & Garcia, in press; Kieffer, 2011), or first-language backgrounds (e.g., Roberts, Mohammed, & Vaughn, 2010), very little research has been done that provides insight into the predictive relationship between early reading-related sub-skill variables and later reading outcome growth.

Significance of the Study

Public schools in the United States have experienced phenomenal and rapid growth in the number of LM learners who often lag far behind their monolingual English-speaking peers in English reading over the past few decades. Consequently, fostering LM learners' English-reading comprehension has become a vital goal of formal reading education at the national, state, and local levels. Despite the nationwide attention focused on the improvement of LM learners' English-reading comprehension ability, knowledge of developmental patterns of English-reading comprehension during the elementary and middle grades still remains lacking. In addition, although the extant literature on LM learners' reading has documented the predictive relationship between English-word reading on reading comprehension at one time point or over a short period, far less is known as to whether and to what extent LM learners' early English word-reading ability contributes to developmental patterns of English-reading comprehension over time.

To my knowledge, the present study is the first study to empirically address the association between LM students' early word-reading ability and English-reading comprehension growth in comparison to those for NE students over lengthy time periods. Although an emerging number of studies has begun to focus on growth trajectories of LM learners' overall English-reading achievement using large-scale longitudinal data (i.e., ECLS-K) in recent years (e.g., Halle, Hair, Wandner, McNamara, & Chien, 2011; Han & Bridglall, 2009; Kieffer, 2008, 2011), no researchers to date have investigated the growth trajectories of a specific reading sub-skill in relation to other early reading sub-skill. The potential results from the current study would make unique contributions to growing knowledge about LM learners' reading comprehension development by adding more detailed information to previously available literature. In addition, findings from the study may have important implications for curriculum decisions and instructional approaches to address individual LM learner's unique literacy learning needs.

Re-Statement of the Research Question and Hypothesis for the Present Study

The research question guiding the study was: Is the relationship between first-grade word-reading proficiency and reading-comprehension proficiency growth through eighth grade different for LM learners as compared to their NE peers?

The major hypothesis for the study was that the relationship between children's word-reading proficiency and reading-comprehension proficiency growth over time would vary as a function of children's language status (i.e., LM learners versus NE students). Thus, an ordinal interaction between initial word-reading proficiency and language status was expected. More specifically, I hypothesized that LM learners who had initially higher word-reading ability would experience greater growth in reading-comprehension proficiency as compared to LM learners and NE peers who had initially lower word-reading ability. LM learners with initially higher word-reading ability would start out at a lower level than their NE peers with initially higher word-reading ability in the spring of first grade. Additionally, I expected that LM learners with initially higher word-reading ability would follow a growth trajectory similar to that of their NE peers with initially higher word-reading ability such that high-performing LM learners would eventually catch up with their high-performing NE peers in reading-comprehension proficiency. On the other hand, LM learners who had initially lower word-reading ability would experience slower growth in reading-comprehension proficiency and lag increasingly behind not only their NE peers who had initially lower word-reading ability but LM learners with initially well-established word-reading ability.

Definition of Terms

Language-minority learners refers to students who come from a home and community setting in which a language other than English is primarily spoken and may have developed some extent of home-language proficiency (e.g., August & Shanahan, 2006; Kieffer, 2008).

Native-English-Speaking Students refers to students who were born in the United States or any other English-speaking country and come from home and community where only English is spoken.

Word Reading refers to the ability to read (a) words by sight as whole units by accessing information stored in lexical memory (Ehri & Robbins, 1992; Perfetti, 1985), and/or (b) words through word analysis strategies such as by using context cues to make predictions about upcoming words (Rumelhart, 1977; Ehri, 1994).

Reading Comprehension is a multifaceted cognitive process in which a reader constructs meaning through interaction with text. The RAND Reading Study Group report (2001) stated that reading comprehension is "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (p. 11). In a similar vein, the NAEP (2009) Reading Framework Committee defines reading comprehension as "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). The reading comprehension measure developed for the ECLS-K study and used in the present study was based on the RAND Reading Study definition of reading comprehension.

Oral English-Language Proficiency refers to the ability to use English language accurately and appropriately in its oral forms in various settings (Cloud, Genesee, & Hamayan, 2000). The specific aspects of oral English-language proficiency examined for the ECLS-K

English-proficiency assessment were listening comprehension, productive vocabulary, and ability to understand and retell a story.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of the present study was to examine the relationship between word-reading proficiency in the spring of first grade and reading-comprehension proficiency growth across the spring of first, third, fifth and eighth grades for language-minority (LM) learners and native-English-speaking (NE) students. The research question guiding the study was: Is the relationship between first-grade word-reading proficiency and reading-comprehension proficiency growth through eighth grade different for LM learners as compared to their NE peers?

In the current chapter, I first provide theoretical perspectives pertaining to the relationship between word reading and reading comprehension growth and moderating factors on the relationship. Next, I provide empirical research findings regarding (a) correlational relationships between word reading and reading comprehension among monolingual children and LM learners and (b) reading-comprehension/reading-achievement development for Monolinguals and LM Learners. Last, I provide a summary statement.

Theoretical Perspectives

In the following sections, I provide a theoretical discussion of (a) how early word reading might be related to reading comprehension growth and (b) how language status and other factors may moderate the relationship between early word reading and reading comprehension growth.

How Might Early Word Reading be Related to Reading Comprehension Growth?

Early word-reading ability for monolinguals is related to later comprehension development. Developmental views of reading for monolingual children suggest that readers move from lower-level word-reading skills to constructing meaning of complex text in a sequential and cumulative manner (e.g., Chall, 1996). Initial acquisition of lower-level word reading skills (i.e., code-breaking) with automaticity and accuracy during the primary grades facilitates reading practice and provides opportunities to gain the various types of knowledge, which in turn leads to developmental improvements in the higher-order processing involved in construction of the meaning-based representation of the texts in the later school years (e.g., Juel, Griffith, & Gough, 1986; Perfetti & Hogaboam, 1975; RAND Reading Study Group, 2002; Stanovich, 2000).

Given the cumulative nature of reading skills, if children have difficulties in word reading in the primary grades, they are likely to experience greater challenge and struggle with text comprehension and fall further behind their same-age peers as they reach the upper elementary or middle school grades (Alexander, Entwisle, & Horsey, 1997; Juel, 1988; Oakhill, Yuill, & Parkin, 1986). The ability to read words fluently and accurately is closely related to the cognitive resources that can be devoted to the processes involved in comprehending and making meaning from text (e.g., Frederiksen & Warren, 1987; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; Just & Carpenter, 1987; Perfetti, 1985). Therefore, word reading is an important prerequisite and consequence for successful reading comprehension and should be considered as a potential causal factor (e.g., Chen & Vellutino, 1997; Conners, 2009; Francis, Fletcher, Catts, & Tomblin, 2005; Cutting & Scarborough, 2006; Georgiou, Das, & Hayward, 2009; Gough, Hoover, & Peterson, 1996; Jenkins & Jewell, 1993; Kirby & Savage, 2008; Joshi & Aaron, 2000; Vellutino, Tunmer, Jaccard, & Chen, 2007).

One theoretical position that can explain the cognitive mechanism between word reading and reading comprehension for monolingual children is that the two constructs develop in mutual support because they share common cognitive processes and draw on the same knowledge sources in working memory (Guttentag & Haith, 1978; LaBerge & Samuels, 1974). Within this view, children who lack the ability to read words quickly and accurately either in isolation or in connected text may have significant demands on cognitive processes, particularly in the area of working memory, while devoting significant attention to decoding the words. Thus, relatively little cognitive processing resources are directed to constructing meaning and monitoring meanings already apprehended (Perfetti, 1985). If children can read words from working memory by sight in a fast and less intrusive way, more sources drawn from working memory can contribute to reading comprehension processes (Frederiksen & Warren, 1987; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; Just & Carpenter, 1987; Perfetti, 1985; Walczyk, 2000). Therefore, learning to read by sight and building a vocabulary of sight words in memory is one of several essentials in reading instruction for beginning readers to promote the development of word reading and reading comprehension skills (Ehri & Snowling, 2004).

Two contradictory theoretical models of reading development in general mainly conceived for monolingual children—*the cumulative growth model* (e.g., Bast & Reitsma, 1998; Stanovich, 1986; Walberg & Tsai, 1983) and *the developmental lag model* (e.g., Aunola, Leskinen, Lerkkanen, & Nurmi, 2004; Francis et al., 1996). To my knowledge, there have been no studies in which two aforementioned models are hypothesized and tested to address the relationship between word reading and reading comprehension growth, although one prior study tested the two hypothetical models for overall initial reading level and its growth pattern among LM learners (cf. Kieffer, 2008). In particular, to date, no one has incorporated the language-status effect into the models.

The cumulative growth model, better known as the Matthew effect (e.g., Bast & Reitsma, 1998; Stanovich, 1986; Walberg & Tsai, 1983), addresses the importance of acquiring early reading skills in general, not specifically the importance of early word reading. However, implications for the significance of early word reading arise from the model. According to the cumulative growth model, more-skilled readers at the early reading acquisition stage grow at more advanced speeds over the years than the less-skilled readers by taking advantage of greater involvement in reading-related activities (Stanovich, 1986). As a result, the gap between children who are initially lesser skilled readers as compared to more skilled readers gradually widens (Pfost, Hattie, Dörfler, & Artelt, 2014). Although the model describes the relationship between initial reading level and their intraindividual reading gains in general, it also applies to the relationship between early word-reading ability and reading comprehension growth, specifically. Based on the conceptual perspective of the model, it is expected that an initially higher word-reading ability would be advantage in reading comprehension development, while initially lower word-reading ability would be disadvantages. Thus, a widening gap in reading comprehension outcomes would occur over school years between children who initially have higher and those who initially have lower word-reading abilities.

Alternatively, according to the developmental lag model, as children receive systematic reading instruction in school, less-skilled readers initially start out with lower reading achievement but tend to make greater gains through escalating speed to acquire reading knowledge and skills more rapidly than those who demonstrate better initial reading. Consequently, initially less-skilled readers are able to catch up to more-skilled peers over time or at least close the achievement gap between the two groups (e.g., Stanovich, Nathan, & Vala-Rossi, 1986; Stanovich, Nathan, & Zolman, 1988). The developmental lag model in the domain of overall reading can be also explained in the particular relationship between early word-reading ability and reading comprehension growth. Children who start elementary school with lower word-reading ability might show lower growth rates in reading comprehension at an early point in time as compared to those who start with higher word-reading ability. However, despite the early increasing competence gap, children with initially lower word-reading ability might gradually accelerate growth rates in reading comprehension and catch up to those with initially higher word-reading ability, therefore narrowing the gap.

How Might Language Status and Other Factors Moderate the Relationship between Early Word Reading and Reading Comprehension Growth?

Language status. The deep and close relationship between early word-reading skills and reading comprehension development for monolingual children has long been theoretically well established (Perfetti & Hogaboam, 1975; Snow, Burns, & Griffin, 1998). However, despite the widely held view of the relationship between the two constructs, given the lack of theoretical and empirical research on LM learners' reading comprehension development, very little is known about whether the role of early word reading for long-term reading comprehension development also pertains to LM learners who learn to read in a second or additional language.

Hypothetically speaking, the association between early word reading and reading comprehension growth may differ between LM learners and their NE peers. There are two possible explanations for the relative influence of children's language status on the relationship between word reading and reading comprehension growth. First, LM learners expend a great deal of cognitive energy and resources to the task of learning to read (e.g., phonological, syntactic, and lexical skills) *in a language that they have yet to master*. The acquisition of word-reading skills for LM learners may require more processing time as compared to their monolingual peers who draw upon substantial oral language skills (Verhoeven, 2011).

However, it is viable to assume that those LM learners who acquire strong early word reading skills would show similar reading comprehension growth to that of their monolingual peers. Or, alternatively, even for those LM learners who acquire strong early word reading skills, their lesser exposure to English relative to monolingual NE peers may result in limited syntactic sensitivities and morphological knowledge that is a presumably a consequence of delay in reading comprehension growth (Kieffer, 2012).

Second, in addition to linguistic and cognitive factors, LM learners' background knowledge may influence the strength of the relationship between word reading and reading comprehension growth. Language-Minority learners are more likely than their NE peers to lack sufficient background knowledge of the topic of a text (e.g., Droop & Verhoeven, 1998; Hacquebord, 1994). Having sufficient type and amount of prior knowledge of the topic to be read plays a strong role in understanding and constructing meaning from text. Some LM learners with limited or interrupted prior educational experiences may possess a lack of background knowledge required to understand much of what is read, resulting in great comprehension difficulty. Even for other LM learners with a high degree of academic schooling in their native language or country, their cultural perspectives and culturally-based assumptions may not match the background knowledge assumed or required in the U.S. classrooms.

Other factors. Two prominent domains—LM learners' oral language proficiency and child's socio-demographic characteristics (e.g., gender, race/ethnicity, and family SES)—may influence the strength of the predictive association between word reading and reading comprehension growth. Thus, they should be taken into consideration in examining the relationship between the two constructs.

First, the relationship between LM learners' English word-reading ability and reading comprehension growth can be largely constrained by initial English oral-language competence. Consistently, as has been the case for monolingual children (Anderson & Freebody, 1981; Roth, Speece, & Cooper, 2002; Vellutino, Scanlon, Small, & Tansman, 1991; Storch & Whitehurst, 2002), elementary school-age LM learners' early oral English-language proficiency is closely interwoven with English-reading performance. Thus, those LM learners who are not yet proficient in oral English language are likely to exhibit difficulties in learning to read in English in the primary grades and attain relatively low levels of English-reading outcomes than their native-English-speaking peers (Kieffer, 2011) or initially proficient LM counterparts (Fitzgerald, Amendum, Relyea, & Garcia, 2015).

Second, the association of LM learners' English word-reading ability with reading comprehension growth can be confounded by child's socio-demographic characteristics such as gender, race/ethnicity, and family SES. Although indicators of family SES, in particular, are significant factors that affect students' literacy attainment in the general population (Aikens & Barbarin; 2008, Chatterji, 2006; Entwisle & Alexander, & Olson, 2005; Fryer & Levitt, 2004; Kaplan & Walpole, 2005; Perie, Grigg, & Donahue, 2005; Snow et al., 1998), such phenomenon is particularly prevalent among LM learners in the United States who are most likely to be from low-income and immigrant backgrounds (Goldenberg, Rueda, & August, 2006; Kieffer, 2012; Roberts, Mohammed, & Vaughn, 2010). Language-minority learners from low SES families often have parents with low levels of formal education, lack of home/family literacy experiences and inadequate access to educational resources, which, as a result, negatively influence second-language literacy development (Cobo-Lewis, Pearson, Eilers, & Umbel, 2002; Goldenberg, 1987; Hus, 2001; McLoyd, 1998).

What is known about Relationship between Word Reading and Reading Comprehension?

The following sections provide empirical research findings regarding static cross-sectional correlational relationship and longitudinal relationship between word reading and reading comprehension among monolingual children and LM learners.

Monolingual Children

Static cross-sectional correlational relationship. The findings on the static relationship between measures of word reading and reading comprehension of monolingual English-language speakers are mixed. First, a large number of studies that have focused on the relationship between word reading and reading comprehension have reported that there are moderate to high positive correlations between the two constructs (National Reading Panel, 2000). In addition, word reading has been found to predict unique variance in reading comprehension tasks (e.g., Snow et al., 1998). However, despite the well-established body of research confirming that word reading and reading comprehension are strongly related, substantial variability has been found in the strength of the association between word reading and comprehension. For example, in Gough, Hoover, and Peterson's (1996) review of 10 studies, correlations between word reading and reading comprehension ranged from $r = .18$ to $r = .83$ across the first grade through college students. Also, there has been considerable variability in the magnitude of variance in reading comprehension explained by word reading. Some researchers reported the proportion of variance (R^2 values) in the range of .0001 or .0005 (e.g., Berninger, Abbott, Vermeulen, & Fulton, 2006), whereas others reported in the range of .90 (e.g., Katzir, Kim, Wolf, Kennedy, Lovett, & Morris, 2006).

A close look at the studies that have explored the correlational relationship between word reading and reading comprehension reveals that the strength of the association has varied by several reader-related factors. First, the correlations between word reading and reading comprehension differ by the ages of the participants. Cross-sectional research for monolingual English-speaking readers has indicated that the relative contribution of word reading to reading comprehension is stronger among younger readers than older ones (Gough et al., 1996; Keenan, Betjemann, & Olson, 2008).

Second, monolingual readers' oral-language proficiency might also influence the strength of the association between word reading and reading comprehension. Guided by the Simple View of Reading (SVR; Gough & Tunmer, 1986; Hoover & Gough, 1990) framework that contends that reading comprehension is best predicted by word reading and listening (linguistic) comprehension and their cross-product, researchers have provided evidence that oral language proficiency predicts a greater proportion of variance in reading comprehension among monolingual English-speaking students (e.g., Anderson & Freebody, 1981; Cutting & Scarborough, 2006; Johnston & Kirby, 2006; Joshi & Aaron, 2000; Savage, 2006; Savage & Wolforth, 2007; Tunmer & Hoover, 1992; Vellutino, Tunmer, Jaccard, & Chen, 2007).

In addition to reader-related characteristics, variance in the magnitude of the correlations may be attributed to different measures or tasks used to assess the two constructs (e.g., Best, Floyd, & McNamara, 2008; Cutting & Scarborough, 2006; Johnston & Kirby, 2006; Keenan et al., 2008). For example, Best and colleagues (2008) found that the amount of variance in reading comprehension explained by word reading skills varied according to comprehension measures, with greater relations evident when a narrative text was used (R^2 values ranging from .39 to .42) as compared to when an expository text was used (R^2 values from .04 to .23).

Longitudinal relationship. Change in the correlational relationship between word reading and reading comprehension for monolinguals during reading development has been widely studied, but findings are divergent and seemingly contradictory. Specifically, some studies show that initial word reading exerts increasingly weaker influence on reading comprehension with increasing age (e.g., Abbott, Berninger, & Fayol, 2010; Burgoyne, Whiteley, & Hutchinson, 2011; Deacon & Kirby, 2004; Juel, 1988; Kim, Wagner, & Lopez, 2012). That is, once children develop a sufficient level of word-reading skills during the primary grades, the relative contribution of word reading to reading comprehension gradually decreases due to less variability in children's word-reading skills during the elementary and middle school years.

On the other hand, previous research guided by the SVR framework has demonstrated that measures of oral language skills (i.e., vocabulary and listening comprehension) exert an increasingly stronger influence on reading comprehension (e.g., Ouellette & Beers, 2010; Storch & Whitehurst, 2002). Still, other longitudinal studies have demonstrated that the magnitudes of the correlations between early word reading and later reading comprehension are similarly retained from the first to the last time point among native-English-speaking students (e.g., Cain & Oakhill, 2011; Cain, Oakhill, & Bryant, 2004; Compton, Fuchs, Fuchs, Elleman, & Gilbert, 2008; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997).

Language-Minority Learners

Static cross-sectional correlational relationship. Language-minority learners' second-language word reading has also been found to be strongly correlated with second-language comprehension when measured at static time points. Several empirical studies have sought to apply the SVR framework to a sample of LM learners (e.g., Droop & Verhoeven, 2003; Erdos, Genesee, Savage, Haigh, 2011; Hoover & Gough, 1990; Jared, Cormier, Levy, & Wade-Woolley, 2011; Lesaux, Crosson, Kieffer, & Pierce, 2010; Manis, Lindsey, & Bailey, 2004;

Proctor, August, Carlo, & Snow, 2005). In support of the SVR framework, the studies have provided evidence that young LM learners' second-language word reading explains some of the variability in second-language comprehension.

Despite the strong correlation evident between word reading and comprehension among LM learners, like monolingual readers, the average amount and range of variance in reading comprehension accounted for by word reading tends to vary depending on several factors—age, native and new-language oral proficiency, and measures and tasks used for assessment. For example, Lesaux and colleagues (2010), who investigated the word reading with reading-comprehension relationship among fourth-grade Spanish-speaking LM learners, found that word reading was more strongly predictive of comprehension when comprehension was measured using a cloze procedure (i.e., Woodcock Language Proficiency Battery-Revised [Woodcock, 1991]) than when measured with reading passages and corresponding questions (i.e., Gates–MacGinitie Reading Test).

Longitudinal relationship. Although there is a small number of studies involving LM learners over time (e.g., Droop & Verhoeven, 2003; Gottardo & Mueller, 2009; Hoover & Gough, 1990; Proctor et al., 2005; Reese, et al., 2000; Verhoeven, 1990, 2011), the studies were conducted with LM learners only in the primary grades by using predictor-to-later-outcome correlational approaches rather than examining growth patterns of reading comprehension in relation to word reading over time. The findings from the correlational studies have revealed that LM learners' age is a significant moderator of the word-reading-comprehension relationship. Specifically, LM learners' word reading accounts for the bulk of variance in reading comprehension during the primary grades, but the correlational relationship gradually decreases with increasing chronological age, while the influence of second-language oral proficiency on reading comprehension becomes increasingly stronger.

There is one recent longitudinal study, in which a growth-curve modeling approach was used in examining the predictive role of LM learners' initial English-word reading in English-reading comprehension growth, but only focusing on Spanish-speaking LM learners in middle schools (e.g., Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou, & Snow, 2010). Mancilla-Martinez and colleagues (2010) reported that Spanish-speaking adolescent LM learners' initial English-word reading significantly predicted rate of growth in English-reading comprehension. Students designated as low-, middle-, and high-performing word readers in fifth grade followed parallel trajectories of English-reading comprehension between fifth and seventh grade. The comprehension trajectories for LM learners with low performance in word reading in fifth grade were far below from those of middle- and high-performing LM learners. In short, LM learners with initially low performance in word reading continued to struggle with English-reading comprehension during the middle school years. Although the study provided valuable evidence about the development of native-Spanish speaker LM learners' word-reading–comprehension relationship, the investigation was limited to middle-school native Spanish-speaking students, with no comparison NE peers. Without a comparison group of NE speakers, it is unclear to what extent the association of initial word reading with reading comprehension growth differs between LM learners and NE students. As well, there is a need to address very early word-reading during the emergent reading phase in relation to longer-term reading comprehension.

What is Known about Reading-Comprehension/Reading-Achievement Development for Monolinguals and LM Learners?

The following sections provide a review of extant research focused on the development of reading comprehension as well as global reading achievement for both monolingual children and LM learners.

Monolingual Children

Several prior longitudinal findings have suggested that reading comprehension growth patterns among school-aged monolingual English-speaking students can be well characterized by quadratic shape functions. That is, trajectories in reading comprehension are initially linear with a high rate of growth, but rate of growth starts declining over time after high initial acceleration, resulting in an eventual plateau around middle grades (Catts, Bridges, Little, & Tomblin, 2008; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Speece, Ritchey, Cooper, Roth, & Schatshneider, 2004; Williamson, Fitzgerald, & Stenner, 2014). For example, Francis and colleagues (1996), who examined monolingual reading achievement growth from first grade through ninth grade, found that the reading trajectory followed a quadratic function in that children initially showed the most rapid growth in reading and began to decrease thereafter. Consistent with Francis and colleagues (1996), Catts and colleagues (2008) also reported that quadratic models provided the best fit to reading achievement growth among monolingual English-speaking children with language impairments tracked from kindergarten through tenth grade.

Language-Minority Learners

Given the limited number of empirical studies examining LM learners' reading comprehension development over time, far less is known about the developmental processes of reading comprehension for LM learners relative to NE peers. While LM learners and NE students often obtain comparable levels of word-level reading skills in English in the primary grades (Chiappe & Siegel, 1999; Lesaux & Siegel, 2003), LM learners gradually struggle with reading comprehension and fall behind their peers in later grades (Lesaux, et al., 2006). Indeed, previous cross-sectional studies reported that LM learners perform substantially lower than NE students on reading comprehension outcomes (e.g., Gottardo & Mueller, 2009; Hutchinson, Whiteley, Smith, & Conors, 2003).

Nakamoto and colleagues (2007) investigated Spanish-speaking LM learners' English-reading comprehension growth following a same cohort from the first grade through sixth grade. Consistent with the trend observed by research evidence on monolingual children's reading comprehension growth, they found an initially rapid growth followed by gradually decreasing growth thereafter among LM learners across the six years. However, their findings further indicated that LM learners' English-reading comprehension scores were comparable to the national averages in the first and second grades but fell increasingly behind the normative sample of NE students and remained behind by sixth grade. Thus, despite the similar shapes of growth trajectories of English-reading comprehension between LM learners and NE peers in the primary grades, the trajectories gradually showed divergent paths by increasing a gap between the two populations as text demands increased.

Summary

In short, a general consensus in theoretical and empirical research conducted with monolingual readers is that reading comprehension performance and development are highly dependent on monolingual children's early word-reading ability. Monolingual children with well-developed word-reading ability tend to show relatively advanced reading comprehension as compared to peers with slow, inefficient, and inaccurate word-reading ability (Ehri, 1979; Perfetti, 1985). However, given the lack of empirical research on LM learners' English-reading development, far less is known about whether LM learners' well-established English-word reading ability also has a positive impact on English-reading comprehension development.

The relationship between early word reading and reading comprehension growth is expected to vary as a function of language status—LM learners and monolingual NE students. One explanation is that the acquisition of word-reading skills for LM learners learning to read in a second or additional language requires more processing time and cognitive demands as compared to their monolingual peers who draw upon substantial oral language skills to reading (Verhoeven, 2011). However, it is viable to assume that those LM learners who initially establish strong word-reading skills would show similar reading comprehension growth to their monolingual peers who also have strong word-reading skills.

The current study extends prior research by addressing reading-comprehension growth in relation to early word-reading ability for a sample of LM learners in comparison to NE peers over the course of elementary and middle school. Findings may provide a conceptual foundation for understanding of whether early word-reading predicts difficulties in English-reading comprehension development for LM learners and inform classroom teachers and future theory and research.

CHAPTER 3

METHODOLOGY

Design

Using eight-year longitudinal data from a nationally representative sample of children from the Early Childhood Longitudinal Study–Kindergarten Class of 1998-1999 (ECLS-K: 1998-1999) dataset, the relationship between the first-grade word-reading proficiency and reading-comprehension proficiency growth across the spring of first, third, fifth and eighth grades was examined. The sample included 992 first-grade LM learners and 7,188 first-grade native-English-speaking (NE) students in 2000 who were followed into third (2002), fifth (2004), and eighth grades (2007).

Three ECLS-K data sources were used: (a) English-reading assessment (basic early reading skills [letter recognition, beginning and ending sounds], word reading, and reading comprehension); (b) parts of a parent interview; and (c) oral English-language proficiency assessment (selected subtests of the *Pre-Language Assessment Scales* [*PreLAS*; Duncan & DeAvila, 1998]). The present study involved six variables. First, drawing upon English-reading assessment data from the ECLS-K dataset, the following two variables were created by the researcher: (a) Word-Reading Proficiency in the spring of first grade (a dichotomous variable indicating two groups—low and high Word-Reading Proficiency); and (b) Reading-Comprehension Proficiency (a dichotomous variable—whether or not a child passed Reading-Comprehension Proficiency). In addition, the following two sets of variables were directly taken from the ECLS-K dataset for the current study: (a) children's Gender, (a dichotomous variable)

Race/Ethnicity (a categorical variable), and Socioeconomic Status (SES) (a continuous variable) that were all collected during the parent interview; and (b) Time to Oral English-Language Proficiency (a categorical variable grouping children based on which of four time points [fall/spring kindergarten, and fall/spring first grade] a child passed the ECLS-K pre-established cut-score on the oral English-language assessment, *PreLAS*).

A series of Hierarchical Generalized Linear Modeling (HGLM; Raudenbush & Bryk, 2002) analyses for longitudinal data was conducted. The independent variable was Word-Reading Proficiency at first grade, and the dependent variable was Reading-Comprehension Proficiency, with Reading-Comprehension Proficiency repeated at first, third, fifth, and eighth grade. The control variables were child's Gender, Race/ethnicity, SES, and Time to Oral English-Language Proficiency.

Data Sources: The ECLS-K

Data for the present study were drawn from the ECLS-K study, sponsored by the U.S. Department of Education, National Center for Education Statistics (NCES) along with supports offered by the Survey Research Center, School of Education at the University of Michigan and Educational Testing Services (ETS). In conducting the ECLS-K study, NCES gathered data from a large-scale, nationally representative sample of U.S. students entering kindergarten in the 1998-99 school year and continuing through eighth grade.

The ECLS-K study is a multifaceted and longitudinal study, designed to capture information on a wide range of individual child, home, and school characteristics collected from student assessment, parent interviews, and teacher and school administration surveys. The ECLS-K study is an effort to better understand children's status at entry to kindergarten in the United States, their transition into elementary school, progression from kindergarten through eighth-grade school years, and to provide important implications with respect to educational policy and classroom practice. The main objectives and potential applications of the ECLS-K study are outlined as:

1) a study of achievement in the elementary and middle school years;
2) an assessment of the developmental status of children in the United States at the start of their formal schooling and at key points during the elementary and middle school;
3) a cross-sectional study of the nature and quality of kindergarten programs in the United States; and
4) a study of the relationship of family, preschool, and school experiences to children's developmental status at school entry and their progress during kindergarten, elementary school, and middle school (Tourangeau, Nord, Lê, Sorongon, & Najarian, 2009, p. 1-4).

There are positive benefits to using the ECLS-K database for the current study. The ECLS-K is a national dataset in which information on children who came from a non-English speaking background was included. Thus, the ECLS-K data is suitable for studying LM learners' English-reading performance. In addition, the present study design fully took advantage of the multi-wave longitudinal nature of the ECLS-K data. It provides an invaluable opportunity to observe students' growth trajectories in reading-comprehension proficiency for a relatively long period of time, which is not available from cross-sectional studies.

ECLS-K Study Sample and Sampling Design

The ECLS-K sample includes 21,409 children who attended both public and private kindergartens offering full- and part-day programs across approximately 3,500 classrooms in 1,280 schools during the 1998-99 academic year. Of 21,409 children originally recruited for the ECLS-K study, 9,189 children were followed through eighth grade (Tourangeau, Nord, Lê, Pollack, & Atkins-Burnett, 2006). The sampling process was conducted by using a multistage probabilistic sampling design that includes three main stages: (a) Primary Sampling Units (PSUs, counties or groups of counties within the United States); (b) schools within sampled PSUs; and (c) students from these schools. In the first stage, the 1990 county-level population data was used to construct PSUs in which contained 1,404 counties or groups of contiguous counties with minimum 15,000 persons. The existing PSU frame was then updated with 1994 population estimates of five-year-olds by race/ethnicity by using the U.S. Census Bureau. The eligibility criterion for the selection of a PSU was to have at least 320 five-year-olds children. Each PSU that did not meet this requirement was collapsed with an adjacent PSU. After collapsing, 1,335 PSUs remained in the sampling frame.

In the second stage of sampling, a sample of representative schools offering kindergarten programs was systematically selected with probability proportional to the measure of size within the 100 PSUs. A total of 1,280 schools (934 public and 346 private schools) were determined from 1,335 PSUs using the school universe files: 1995-96 Common Core of Data (CCD), Private School Universe Survey (PSS), Bureau of Indian Affairs, and the Department of Defense. The minimum required sample size of children for a school to be included was 24 children for public schools and 12 children for private schools. Asians and Pacific Islanders (APIs) were over-sampled to ensure adequate sample sizes for statistical subgroup comparisons. Finally, the student sample was obtained from 1,280 schools.

After the first data collection wave in the fall of first grade, sample attrition was observed due to high mobility among the children who were initially selected. In the spring of first grade, thus the sample was refreshed to restore the reduced sample size and to have a nationally representative population of first graders by including children who had not attended kindergarten in 1998 and thus would not have been selected during 1998-99 academic year. As a result, 165 new children were added to the sample in the spring of first grade. However, at third grade, the sample was not representative of third grade students because children who had just arrived to the United States were not included in the sample. Thus, the third grade data was only representative of the population cohort who participated in the ECLS-K study, but not representative of all third grade children in the United States in 2001-2002. Population cohort references the entire group of children who began kindergarten during the 1998-1999 school year in the United and were following over the several years while participating in the ECLS-K study (Tourangeau et al., 2009).

Instruments and Procedures

In the present section, ECLS-K instruments and procedures are described. In a following section, variables (and reliabilities) used in the present study are portrayed, including variables that were created from ECLS-K variables and variables that were taken directly from ECLS-K.

Three ECLS-K instruments were selected to create the variables for the present study: (a) English-reading assessment, (b) parts of a parent interview, and (c) oral English-language proficiency. The NCES field staff collected both English-reading assessment and oral English-language proficiency data from the participating children and information about family and children's characteristics from the children's parents/guardians. A majority of the field staff was mostly former educators or teachers, and experienced in working with children and conducting assessments. They had in-person training sessions before collecting data. The field staff was divided into 100 geographic areas selected for the ECLS-K study as a data collection team consisting of one field supervisor and three assessors. The teams had responsibility for all data collection activities within their assigned work areas including conducting the direct child assessments and the parent interviews. The three types of ECLS-K instruments are described in the following sections.

ECLS-K English-Reading Assessment and its Development

In the following sections, I provide a summary description of the ECLS-K English-reading assessment, the ECLS-K framework for the reading assessment, item development for the reading test, test administration procedures, Proficiency Level scores, and validation of the English-reading scale. In the Proficiency Level scores section, I describe the ECLS-K Proficiency Level scores that were used as a basis for creating two variables for the present study, Word-Reading Proficiency and Reading-Comprehension Proficiency. A detailed description of how the two variables were created is presented in the later section, Variables (and Reliabilities) Used in the Current Study.

Summary description of the ECLS-K English-reading assessment. The ECLS–K English-reading test was designed to assess children's cognitive skills and knowledge in reading that were typically taught and developmentally essential in elementary and middle schools' literacy curricula. In consultation with curriculum specialists, the test was designed as a developmental scale test. The arrayed sets of items formed a vertical scale, based on Item Response Theory (IRT), such that at a particular point in time a student's performance could be placed on the ladder-like scale.

Table 3.3 presents descriptions of 11 Proficiency Levels identified in the kindergarten through eighth-grade reading assessments. The 11 Proficiency Levels represented children's cognitive reading development and marked developmental stages in going from easiest to the most difficult level. Within each Proficiency Level, there were four items that were similar in content and difficulty. The items embedded in Proficiency Levels formed a hierarchical structure implying that a child who mastered a particular Proficiency Level was expected to have mastered all the lower Proficiency Levels.

Two-stage adaptive testing was used so that students responded to items in their personal developmental range. In the first-stage, in order to assess the child's approximate reading level, the child received a first-stage routing test consisting of 12 to 20 items with a range of difficulty levels selected from a large pool of test items. Then, based on the performance level on the first-stage routing test, the difficulty level of the second-stage test form (the actual reading assessment) was determined, and a battery of test items was provided in the second stage (Rock & Pollack, 2002). That is, a child who performed above grade level on the first-stage routing test received a second-stage form with more difficult items, whereas a child who scored below grade level on the routing test received a less difficult second-stage reading test form. By matching the item difficulties to each child's developmental reading level, the two-stage, adaptive testing format led to increasing test efficiency and accuracy, reducing the risk of floor and ceiling effects (Tourangeau et al., 2006; Weiss, 1982).

The entire assessment then consisted of 44 items, four items at each of 11 Levels. However, the entire set of 44 items was not administered at each grade level. Instead, the ECLS-K reading test items were used only in grades for which their difficulty was appropriate. As shown in Figure 3.1, reading test items corresponding to Proficiency Level 1 through 3 appeared only in the kindergarten and first-grade assessments; items for Level 4 appeared in kindergarten, first-, and third-grade assessments; items for Level 5 appeared in all grade-level assessments; items for Levels 6 and 7 appeared in third- and fifth-grade assessments; items for Level 8 appeared in third-, fifth-, and eighth-grade assessments; items for Level 9 appeared in fifth- and eighth-grade assessments; and items for Level 10 in eighth-grade assessment only

(Najarian et al., 2009). Viewed from the child perspective, children in kindergarten and first grade could have received up to 20 items (four items at each of Levels 1 through 5), depending on a child's pass rate at a given level. Children in third grade could have received up to 20 items (four items at each Levels 4 through 8), depending a child's pass rate at a given level. Children in fifth grade could have received up to 20 items (four each at Levels 5 through 9), and children in eighth grade could have received up to 16 items (four each at Levels 5, 8, 9, and 10).

Framework for the ECLS-K assessment. The ECLS-K English-reading test specifications were derived from the Reading Framework for the 1996 National Assessment of Educational Progress (NAEP; National Assessment Governing Board, 1994). The Framework is based on a developmental outlook about reading growth in which different cognitive abilities are emphasized at different phases of development. Therefore the English-reading assessment test developers created a ladder-like set of items, progressing from items representing focal cognitions of code-breaking during early reading development to other items representing reading cognitions developed later and later in time. The NAEP frameworks served as useful models because both the ECLS-K and NAEP assessment projects have similar goals that are to assess cognitive skills in reading that are typically taught and developmentally emphasized at different points in time in literacy curricula. The NAEP Framework, developed for the fourth grade and up, features four categories of reading comprehension skills: initial understanding, developing interpretation, personal reflection and response, and demonstrating a critical stance. To accommodate applicability to the early elementary years in the ECLS-K, two additional categories were added to the NAEP framework in developing the ECLS-K reading framework: basic skills (e.g., familiarity with print, recognition of letters and phonemes, and decoding) and vocabulary. The basic skills represent the major emphasis of first-grade reading assessment.

After first grade, there is a decrease in the emphasis on basic skills so that the allocation of measuring different ones of four reading comprehension skills increases in third, fifth, and eighth grades, that is, items shift from measuring selected early-reading skills to reading comprehension abilities.

Item development for the ECLS-K reading test. Following the model of the NAEP 1996 Reading Framework, a pool of ECLS-K reading test items was developed by item writers from Educational Testing Service (ETS) and literacy curriculum specialists and practitioners. There were a total of nearly 200 reading test items. A partial pool of items was borrowed or adapted, with permission, from published commercial tests including the *Peabody Individual Achievement Test-Revised* (Markwardt, 1989), the *Peabody Picture Vocabulary Test–Revised* (Dunn & Dunn, 1981), the *Primary Test of Cognitive Skills* (Huttenlocher & Levine, 1990), the *Test of Early Reading Ability* (Reid, Hresko, & Hammill, 1981), the *Woodcock-Johnson Tests of Achievement–Revised* (Woodcock & Bonner, 1989) for first, third, and fifth grades; and from other NCES studies including released NAEP, the National Education Longitudinal Study of 1988 (NELS:88), and the Education Longitudinal Study of 2002 (ELS: 2002) test items for eighth grade (Najarian, Pollack, & Sorongon, 2009).

ECLS-K procedures for administering the English-reading assessment. The English-reading assessment was conducted by trained NCES examiners who visited children in the school. Given the two-stage adaptive structure of the assessments, testing sessions were individually administered to provide more sensitivity to each child's needs (Rock & Pollack, 2002). The test was un-timed, and testing time averaged from 50 to 70 minutes per child at each testing occasion. While the first-grade reading test items were presented in easel format, the third-, fifth-, and eighth-grade reading assessment formats incorporated a paper-based booklet format containing the reading passages to accommodate longer reading passages used for the older sample (Tourangeau et al., 2006).

ECLS-K Proficiency Level scores. One type of score provided by the ECLS-K researchers is a Proficiency Level. For the present study, the ECLS-K Proficiency Level scores were used to create two secondary variables, Word-Reading Proficiency and Reading-Comprehension Proficiency. The two specific variables for the present study are detailed in a following section, Variables (and Reliabilities) Used in the Current Study. Clear understanding of the nature of the ECLS-K Proficiency Level variable is necessary as a preliminary foundation for understanding the specific variables used in the present study that will be described in a following section.

The ECLS-K Proficiency Level represented a student's specific level of mastery on the vertical developmental scale (as shown in Table 3.3 and Figure 3.1) (Rock, 2012). The 11 Proficiency Levels shown in Table 3.3 are assumed to comply with the Guttman model (Guttman, 1950). That is, a particular Proficiency Level that a student attained at a certain point in time indicates that the student mastered all previous or lower levels and did not yet master higher levels. The Proficiency Levels function as "gates" that children pass through over time. The highest Proficiency Level mastered by a child at each assessment occasion was the highest of the 11 Proficiency Levels mastered by passing three or four of the four-items in a given level (cluster of four items). For instance, if a first-grade child answered correctly at least three out of the four questions within each cluster (four items per Level) at reading Proficiency Levels 1, 2, and 3, but did not pass the cluster of four items at Level 4, the highest Proficiency Level that the child mastered would be Level 3. A value of 0 indicated that a child was unable to reach Proficiency Level 1.

Validation of the ECLS-K scale. One means of the ECLS-K scale validity assessment was that the overall English-reading assessment items were reviewed by elementary and middle school curriculum specialists across different geographic regions of the United States for content, difficulty, sensitivity, and relevance to the reading assessment framework. The items that passed the review stage by school curriculum specialists were field tested.

The ECLS-K study researchers provided a second indication of scale validity. One score (not used in the present study) that can be obtained from the ECLS-K English-reading assessment was an overall reading ability score (a theta score). The ECLS-K researchers assessed interpretation of scores arising from the vertical scale by using the overall reading ability score in conjunction with other non-ECLS-K test scores. A means of assessing the validity of score inferences from the scale was to compare the field-test overall reading ability (theta) estimate with scores on the following reading assessment instruments in approximately 1,800 children: the *Kaufman Test of Educational Achievement* (*KTEA*; Kaufman & Kaufman, 1998) test for first grade and the *Woodcock-McGrew-Werder Mini-Battery of Achievement* (*MBA*; Woodcock, McGrew, & Werder, 1994) test for third and fifth grade. The correlation of the overall reading ability estimate (theta) based on ECLS-K reading field-test results with the *KTEA* scores was in the mid-to upper-eighties (Rock & Pollack, 2002), and that with the *MBA* scores for third and fifth grades was .83 and .73, respectively (Pollack et al., 2005; Tourangeau et al., 2006). Comparison of field test results with scores on an established reading assessment instrument was not conducted during the eighth-grade reading field test. The design and content of the eighth-grade reading assessments were drawn from previous assessments including released items from NAEP, NELS:88, ELS:2002, and the ECLS-K fifth-grade English-reading assessment. Thus, the test authors considered evidence of the high correlations from the prior validation studies from NAEP, NELS, and the ECLS-K fifth grade as support for the ECLS-K eighth-grade item pool (Najarian et al., 2009).

Parent Interview

The NCES field staff collected data on socio-economic and demographic characteristics from the participating children's parents/guardians through interview. The NCES field staff interviewed the parent at home over the telephone, lasting approximately 45 minutes. A Computer-Assisted Telephone Interviewing (CATI) method was used to pose the questions on the computer screen and record the parent's responses directly into the computer during the parent interview. If a respondent did not have a telephone or was reluctant to do a phone interview, the interview took place in person. Although the language of interviews was predominantly English, bilingual interviewers were trained to conduct the interview for those parents/guardians whose primary language was not English. Some information collected from the parent interview was used for the study and is described in the following sections.

Home language background. Parents who participated in the ECLS-K study responded to two questions regarding student's home language: "Is any language other than English spoken in your home?" and "What is the primary language spoken in your home?" A composite variable of whether English was a student's home or primary language was created from the two questions. The specification for the variable composite was as follows: If the first question's response was 'no other language than English regularly spoken in home,' then the variable was coded as 'English is a student's home language.' If the first question's response was 'a language other than English was regularly spoken in the home' and any non-English language was reported in the second question, then the variable was coded as 'English is not a student's home language.'

Gender, race/ethnicity and SES. Student's socio-demographic characteristic information—gender, race/ethnicity and SES—was collected from the parent interviews in the first grade. Parents/guardians were asked to provide information on a child's gender, and identify child' race/ethnicity as in one of the following categories: White (non-Hispanic), Black (non-Hispanic), Hispanic, and Asian/Pacific Islander/Other.

In addition, parents/guardians were asked to provide information on five items (see Table 3.4), including overall household income, the sample child's father/male guardian's education, mother/female guardian's education, father/male guardian's occupation prestige and mother/female guardian's occupational prestige. Drawing on the five items, NCES researchers created a composite variable that captures the household's SES at the time of data collection for first grade (spring 2000). If there were missing values for some of the five components of the SES for children with a female single parent or male single parent, imputation procedures were undertaken to fill in the missing information.

The SES variable is estimated both on a continuous (i.e., *W1SESL*) and a categorical (i.e., *W1SESQ5*) scale. NCES researchers calculated the continuous SES variable by transforming the scores of the five items into z-scores and then averaging the five z-scores, each of which had a mean of 0 and a standard deviation of 1. The continuous SES variable ranges from -2.96 to 2.88. Using the continuous measure of SES, NCES researchers created the categorical SES variable to indicate the quintile for the value of the composite SES with the first quintile representing the lowest SES group to the fifth quintile representing the highest SES group. For the present analyses, the SES variable on a continuous scale was used.

Oral English-Language Proficiency

An oral English-language proficiency assessment was administered to children who were identified as needing screening for oral English-language proficiency including LM learners who spoke a non-English language in the home in the fall and spring of kindergarten and in the fall and spring of first grade. Three of the six subtests of the English *Pre-Language Assessment Scales (PreLAS) 2000* Form C (Duncan & DeAvila, 1998) were selected for the ECLS-K study to measure children's listening comprehension, vocabulary, and ability to understand and produce language. The *PreLAS 2000* is known as a widespread language screening tool in identifying English-language learners from pre-kindergarten through first grade (NCES, 2002). There were 60 items across the three subtests, so raw scores could range from 0 to 60.

The key purpose of the assessment was to determine whether children had sufficient oral English-language proficiency to participate in English-language battery of assessments at any given time point. Children who passed a cut-score of 37 out of a total score of 60, established by the authors of the *PreLAS 2000*, were assumed to be proficient in English and thus were administered the English reading assessment (Rock & Pollack, 2002). Children who scored 36 or below in *PreLAS 2000* during one data collection period were not given English reading assessment, but their oral English-language proficiency was rescreened at the subsequent data collection time point to determine whether they had progressed to demonstrate sufficient oral English-language proficiency and they were eligible to take reading assessment in English. Split-half reliability coefficients for the three subtest of the English *PreLAS 2000* were .97, .96, .98, and .96 in the fall and spring of kindergarten, and the fall and spring of first grade, respectively (Rock & Pollack, 2002).

Variables (and Reliabilities) Used in the Current Study

In the following section, I describe each of the variables used in the present study, and where relevant and possible, their reliabilities. Table 3.5 also provides a list of the present-study variables (column 1) and a description of each variable (levels used in the HGLM analysis for the present study, definitions, coding scheme, measurement scale, and original ECLS-K variable names).

English Reading: Word-Reading Proficiency and Reading-Comprehension Proficiency Variables for the Study

The two variables—Word-Reading Proficiency and Reading-Comprehension Proficiency—for the present study were constructed by using the ECLS-K variable, Highest Proficiency Level Mastered (described earlier). Recall that the ECLS-K Proficiency Level score was on an ordinal scale of 0 to 10, and that the foundational items at the lowest Proficiency Levels were about word reading, and the different comprehension levels followed in sequence (see Table 3.3).

Word-Reading Proficiency. Word-Reading Proficiency was a dichotomous predictor variable that indicated whether a child had low or high Word-Reading Proficiency in the spring of first grade. From the first-grade reading assessment, children were divided into two groups: low and high Word-Reading Proficiency. Children with low Word-Reading Proficiency were defined as those who reached the highest reading Proficiency Level 0, 1 (letter recognition), 2 (beginning sounds), or 3 (ending sounds), but did not reach reading Proficiency Level 4 (reading sight words) in the spring of first grade. Children with high Word-Reading Proficiency were defined as those who passed Levels 4 and 5, or above (see Table 3.3 for definitions of Levels above Level 5). In this way, two clearly distinct groups of children were formed such that a group of children with moderate Word-Reading Proficiency was excluded (children who reached Proficiency Level 4, but did not achieve Level 5 [reading words in context]). In the analyses, a value of 0 represented children in the low Word-Reading Proficiency group, and a value of 1 represented children in the high Word-Reading Proficiency group.

The rationale for the group assignment decisions was as follows: Children in the low-proficiency group were developing pre-word-reading skills such as letter identification and phonological awareness, but had not yet been proficient in word-reading skills. Children in the high-proficiency group, on the other hand, had gained pre-word-reading skills and become proficient in reading words by sight (i.e., Level 4) and in the context of text (i.e., at least Level 5) by the spring of first grade. Table 3.6 shows the number and percentage of children in the two groups by low and high Word-Reading Proficiency.

Reading-Comprehension Proficiency. Following the same procedure used by O'Connell and her colleagues (2008, 2013), the outcome variable for the present study, Reading-Comprehension Proficiency, was created from whether or not a child achieved reading-comprehension Proficiency Level 8. The outcome variable was a repeated measure at each of the four time points (spring of first, third, fifth, and eighth grade). That is, the dichotomous variable for Reading-Comprehension Proficiency was for each child at each time point either a 0 or 1, indicating whether Proficiency Level 8 had been reached (coded as 1) or not (coded as 0). So for example, a child who did not reach Reading-Comprehension Proficiency (Proficiency Level 8) in the spring of third grade, but did reach it in the spring of fifth grade would have outcome scores of 0 (for the spring of first grade), 0 (for the spring of third grade), 1 (for the spring of fifth grade), and 1 (for the spring of eighth grade)

The rationale for choosing reading comprehension Proficiency Level 8 was that it was the only comprehension level for which items were administered at all three grade levels beyond first grade—the spring of third, fifth, and eighth grade (see Figure 3.1). Children who achieved

Proficiency Level 8 demonstrated the ability to understand an author's craft and make connections between a problem in the narrative and similar life problems (Pollack et al., 2005). Children passing Proficiency Level 8 have achieved a reasonably advanced comprehension ability in that they could make inferences using explicit cues in text, identify the clues used to make inferences, use background knowledge to understand homonyms, understand why authors' make choices and how they use their texts to impact readers, and connect text content to life problems. While Proficiency Level 8 was not the most advanced reading-comprehension level, it was construed as equivalent to the NAEP 8th grade reading framework. The NAEP expectations of 8th grade students' reading comprehension performance involve the ability to make inferences about a text, interpret causal relations, and analyze and evaluate the author's perspective. Thus Proficiency Level 8 was considered a sufficiently high expectation for mastery by the eighth grade.

Reliability. According to the ECLS-K study researchers, an approach to a reliability estimate of the highest reading Proficiency Level mastered variable was to evaluate the extent to which the measurement yielded consistent or similar results under different circumstances or on a different occasion (Pollack et al., 2005). For instance, when a child's highest reading Proficiency Level mastered was Level 5 in the spring of first grade, reliability estimates could be determined by the extent to which the same highest Proficiency Level 5 would be achieved in other circumstances in which a different set of items may have been used.

To assess the reliability of the highest reading Proficiency Level mastered, the ECLS-K researchers calculated the inter-rater reliability between two differentiated coding methods in obtaining a child's highest reading Proficiency Level mastered: (a) using the actual four-item cluster response data solely; and alternatively (b) using IRT ability estimates and item parameters that were used to generate pass/fail scores and the highest reading Proficiency Level mastered for the same child (Najarian et al., 2009). The inter-rater reliability estimates by comparing the two coding methods were applied to 80% of the full sample; that is, using only students who had non-missing actual four-item cluster responses. The remaining 20% with missing values in four-item cluster responses were determined by IRT model-based imputations alone. The percentages of agreement on each value were computed by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100. The percentages of agreement within one score point in the spring of first, third, fifth, and eighth grades were 96%, 96%, 96%, and 84%, respectively (Najarian et al., 2009).

Time

The variable denoting the passage of time was specified as individual child's actual age in months on the day the English reading assessment was administered (Singer & Willet, 2003). Child age provides a continuous measure that is sensitive to the chronological distance between assessment points and therefore contributes more variance to an outcome than does time measured as static months of administration. Child age also provides a detailed summary of the growth process. Children's actual age in months on the day assessment was centered on the average child's age at the testing date in the spring of first grade for the HGLM analysis.

Language Status

Following procedures used by Han and Bridglall (2009), and Kieffer (2011), the language status classification was determined based on home-language information that the participating students' parents/guardians provided during the interviewing process during the child's first grade year. If parents/guardians reported English as the primary language spoken at home, the student was identified as a NE student. If parents/guardians reported that a non-English language was spoken as a primary language at home, the student was considered as a LM learner. In the analyses, Language Status was a dichotomous variable in which a value of 0 indicated NE students and a value of 1 indicated LM learners (reference group).

Control Variables

Child's demographic data (i.e., Gender, Race/ethnicity, and SES) and Time to Oral English-Language Proficiency were included as control variables in the analyses because they have been previously identified as significant predictors of reading achievement in the literature (e.g., Chatterji, 2006; Kieffer, 2008; 2011; McCoach et al., 2006; Roberts et al., 2010).

Gender, Race/ethnicity, and SES. The Gender variable was represented by a dichotomous variable indicating whether a child was female (coded as 1; reference group) or male (coded as 0). Following the ECLS-K classification, the Race/ethnicity variable consisted of four categories representing (a) White, non-Hispanic, as a reference group; (b) Black, non-Hispanic; (c) Hispanic; and (d) Asian/Pacific Islander/Other. The household's SES variable was the NCES-computed composite variable, estimated on a continuous scale through a z-transformation in first grade (Spring 2000). In the present study it ranges between -2.96 and 2.88.

Time to Oral English-Language Proficiency. The Time to Oral English-Language Proficiency variable was taken directly from the ECLS-K dataset as created by the ECLS-K researchers. Children were categorized into five groups on the basis of the when they passed the ECLS-K pre-established cut-score on the English *PreLAS* assessment (cf. Kieffer, 2011 for a similar procedure). The cut-score on the English *PreLAS* assessment by the ECLS-K researchers and the *PreLAS* test authors was 37. The five groups in the present study were: (a) kindergarten children who were not identified as needing the *PreLAS* test (specified as the reference category); (b) children who became proficient in English (passed the cut-score of the *PreLAS* test) by the fall of kindergarten; (c) children who became proficient in English (passed the cut-score) by the spring of kindergarten but not sooner; (d) children who became proficient in English (passed the cut-score) by the fall of first grade but not sooner; and (e) children who became proficient in English (passed the cut-score) by the spring of first grade but not sooner. In the present-study sample, all children had passed the cut-score by the spring of first grade at the latest.

Sample for the Current Study

Criteria for Sample Selection for the Present Study

The sample for the study consisted of a subset of children who participated in the ECLS-K study. To be eligible for the present analysis, the sample met the following inclusion criteria for children who: (a) had parents' report of the primary language spoken in the home that was used to identify the subsample (i.e., LM learners versus NE children); (b) had at least one measurement occasion of Reading-Comprehension Proficiency from the four data collection points (the spring of first, third, fifth and eighth grades); (c) had non-missing values on Word-Reading Proficiency mastered in the spring of first grade; and (d) had a valid non-missing sampling weight on English-reading Proficiency Levels for first, third, fifth and eighth grades in the ECLS-K database.

A fifth criterion was used that excluded some children. As described earlier, to ensure that two distinct Word-Reading Proficiency groups were formed, children with "moderate-level" proficiency (as operationalized in a preceding section) were excluded. The final sample of children for the study, therefore, had a valid predictor variable (either low or high Word-Reading

Proficiency group), at least one measurement occasion on dependent variable, and a non-missing longitudinal sampling weight.

Description of the Selected Sample for the Present Study

The analytic sample included 8,180 children with 992 LM learners and 7,188 NE students. Table 3.2 presents the unadjusted percentage distribution of demographic characteristics of the analytic sample and the comparable ECLS-K full sample. For every characteristic, the analytic sample percentages are highly similar or identical to the ECLS-K full sample.

Overall, children's mean age in the spring of first grade was 87 months (range=72 to 96 months). The sample was approximately evenly divided between female and male. The two language-status subsamples differed by race/ethnicity, SES, and Time to Oral English-Language Proficiency.

The LM-learners group consisted of approximately 69% Hispanic, 11% White, 1% Black, and 19% Asian/Pacific Islander/Other. The NE-students group consisted of nearly 68% White, 16% Black, 10% Hispanic, and 6% Asian/Pacific Islander/ Other. The distributions of race/ethnicity for each group were comparable to those reported in the study by Kieffer (2008), where the same procedure was used to define LM and NE groups. The LM learners were somewhat more socioeconomically disadvantaged than the NE students with more children in the lower and lowest (1^{st} Quintile) SES quintile.

In addition, the LM learners are heterogeneous with respect Time to Oral English-Language Proficiency. Among 992 LM learners, at fall of kindergarten, nearly 72% were identified by teachers as needing oral English-language screening assessment, while slightly more than 28% were excluded from oral English-language screening assessment. Of 72% of

LM learners who were eligible for oral English-language screening assessment, approximately 30% passed the oral English-language assessment in the fall of kindergarten, 19% passed in the spring of kindergarten, 3% passed in the fall of first grade, and 20% passed in the spring of first grade. All children in the current study passed the oral English-language proficiency assessment by the spring of first grade; that is, they became sufficiently proficient in English to participate in English-reading assessments in the spring of first grade.

Data Analytic Approach

Data Preparation

Handling missing data. Missing values are a common occurrence in any large-scale longitudinal studies. The ECLS-K data also contains multiple missing values at each time point. Hierarchical Linear Model (HLM)-type models are flexible in handling missing data at level 1, but it does not allow missing values at level 2. The percentages of missing data for the outcome variable in the spring of third, fifth, and eighth grade were 7.52%, 25.68%, and 34.34%, respectively. To investigate whether missing data were distributed randomly, a missing value analysis using the Expectation–Maximization method was performed. Little's Missing Completely At Random test indicated that the current data were not missing completely at random ($\chi^2 = 195.99$, $df = 2$; $p < 0.001$; Little & Rubin 1987). Therefore, a multiple imputation using an iterative Markov chain Monte Carlo technique was performed to include all observed data and maximize power of analysis (Allison 2002; Rubin, 2004).

The multiple imputation technique involves replacing missing data with a set of plausible values drawn from predictive distribution of the missing values multiple times (Rubin, 1987). The technique has the advantage of computing missing values based upon the observed data and available information, producing unbiased parameter estimates which reflect the uncertainty of estimation in the missing data (Schafer & Graham, 2002).

In the multiple imputation process, five imputed data sets were generated. Five imputations achieved 91 efficiency of estimate even with 50 of missing information (Rubin, 1987; Schafer, 1997). The five imputed datasets were then combined to yield a final single set of results into the Stata software program, in which parameter estimates were averaged across the five imputed data sets, and standard errors were adjusted by incorporating the variance in imputed values across the five imputed data sets.

Sampling weights. The ECLS-K sample was from a multistage stratified sampling frame with a complex design, including equal probability systematic sampling for students other than APIs and higher rate of probability sampling for APIs. These procedures would yield over or underestimation of the population. Therefore, analyses using the ECLS-K data require the use of weights to compensate for unequal probabilities of selection within and between schools (e.g., oversampling of private schools and Asian/Pacific Islander children) and to balance the demographic profile of the sample.

The ECLS-K public-use database provided sampling weights to be used for descriptive and inferential analyses. For descriptive analysis, a child-level sampling weight in the first grade (C4CPTW0) was employed. For HGLM analysis for change, a child-level sampling weight designed for analyses involving the full sample of children across the spring of first, third, fifth and eighth grades (C4_7CW0) was included. The application of the sampling weight procedures results in enhancing the generalizability of empirical results to a larger population by accounting for the unequal selection probabilities of certain subpopulations and adjusting for non-response bias over time. The results of the sampling weight procedure produced unbiased estimates for the nationally representative population of U.S. first-, third-, fifth-, and eighth-grade students in 2000, 2001, 2003, and 2006, respectively (NCES, 2001; 2002; 2004).

Preliminary Data Analysis

Prior to proceeding to a series of HGLM analyses, preliminary tests were completed in order to facilitate interpretation of results. First, for the preliminary examination, descriptive statistics, and bivariate correlations for all variables across the time points were examined to understand the basic features of the data in the present study. Next, as suggested by Menard (2010), multicollinearity was examined to identify whether there was a strong correlation among predictors and control variables by using a tolerance and Variance Inflation Factor (VIF). Finally, to identify the most appropriate functional time for growth (e.g., linear versus curvilinear) that captured growth trend of the outcome variable in the data, a series of unconditional models was fitted by a comparison of competing nested unconditional models.

The HGLM Analysis

HGLM (Raudenbush & Bryk, 2002), also known as a Generalized Linear Mixed Model (GLMM; Skrondal & Rabe-Hesketh, 2004), served as the primary analysis for the current study. The HGLM approach employs the conceptual framework of the Logistic Regression model and the results are interpreted based on the Logistic Regression model (Snijders & Bosker, 1999). In the HGLM analysis for a longitudinal data, repeated measurements on individuals are expressed as a function of time.

HGLM approach is the best-suited modeling procedure for the current study because of the dichotomous nature of the outcome variable (i.e., Reading-Comprehension Proficiency). Given that the dichotomous variable has the restricted values of 0 and 1, its residuals cannot be normally distributed. The dichotomous variable thus violates the assumptions of normality, linearity, and homoscedasticity presupposed by Ordinary Least Squares (OLS) regression (Long, 1997) as well as HLM that can be applied only to continuous outcomes with a normal sampling model and an identity link function (Raudenbush & Bryk, 2002). Therefore, it is appropriate to use the HGLM approach that contends with the issues by modeling for binary outcomes with a Bernoulli (or binominal) sampling model and logit link (Raudenbush & Bryk, 2002).

There are two additional reasons that the HGLM approach is a well-suited modeling procedure for the present study. First, HGLM is suitable for the analysis of nested or hierarchical data structure. In the current data, the time variable was nested in child-level data (i.e., first-grade Word-Reading Proficiency, Language Status, Gender, Race/ethnicity, SES, and Time to Oral English-Language Proficiency). Although HGLM employs the conceptual framework of Multiple Logistic Regression and takes the interpretations of results based on the structure of the Multiple Logistic Regression, Multiple Logistic Regression does not properly account for potential dependency that is inherent when dealing with hierarchical information (Snijders & Bosker, 1999). The HGLM approach provides potential solutions for dealing with the lack of independence among the observations clustered within individuals over time (Raudenbush & Bryk, 2002). In HGLM, a penalized-quasi likelihood (PQL; Breslow & Clayton, 1993), also known as Generalized Estimating Equations, is used as an estimation technique for fitting Multilevel Logistic Regression models by appropriately accommodating the binary dependent variable.

Additionally, HGLM offers flexibility and adequate estimation of individual change over time and how child-level characteristics are associated with the average level and change of reading comprehension over time for all participants, including those with incomplete data. In addition, HGLM approach for longitudinal data has flexibility in terms of data requirements permitting unequally balanced numbers of participants and uneven spacing of occasions (Raudenbush & Bryk, 2002).

An important distinction between parameter interpretation in traditional regression models and the HGLM model is how coefficients (beta values) are created and interpreted. In traditional linear regression models (e.g., HLM), coefficients are used to interpret the effects of independent variables on a dependent variable. However, to use coefficients in HGLM or Logistic Regression model, the values of the dichotomous outcome variable (0 and 1) must be transformed into log-odds (i.e., logit; the logarithm of odds), so that estimates of coefficients represent changes in log-odds of the dependent variable as opposed to the changes in the dependent variable itself.

The coefficients (logits) are converted to odds-ratios by using the inverse exponential transformation. The odds-ratio is essential for proper interpretation of the results of HGLM and Logistic Regression because the odds ratio is a measure that describes the strength of association between a predictor variable and the occurrence of the outcome variable. The odds-ratio is defined as the ratio of the probability of success (i.e., a child achieving Reading-Comprehension Proficiency) in one group relative to the probability of success in the other group. In the example of the predictor variable—Word-Reading Proficiency, the odds-ratio greater than 1.0 indicates that the high Word-Reading Proficiency group (reference group) is more likely to achieve Reading-Comprehension Proficiency relative to the low Word-Reading Proficiency group. If the odds-ratio is less than 1.0, then the high Word-Reading Proficiency group is less likely to achieve Reading-Comprehension Proficiency than the low Word-Reading Proficiency group. If the odds-ratio is equal to 1.0, it indicates that an association does not exist, and that there is no difference in the odds for the high Word-Reading Proficiency group and the odds for the low Word-Reading Proficiency group. Therefore, the odds-ratio was used to predict the likelihood of achieving Reading-Comprehension Proficiency and interpreted as how different the odds of achieving Reading-Comprehension Proficiency are for two different groups.

Modeling Strategy

The two-level HGLM with the repeated observations over time was estimated by using Stata software *xtlogit* command (version 12.0, StataCorp, 2011a). The within-person or time-point data (level 1) were nested in between-person or child-level data (level 2), which accounted for the association across the four time periods. The within-person model estimated how Reading-Comprehension Proficiency changed over time. The between-person model estimated the interaction effect between Language Status and Word-Reading Proficiency on Reading-Comprehension Proficiency growth across the first, third, fifth, and eighth grades, while accounting for main effects of the two predictors and control variables. The purpose of the inclusion of the control variables along with the predictors in the same model was to isolate the impact of the control variables on the dependent variable from the effects of the predictors. Thus, the explanatory power of the predictors (main and interaction effects) on the dependent variable was assessed, while all control variables in the model were held constant.

The control variables for the current study were referenced and specified in the Stata program by using *local controls* command, followed by the control variables, prior to *xtlogit* command.

Additionally, note that due to the nature of dichotomous outcome variable (i.e., Reading-Comprehension Proficiency), reading comprehension *growth* in fact refers to growth of the probability of achieving Reading-Comprehension Proficiency (ECLS-K reading Proficiency Level 8).

Specifications of two-level HGLM models. In contrast to the typical HLM in which a normal sampling model and an identity link function are used, the HGLM approach accommodates binary outcomes using a Bernoulli (or binominal) sampling model and logit link function at level 1 (Raudenbush & Bryk, 2002). In HGLM, the dichotomous dependent variable is transformed onto a logit scale to eliminate the 0/1 range constraints and makes the skewed distribution approximate a normal distribution. The logit-transformed probability can be theoretically assumed as any real value, and can be modeled as a linear function of a set of predictor variables. The following section describes the specification of the level-1 model in HGLM that consists of three parts—a sampling model, a link function, and a structural model—and the level-2 model.

Level-1 sampling model. The first part of HGLM was the level 1 sampling model. Given the level-1 binary outcomes, the level-1 sampling model utilized the Bernoulli (binominal) distribution expressed as:

$$Y_{ti} \mid \varphi_{ti} \sim Bernoulli(\varphi_{ti}),$$

where Y_{ti} referred to whether child i at time t ever mastered Reading-Comprehension Proficiency, given the probability of success of outcome (φ_{ti}) for child i at time t. With the Bernoulli sampling model, the expected value and variance of Y_{ti} was equal to the probability of success in mastering Reading-Comprehension Proficiency. That was written as:

$$E(Y_{ti} \mid \varphi_{ti}) = \varphi_{ti}, \qquad \text{Var}(Y_{ti} \mid \varphi_{ti}) = \varphi_{ti}(1 - \varphi_{ti}).$$

Level-1 link function. The second part of HGLM was to specify a level-1 link function that transforms the expected values—0 and 1—into any real value, η_i, that is the log-odds of success.

The logit transformation involved two steps. The first step was to calculate the odds of the success by taking the ratio of a value, φ to $1-\varphi$ (Long, 1997; Snijders & Bosker, 1999). While φ is the probability of achieving Reading-Comprehension Proficiency, $1-\varphi$ is the probability of not achieving Reading-Comprehension Proficiency. The odds of the success, a ratio of probability of success to the ratio of probability of failure, could be represented as follows:

$$\text{Odds} = \frac{\varphi_i}{1-\varphi_i}.$$

The next step was to take the natural logarithm of the odds to obtain the logit. The logit could be given as the following:

$$\eta_i = \text{logit}\ (\varphi_i) = \ln\left(\frac{\varphi_i}{1-\varphi_i}\right),$$

where the predicted values for η_i was the log-odds (logit) of success for a child i, and ln is the natural logarithm. Given that the coefficients from the regression models using the predicted logits represented the log-odds of success in achieving Reading-Comprehension Proficiency, the predicted logits needed to be converted back to predicted probabilities using the inverse link as follows:

$$\varphi_i = \text{logit}^{-1}(\eta_i) = \frac{\text{odds}}{1 + \text{odds}} = \frac{\text{esp}(\eta_i)}{1 + \text{esp}(\eta_i)}$$

Level-1 structural model. The third part of HGLM was the level-1 structural model. The level-1 structural model was the within-person model, in which the log-odds of success in achieving Reading-Comprehension Proficiency were modeled as a function of time. Each child's Reading-Comprehension Proficiency was defined by an individual growth trajectory that depends on a unique set of parameters (Bryk & Raudenbush, 1987, 1992). The level-1 structural model was expressed as follows:

$$\eta_{ti} = \beta_{0i} + \beta_{1i}\, TIME_{ti} + \beta_{2i} TIME^2_{ti},$$

where η_{ti} represented the log-odds of Reading-Comprehension Proficiency for child i at time point t, and β_{0i} represented initial status of child i in the spring of first grade (i.e., $TIME = 0$). $TIME_{ti}$ indicated child's age in months at time point t, centered on the sample mean at the testing date in the spring of first grade, and $TIME^2_{ti}$ was the square of $TIME_{ti}$. The level-1 submodel assumed that a quadratic line would represent each child's true change over time. The two slope parameters (β_{1i}, and β_{2i}) were included in the level-1 model: β_{1i}, associated with *TIME*, estimating the instantaneous growth rate of child i's log-odds of Reading-Comprehension Proficiency; and β_{2i} (i.e., the coefficient on the quadratic slope term), associated with $TIME^2$, estimating quadratic changes in the log-odds of Reading-Comprehension Proficiency over time, reflecting the acceleration/deceleration of the growth trajectory. No residual was not included in the structural model as it was specified by the sampling model.

Level-2 model. Finally, HGLM was completed by specifying the level-2 structural model. The level-2 model models the association between inter-individual differences in change trajectories and time-invariant, person-specific characteristics (i.e., fixed effects) of the individual (Singer & Willet, 2003). The level-2 model simultaneously reflects the general patterns (i.e., the between-group differences in intercepts and slopes) as well as inter-individual heterogeneity in patterns within groups. Singer and Willett (2003) suggest four distinct features for the level-2 model: (a) outcomes must be individual growth parameters from the level-1 structural model (i.e., β_{0i}, β_{1i}, and β_{2i}); (b) each individual growth parameter from the level-1 structural model must appear in a separate equation of the level-2 model; (c) each equation must specify a relationship between an individual growth parameter and the predictors; and (d) level-2 model must allow individuals who share common predictors to vary in individual change trajectories. The level-2 model can be expressed as:

$$\beta_{0i} = \gamma_{00} + \gamma_{01}PREDICTOR_{ti} + \zeta_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}PREDICTOR_{ti}$$

$$\beta_{2i}= \gamma_{20}+ \gamma_{21}PREDICTOR_{ti},$$

In the level-2 structural model, each child's intercept, β_{0i}, and the growth parameters, β_{1i} and β_{2i}, were expressed as functions of the fixed effects—level-2 intercepts (i.e., γ_{00}, γ_{10}, and γ_{20}) and level-2 slope parameters (i.e., γ_{01}, γ_{11}, and γ_{21})—associated with the predictor and control variables, *PREDICTOR*. The fixed effects captured systematic differences between individuals in change trajectory, representing the effect of variation in level-2 predictor variables (i.e., *PREDICTOR*). The equation contained a random error term (i.e., ζ_{0i}) that represented deviations of the individual growth parameters from the population averages (Singer & Willet, 2003).

Fitting the two-level model for change to data. Table 3.7 displays a taxonomy of the four multilevel logistic models for change that fit to the current data. The taxonomy of multilevel models shows a systematic sequence of statistical models in which each model extends a previous model, allowing examination and comparison across models (Singer & Willet, 2003). Table 3.7 shows specifications of level-1 and level-2 submodels at the five sequential models.

As recommended by Francis, Schatschneider, and Carlson (2000), the results were demonstrated in two phases: unconditional and conditional phases. In the unconditional phase, three unconditional models (i.e., Model A, B, and C) without including child-level predictors and control variables were fitted to identify the best model to capture the shape of growth by a comparison of competing nested models (e.g., linear versus curvilinear).

The first model to be fit to data was an *unconditional means model* (i.e., Model A in the Table 3.7) that had no predictor variables at both level-1 and -2 structural models. The second step to be fit to data was an *unconditional linear growth model* (i.e., Model B) with a random intercept and a random effect for the linear change (i.e., *TIME*). Model B included *TIME* as the only level-1 predictor variable, while none of predictors were specified at level-2 equations. The unconditional models allowed (a) determination of the extent of between-individual variation on the outcome (η_{ti}, the log-odds of Reading-Comprehension Proficiency), (b) estimation of the intra-class correlations (ICC) among the growth parameters and the reliability of effects at each level, and (c) examination of a proper specification of each child's growth equation and baseline statistics for evaluating consequent level-2 model (Raudenbush & Bryk, 2002). An additional unconditional growth model was fit to the data—an *unconditional quadratic growth model* (i.e., Model C)—that included the acceleration/deceleration rate parameter associated with level-1 predictor $TIME^2$.

In the conditional phase, based on the best-fitting unconditional model determined in the first phase, a *conditional growth model* (i.e., Model D) was fitted to examine the growth rate for the probability that children achieve Reading-Comprehension Proficiency as a function of the interaction effect between the two level-2 predictor variables—Language Status and Word-Reading Proficiency. Model D took into account the interaction effect, the main effects of the two predictor variables, and the control variables (i.e., Gender, Race/ethnicity groups, SES, and Time to Oral English-Language Proficiency groups) at level-2 submodel.

Model comparisons. The selection of a final model was determined by model comparisons through examination of deviance statistics (-2 Log-Likelihood) that provide a comparative index of goodness-of-fit versus parsimony, Akaike information criterion (AIC), and

Bayesian information criterion (BIC). Examining deviance statistics was particularly preferable because this approach offers superior statistical properties and allows composite tests on several parameters simultaneously (Singer & Willett, 2003).

CHAPTER 4

RESULTS

The results are presented in three main sections. In the first section, preliminary analyses results are presented. In the second section, results of the Hierarchical Generalized Linear Models (HGLM) analyses are presented to address the research question. The research question guiding the current study was: Is the relationship between first-grade word-reading proficiency and reading-comprehension proficiency growth through eighth grade different for language-minority (LM) learners as compared to their native-English-speaking (NE) peers? The major hypothesis for the study was that the relationship between children's word-reading proficiency and reading-comprehension proficiency growth over time will vary as a function of children's language status (i.e., LM learners versus NE students). An ordinal interaction of initial word-reading proficiency and language status was thus expected. Finally, I conclude the chapter by providing a summary of findings.

Preliminary Analysis

Prior to fitting the growth curves to address the research question, I conducted preliminary analyses. First, descriptive statistics for all variables across the time points were examined. Next, correlations and multicollinearity were evaluated to identify whether there is a strong correlation among the variables using a tolerance and Variance Inflation Factor (VIF). Finally, to determine the shape of patterns (e.g., linear versus quadratic growth) that captured the growth trajectories of the outcome variable in the data, I fitted a series of unconditional models through a comparison of competing nested unconditional models.

Descriptive Statistics

Table 4.1 displays proportions (and standard deviations) of children achieving Reading-Comprehension Proficiency by full sample, Language-Status subsamples, and Word-Reading Proficiency Groups (low and high) across the first, third, fifth, and eighth grades. Recall that Reading-Comprehension Proficiency is an indicator variable showing whether or not a child achieved Reading Proficiency Level 8 at a given time point. As Table 4.1 shows, the proportion of children achieving Reading-Comprehension Proficiency for the full sample gradually increased over time (see Marginal Mean). On average, the proportions of the full sample of children who achieved Reading-Comprehension Proficiency in the first, third, fifth, and eighth grades were 0.01, 0.28, 0.44, and 0.68, respectively (see column 4). The first two columns in Table 4.1 show that from the third grade on, children with initially high Word-Reading Proficiency tended to achieve Reading-Comprehension Proficiency to a greater degree than children with initially low Word-Reading Proficiency.

Looking at the Language-Status subsamples' marginal mean proportions, in the first grade, the proportions of LM learners and NE students who achieved Reading-Comprehension Proficiency were near 0. However, greater absolute differences between the two sub-groups appeared by the third grade, but by the eighth grade the two groups were more similar. As Figure 4.1 shows, in the third and fifth grade, the proportions of LM learners who achieved Reading-Comprehension Proficiency in the third and fifth grades (0.15 and 0.26, respectively) were approximately half those of NE students (0.29 and 0.46, respectively). In the eighth grade, however, the proportions of the LM learners and NE students who achieved Reading-Comprehension Proficiency were very close (0.61 and 0.68, respectively).

As would be expected, the standard deviations for the first-grade Reading-Comprehension Proficiency were relatively low (0.07 for LM learners and 0.11 for NE students) because few children would be expected to attain Reading-Comprehension Proficiency by the end of first grade. Notably, the standard deviations of the two groups dramatically increased from the first to third grade and remained fairly steady across the third, fifth, and eighth grade, indicating that the scores in the third, fifth, and fifth grades were more widely dispersed than those in the first grade.

Table 4.1 also displays the proportions (and standard deviations) for the four following subgroups of children—a) LM learners with low Word-Reading Proficiency (LM-Low), b) LM learners with high Word-Reading Proficiency (LM-High), c) NE students with low Word-Reading Proficiency (NE-Low), and d) NE students with high Word-Reading Proficiency (NE-High). As would be expected, only a few or none of children across the four groups achieved Reading-Comprehension Proficiency in the spring of first grade. However, across the third, fifth, and eighth grades, the proportions of children in the LM-Low and NE-Low groups who achieved Reading-Comprehension Proficiency were considerably lower than those of children in the LM-High and NE-High groups who achieved Reading-Comprehension Proficiency. By the end of eighth grade, over 8 in 10 children in the LM-High and NE-High groups achieved Reading-Comprehension Proficiency, whereas only approximately 4 in 10 children in the LM-Low and NE-Low groups achieved Reading-Comprehension Proficiency.

In addition, Table 4.2 shows the number and percentage of children in the two groups of Word-Reading Proficiency further subcategorized by Time to Oral English-Language

Proficiency. Among children in the high Word-Reading Proficiency group, only 10% were not proficient in oral English at kindergarten entry and identified as needing the *PreLAS* test, whereas nearly 20% of children in the low Word-Reading Proficiency were not proficient in oral English at kindergarten entry. Due to the difference between the two groups, Time to Oral English-Language Proficiency was confirmed to be a potential confounding factor and was needed as a control variable in analyses.

Correlations and Collinearity

Table 4.3 shows zero-order phi-coefficient correlations between Reading-Comprehension Proficiency (a binary variable indicating whether or not children achieved Proficiency Level 8) at the four time points and Word-Reading Proficiency (a binary variable indicating whether a child had a low or high Word-Reading Proficiency) in the first grade. First-grade Word-Reading Proficiency (the reference category is the high-Word-Reading-Proficiency group) was very slightly positively and significantly related to Reading-Comprehension Proficiency at each grade, though several correlation coefficients were nearly negligible and the remaining correlations were modest (r_{φ} = 0.07 to 0.39). Most noticeable in Table 4.3 (column 2) was that the correlation between first-grade Word-Reading Proficiency and Reading-Comprehension Proficiency increased substantially after the first grade and stabilized at moderate levels across the third, fifth, and eighth grades. The highest magnitude of correlation coefficient was observed in the eighth grade (r_{φ} = 0.39).

Significant positive relationships among the four time-points of Reading-Comprehension Proficiency were also found (r_{φ} = 0.05 to 0.39), though again, they were either negligible or modest. In some cases, the statistical significance was likely due in part to the large sample size. The relatively low correlations of Reading-Comprehension Proficiency in the first grade with the third, fifth, and eighth grades (column 2) indicated that attainment of Reading-Comprehension Proficiency in the spring of first grade had a weak relation with attainment of Reading-Comprehension Proficiency in the other grades. However, as shown in Table 4.3 (column 3), attainment of Reading-Comprehension Proficiency in the spring of third grade had a relation with attainment in the spring of fifth and eighth grades at least to a modest extent, as did attainment in the spring of fifth grade with attainment in the spring of eighth grade. The pattern indicates the possibility that an optimal level of word-reading ability has to develop before high-level reading-comprehension proficiency can be attained, which is supported by prior research. However, the pattern was likely an artifact of the measurement system—once reading reading-comprehension proficiency was attained, then it had to remain attained.

To assess collinearity, Table 4.4 presents correlation coefficients among the predictors and all control variables for the HGLM analyses. An examination of Phi correlation coefficients showed that there was a significantly negative but weak Phi correlation between Word-Reading Proficiency and Language Status (r_{φ} = -0.13). That is, a larger portion of NE students than LM learners tended to attain high Word-Reading Proficiency in the first grade. Word-Reading Proficiency was, however, significantly and positively related to Female (r_{φ} = 0.13), White (r_{φ} = 0.21), and SES ($r_{point\text{-}biserial\ (pb)}$ = 0.36), indicating that Female, White, and higher SES were more likely to attain high Word-Reading Proficiency in the first grade than Male, other Race/ethnicity groups than White, and lower SES, respectively.

Language Status was significantly but moderately strongly and positively correlated with Hispanic (r_{φ} = 0.39) and Asian/Pacific Island and Others (r_{φ} = 0.29), reflecting that LM learners in the present study tended to be Hispanic and Asian/Pacific Island and Others. Language status was weakly but significantly negatively related to SES (r_{pb} = -0.19), indicating that LM learners tended to be described with lower SES.

It is worth noting that the subgroups of Time to Oral English-Language Proficiency were significantly correlated with Language Status and Word-Reading Proficiency variables. The correlations with Language Status in Table 4.4 indicated that only a subgroup of children who were fully proficient in oral English proficiency at kindergarten entry was strongly significantly negatively related to LM learners (r_φ = -0.70), whereas remaining subgroups of children who became proficient in oral English proficiency during the kindergarten and first-grade years were modestly significantly positively correlated with LM learners (r_φ = 0.14 to 0.40). The preceding correlation patterns were expected because LM learners tended to attain oral English-language proficiency later than earlier, while NE students were orally proficient at kindergarten entry.

The correlations of Time to Oral English-Language Proficiency with Word-Reading Proficiency in Table 4.4 also suggested that among the five subgroups of Time to Oral English-Language Proficiency, a subgroup of children who were not identified as needing the oral proficiency test at kindergarten entry was significantly positively, but weakly, related to high Word-Reading Proficiency (r_φ = 0.13), while other subgroups of children who gained oral English proficiency during the kindergarten and first-grade years were weakly negatively related to high Word-Reading Proficiency (r_φ = -0.14 to -0.05). That is, children will full oral English-language proficiency earlier were more likely to attain high Word-Reading Proficiency in the first grade than others who gained oral English-language proficiency later.

The subgroup of children with fully proficient at kindergarten entry was significantly positively correlated with White (r_φ = 0.41), Black (r_φ = 0.12), and SES (r_{pb} = 0.19), indicating that White, Black, and higher SES were more likely to arrive in kindergarten with full oral

English proficiency as compared to Hispanic, Asian/Pacific Island and Others, and lower SES, respectively.

Given the significantly correlated multiple control variables and predictor, potential multicollinearity problems were tested using a tolerance and Variance Inflation Factor (VIF). As a rule of thumb, tolerance values less than 0.1 and VIF values above 10 indicate the presence of the multicollinearity effect (Myers, 1990). The tolerance values of all variables were greater than 0.1 and the VIF values ranged between 1.03 and 1.88, indicating that there were no problematic multicollinearity conditions and that the subsequent HGLM analyses and interpretations could be considered to be reasonably robust.

Selecting a Functional Form for Growth

Three unconditional growth models (Model A, B, and C in Table 4.5) were estimated to determine a functional form of growth (i.e., linear versus quadratic growth) in the probabilities of achieving Reading-Comprehension Proficiency between the spring of first grade and eighth grade. Relative model fit was assessed by comparing the –2 log likelihood (-2LL) statistics of competing, nested models (Snijders & Bosker, 1999). Note that in describing results of HGLM analyses the phrase “the probability of achieving Reading-Comprehension Proficiency” is used throughout. As described in The HGLM Analysis section in Chapter 3, in the HGLM analysis, the dichotomous dependent variable is transformed into log-odds (i.e., logit; the natural log of the odds of the dependent variable occurring or not), so that estimates of coefficients represent changes in log-odds of the dependent variable as opposed to the changes in the dependent variable itself. To facilitate interpretation, therefore, the results of the analysis are reported in the form of (a) odds ratios, converted from the coefficients using the exponential function; and (b) predicted probabilities, converted from the log-odds coefficients through a logit-link function.

Unconditional Means Model (Model A)

The first model to fit was an unconditional means model (Model A) without any predictor variables. The purpose for fitting Model A was to examine whether systemic variation existed within children ignoring time. Table 4.5 shows the results of fitting Model A to the current data. The average baseline odds ratio for achieving Reading-Comprehension Proficiency was statistically significantly different from zero ($p < .001$), which indicated that there was adequate variation to warrant further analysis. The Intraclass Correlation Coefficient (ICC; which uses $\pi^2/3$ as the within-group variance in multilevel logit models) was estimated as 0.074, indicating that 7.4% of the total variation in achieving Reading-Comprehension Proficiency was attributable to difference between children.

Unconditional Linear Growth Model (Model B)

The next step was to estimate an unconditional growth model (Model B) by taking into account only a linear growth factor (i.e., child's age in months) as a predictor at the level-1 submodel. The results of Model B (see Table 4.5) indicated that the fixed effects (i.e., intercept [initial status] and instantaneous growth rate [initial velocity]) were significantly different from zero ($p < .001$).

With time included as a fixed effect, the ICC accounting for linear growth was calculated. The ICC was estimated as 0.451 suggested that 45.1% of the total variation in achieving Reading-Comprehension Proficiency was due to between-individual differences across time.

Unconditional Quadratic Growth Model (Model C)

The third unconditional model to fit was an unconditional quadratic growth model (Model C) that included both a linear and quadratic growth term as level-1 predictors. Although Model B was found to be a better model fit than Model A, the graphical representation (see

Figure 4.2) captured a potential quadratic trend. Thus a growth model with a quadratic factor was further examined to determine the growth rates of the probabilities of achieving Reading-Comprehension Proficiency over time. The results for the unconditional quadratic growth model (Model C in Table 4.5) revealed that the fixed effects (i.e., intercept, instantaneous growth rate, and acceleration/deceleration rate) were all statistically significant ($p < .001$).

The results for Model C indicated that the estimated odds ratio of achieving Reading-Comprehension Proficiency for overall sample in the spring of first grade was 0.009 ($p < .001$), corresponding to the estimated probability of 0.009/(1 + 0.009) = 0.009. That is, as a whole, approximately 1.0% of children in the sample were likely to achieve Reading-Comprehension Proficiency in the spring of first grade. The positive coefficient associated with the instantaneous growth rate (γ_{10}= 0.14, *OR* [Odds Ratio] = 1.15, 95% = 1.15 to 1.15, $p < .001$) and the negative coefficient associated with the acceleration/deceleration rate (γ_{20} = -0.001, $p < .001$) indicated that the probability that children achieved Reading-Comprehension Proficiency initially increased, but the growth rate of the probability decelerated by the spring of eighth grade.

The ICC was estimated as 0.483 suggesting that 48.3% of the total variation in Reading-Comprehension Proficiency was due to between-individual differences across time. As compared to 7.4% and 45.1% of the variance was explained by differences between children in Model A and B, respectively, Model C provided a better estimate of the proportion of variance in Reading-Comprehension Proficiency that was attributable to variation between children. The random effects information from the variance component analysis indicated that there were statistically significant variability in the log-odds of achieving Reading-Comprehension Proficiency (τ_{00} = 1.12, *SE* = 0.003, $p < .001$).

Model Comparisons

In comparing Model A (deviance = 11,722,700.2, 1 parameters) to Model B (deviance = 8,561,193.6, 2 parameters), the Wald test, Akaike information criterion (AIC), and Bayesian information criterion (BIC) were performed to assess whether a reduction in deviance given an additional parameter contributed to significant improvement in the fit of the model. The results of the Wald test ($\chi^2[1] = 1.4e{+}06$, $p < .0001$), AIC, and BIC (see Table 4.5) indicated that an inclusion of a linear growth term in Model B significantly led to a better model fit.

However, in comparing Model B to Model C (deviance = 8,212,451.6, 3 parameters), the results for the Wald test ($\chi^2[1] = 2.8e{+}05$, $p < .0001$), AIC, and BIC suggested that an inclusion of the quadratic growth term in Model C resulted in a statistically significant improvement in the fit of the model. Therefore, a quadratic function of time was determined as the best representation of growth for the data.

HGLM Final Analyses Results

In the following sections, I first report results for the research question on the interaction effect of child's Language Status and Word-Reading Proficiency on Reading-Comprehension Proficiency growth. Recall that Reading-Comprehension Proficiency *growth* refers to growth of the probability of achieving Reading-Comprehension Proficiency (ECLS-K reading Proficiency Level 8). The follow-up examination of the main effects of the two predictor variables (i.e., Language Status and Word-Reading Proficiency) was accomplished in order to assess whether the main effects held in the face of a significant interaction. The effects of the control variables included in the HGLM model are also presented. To examine the interaction and main effects, a conditional growth model (i.e., Model D) was estimated. Model D, the final full model, included the interaction effect between child's Language Status and Word-Reading Proficiency, main effects of each of the two preceding variables, and a set of control variables (i.e., Gender, Race/ethnicity, SES, and Time to Oral English-Language Proficiency) on the intercept (initial status), instantaneous growth rate (linear slope), and acceleration/deceleration rate (quadratic slope) parameters in the level-2 submodel.

Is the Relationship between First-Grade Word-Reading Proficiency and Reading-Comprehension-Proficiency Growth through Eighth Grade Different for LM Learners as Compared to Their NE Peers?

Interaction effects of Language Status and Word-Reading Proficiency. The relationship between Word-Reading Proficiency and Reading-Comprehension-Proficiency growth significantly varied according to children's Language Status. The statistical results for Model D are provided in Table 4.5. The results of the fixed-effects estimation of Model D revealed that the interaction term had a statistically significant effect on the intercept (*OR* = 0.54, $p < .001$), a small but statistically significan0t effect on instantaneous growth rate (*OR* = 1.01, $p < .001$), and a small but statistically significant effect on acceleration/deceleration rate (*OR* = 0.99, $p < .001$) for the probability that children achieved Reading-Comprehension Proficiency, holding all else constant. It should be noted that the odds ratios of instantaneous growth rate and acceleration/deceleration rate, close to 1.00, indicated small interaction effects possibly due to the large sample size and the unit of measurement of the binary independent variable. Practical significant may be further gleaned from visualization of the growth trajectories and from the subgroup proportions. The growth trajectories of the probability of achieving Reading-Comprehension Proficiency for the four subgroups of children were estimated and plotted based on the final model (Figure 4.3). The trajectories in combination with the results of the descriptive statistics for proportion of students attaining proficiency (i.e., Table 4.1) are explained and discussed in the following sections, where the practical significance of the interaction effect is also emphasized.

On the whole, better Word-Reading Proficiency at the start promotes greater growth in Reading-Comprehension Proficiency. In the spring of first grade, there were only slight, but statistically significant, differences across the four groups in the probability of achieving Reading-Comprehension Proficiency, but variation in the instantaneous growth rates and acceleration/deceleration rates across groups was apparent. On the whole, when children's demographic backgrounds and Time to Oral English-Language Proficiency test were controlled for, children who began first grade with higher Word-Reading Proficiency, regardless of Language Status, made better Reading-Comprehension Proficiency progress than did children who began with lower Word-Reading Proficiency. As shown in Figure 4.3, the top two groups (high Word-Reading Proficiency groups) outperformed the bottom two groups (low Word-Reading Proficiency groups) from first-grade through eighth grade. The results of the descriptive statistics in Table 4.1 also support the practical significance. Children with high Word-Reading Proficiency made noticeably greater increase from the spring of first grade to eighth grade (as shown in column three, the predicted probabilities of 0.02 to 0.81, respectively) relative to children with low Word-Reading Proficiency (as shown in column two, the predicted probabilities of 0.00 to 0.37, respectively). In short, better word-reading ability at the start was important, regardless of language status.

However, early Word-Reading Proficiency was especially beneficial for LM learners. On the whole, for LM children who began with relatively high Word-Reading Proficiency, Reading-Comprehension Proficiency nearly approached that of NE students with initially high Word-Reading Proficiency throughout the years, *and* the Language Status gap was closed by the spring of eighth grade when the predicted probabilities of achieving Reading-Comprehension Proficiency were 0.81 for both LM learners and NE students (see Table 4.1).

To elaborate, when the two groups of children with high Word-Reading Proficiency—children in the LM-High and NE-High groups (the top two, depicted by the dashed and solid lines, respectively, in Figure 4.3)—were compared, the positive effect of high Word-Reading Proficiency was particularly strong for NE students, predominantly between the spring of first grade and fifth grade. Children in the NE-High not only had a significantly higher predicted probability of achieving Reading-Comprehension Proficiency in the spring of first grade, but also showed an initially faster instantaneous growth rate than did children in the LM-High group. Table 4.1 also shows that across the spring of the first, third, and fifth grades, children in the NE-High made slightly more increases in the probability of achieving Reading-Comprehension Proficiency (0.02, 0.39, and 0.57, respectively) as compared to children in the LM-High (0.01, 0.27, and 0.40, respectively). However, beginning around the spring of fifth grade, children in the NE-High group had a greater deceleration rate than those in the LM-High group. By the spring of eighth grade, thus, children in the LM-High group caught up with the predicted probability for children in the NE-High group by narrowing the gap. Although the effect of Language Status was negligible by the eighth grade among children with initially high Word-Reading Proficiency, from a practical standpoint, it is important to note that children in the LM-High group lagged behind those in the NE-High group for many years.

On the other hand, LM learners who began with lower Word-Reading Proficiency were at a disadvantage compared to their NE peers. Their growth progression departed from their NE peers, fanning out rather than closing in. To elaborate, for the two groups of children who had the lowest Word-Reading Proficiency—children in the LM-Low and NE-Low groups (the bottom two, depicted by dotted and dash-dot lines, respectively, in Figure 4.3), acceleration rates were substantially different. The trajectories of both groups showed a similarly slow and consistent growth rate between the spring of first grade and third grade, and were virtually indistinguishable each other by the spring of third grade. However, as children in NE-Low group showed a slightly faster rate of acceleration relative to that of children in the LM-Low group beginning around the spring of third grade, the trajectory lines for both groups started to separate from each other, which led to a divergence in the trajectories by the spring of eighth grade. Table 4.1 also provides further information corroborating the visualization in Figure 4.3. Note that children with the LM-Low on the whole made slower progress than their peers in the NE-Low from first through eighth grade, with the proportion of students achieving proficiency somewhat consistently lower throughout the grades. In the spring of eighth grade, the predicted probabilities of achieving Reading-Comprehension Proficiency for children in the LM-Low and NE-Low groups were approximately 0.36 and 0.41, respectively (see columns five and eight in Table 4.1). Therefore, although the interaction effect for instantaneous growth rate and acceleration/deceleration rate was very small, the effect was notable and practically important.

Main effects of Language Status and Word-Reading Proficiency. There was a significant main effect for Language Status, but it did not hold true for the intercept, instantaneous growth rate, and acceleration/deceleration rate of Reading-Comprehension-Proficiency attainment in the face of the significant interaction effect. As shown in Figure 4.3, in the spring of first grade, both LM learners and NE students who were in the low Word-Reading-Proficiency group began with the same intercept. That is, it is not true that, on the whole, one language group outperformed the other.

Turning to instantaneous growth rate, again, for children in the low Word-Reading-Proficiency group, the instantaneous growth rate appeared to be nearly identical. That is, it is not true that, on the whole, one language group outperformed the other.

As for acceleration/deceleration rate, the pattern of curvature for the two Language-Status groups was also conditioned by Word-Reading-Proficiency group affiliation. For children in the high Word-Reading-Proficiency group, NE students started to decelerate earlier than LM learners, while for children in the low Word-Reading-Proficiency group, NE students started to accelerate more sharply than LM learners. Therefore, it is not true that, on the whole, one language group outperformed the other for acceleration/deceleration.

A significant main effect was also found for Word-Reading Proficiency, but it held true only for the intercept and instantaneous growth rate but not for acceleration/deceleration rate. As shown in Figure 4.3, in the spring of first grade, regardless of Language Status, children with high Word-Reading Proficiency outperformed those with low Word-Reading Proficiency, and they also had a greater instantaneous growth rate than their counterparts. As for acceleration/deceleration rate, however, the two Word-Reading-Proficiency groups exhibited different curvatures in that children in the high Word-Reading-Proficiency group showed a deceleration in growth, while those with low Word-Reading Proficiency displayed an acceleration.

Main effects for the control variables. Although the control variables included in the final model (i.e., children's Gender, Race/ethnicity, SES, and Time to Oral English-Language Proficiency) were not of interest in the current study, significant results for associations between control variables and outcomes are explained in the following sections.

Gender. There were significant differences between female and male children, favoring females in the intercept (*OR* = 0.80, $p < .001$), instantaneous growth rate (*OR* = 1.02, $p < .001$), and acceleration/deceleration rate (*OR* = 0.99, $p < .001$) for the probabilities of achieving Reading-Comprehension Proficiency, when controlling for other variables in the final HGLM model. Specifically, the odds ratio of achieving Reading-Comprehension Proficiency for female children in the spring of first grade was 0.80 (95% CI = 0.79, 0.81), which was less than 1.0, such that female children were 1.25 times less likely (1/0.80 = 1.25) than male children to achieve Reading-Comprehension Proficiency in the spring of first grade. The odds ratios for instantaneous growth rate and acceleration/deceleration rate for female children were 1.02 (95% CI = 1.02, 1.02) and 0.99 (95% CI = 0.99, 0.99), respectively, which indicated that female children exhibited greater instantaneous growth rate but a slightly slower rate of deceleration as compared to male children. The predicted probabilities of achieving Reading-Comprehension Proficiency in the spring of eighth grade for female and male children were approximately 0.73 and 0.62, respectively.

In summary, the growth trajectories significantly varied between female and male children. Although female children, on average, started with slightly lower probability to achieve Reading-Comprehension Proficiency than male children, female children gained Reading-Comprehension Proficiency at a faster rate relative to male children during the elementary and middle school years such that female children outperformed male children by the spring of eighth grade.

Race/ethnicity. Each of the racial/ethnic groups—Black, Hispanic, and Asian/Pacific Islander/Other children—was compared with White children (a reference group). When Black and White children were compared, statistical differences between the two groups were found in the intercept (*OR* = 0.29, $p < .001$), and instantaneous growth rate (*OR* = 1.004, $p < .001$), but not in acceleration/deceleration rate (*OR* = 1.00, $p = 0.42$), in the probabilities of achieving Reading-Comprehension Proficiency. The odds ratio of achieving Reading-Comprehension Proficiency for Black children in the spring of first grade was 0.29 (95% CI = 0.29, 0.30), indicating that Black children were 3.45 times less likely (1/0.29 = 3.45) than White children to achieve Reading-Comprehension Proficiency. The odds ratio for instantaneous growth rate, 1.004 (95% CI = 1.002, 1.005), suggests that Black children exhibited linear increase at a greater rate than White children. No difference was found between the two groups in decelerating growth rate. Despite the sharper increase for Black children, the gap between the two groups continued to widen by the spring of eighth grade with the predicted probabilities of 0.45 and 0.75 for Black and White children, respectively.

A comparison between Hispanic and White children indicated that Hispanic children were statistically different from White children in the intercept (*OR* = 0.35, $p < .001$), instantaneous growth rate (*OR* = 1.02, $p < .001$), and acceleration/deceleration rate (*OR* = 0.99, $p < .001$). Specifically, the odds ratio of achieving Reading-Comprehension Proficiency for Hispanic children in the spring of first grade was 0.35 (95% CI = 0.34, 0.37), indicating that Hispanic children were 2.86 times less likely (1/0.35 = 2.86) than White children to achieve Reading-Comprehension Proficiency in the spring of first grade. The odds ratios for instantaneous growth rate and acceleration/deceleration rate for Hispanic children were 1.02 (95% CI = 1.02, 1.02) and 0.99 (95% CI = 0.99, 0.99), respectively, which indicated that Hispanic children displayed linear increase at a slightly higher rate followed by a slower rate of deceleration as compared to White children. Despite the higher instantaneous growth rate for Hispanic children, the gap between the two groups remained consistent by the spring of eighth grade with the predicted probabilities of 0.59 and 0.75 for Hispanic and White children, respectively.

Asian/Pacific Islander/Other children were also statistically different from White children in the intercept (*OR* = 0.74, $p < .001$), instantaneous growth rate (*OR* = 0.99, $p < .001$), and acceleration/deceleration rate (*OR* = 1.00004, $p < .001$). The odds ratio of achieving Reading-Comprehension Proficiency for Asian/Pacific Islander/Other children in the spring of first grade was 0.74 (95% CI = 0.29, 0.30), indicating that Asian/Pacific Islander/Other children were 1.35 times less likely (1/0.74 = 1.35) than White children to achieve Reading-Comprehension Proficiency in the spring of first grade. The odds ratios for instantaneous growth rate and acceleration/deceleration rate for Asian/Pacific Islander/Other children were 0.99 (95% CI = 0.99, 0.99) and 1.00004 (95% CI = 1.00003, 1.00005), respectively, which indicated that Asian/Pacific Islander/Other children displayed linear increase at a slightly lower rate followed by a faster rate of deceleration as compared to White children. The predicted probability in the spring of eighth grade for Asian/Pacific Islander/Other children was 0.73 such that they tended to catch up to White children by the end of eighth grade.

In summary, in the spring of first grade, on average, all three racial/ethnic groups—Black, Hispanic, and Asian/Pacific Islander/Other children—had significantly lower levels of Reading-Comprehension Proficiency than White children. Asian/Pacific Islander/Other children were the only racial/ethnic group that showed increasingly steady growth and narrowed the gap with White children by the spring of eighth grade, whereas disparities still existed between Black and Hispanic children and White children.

SES. Children's SES had a statistically significant effect on the intercept (*OR* = 1.52, $p < 0.001$), instantaneous growth rate (*OR* = 1.01, $p < 0.001$), and acceleration/deceleration rate (*OR*

= 0.999, $p < 0.001$) in the probability of achieving Reading-Comprehension Proficiency. More specifically, the significant odds ratio of the intercept (*OR* = 1.52, $p < 0.001$) implied that a one-standard deviation increase in SES was associated with a 1.52-fold increase in the odds of achieving Reading-Comprehension Proficiency in the spring of first grade. In other words, a one-standard deviation change in SES yielded more than a 40% (a log-odds of 0.42) increase in the predicted probability of achieving Reading-Comprehension Proficiency in the spring of first grade. The odds ratios for instantaneous rate of change and acceleration/deceleration rate were 1.01 (95% CI = 1.01, 1.01) and 0.99 (95% CI = 0.99, 0.99), respectively, which implied that children from higher SES families had a slightly greater instantaneous growth rate than those from lower SES families in the probability of achieving Reading-Comprehension Proficiency, but the former group showed a relatively slower rate of deceleration.

In summary, children's SES was significantly and positively related to Reading-Comprehension Proficiency attainment across time. Children from higher SES were not only more likely to achieve Reading-Comprehension Proficiency in the spring of first grade, but all other things being equal, also continued to achieve at higher growth rates across time.

Time to Oral English-Language Proficiency. Finally, the four groups of children categorized according to Time to Oral English-Language Proficiency were compared with a reference group of children who were not identified as needing the oral proficiency test at kindergarten entry.

When the first group of children (i.e., children who gained proficiency by the fall of kindergarten) was compared with the reference group, there were statistical differences between the two groups in the intercept (*OR* = 0.82, $p < .001$), instantaneous growth rate (*OR* = 1.01, $p < .001$), and acceleration/deceleration rate (*OR* = 0.99, $p < .001$) for the probabilities of achieving Reading-Comprehension Proficiency. The odds ratio of achieving Reading-Comprehension Proficiency for the first group in the spring of first grade was 0.82 (95% CI = 0.78, 0.86), indicating that the first group of children was 1.22 times less likely (1/0.82 = 1.22) than the reference group to achieve Reading-Comprehension Proficiency. The odds ratios for instantaneous rate of change and acceleration/deceleration rate for the first group were 1.01 (95% CI = 0.01, 0.02) and 0.99 (95% CI = 0.99, 0.99), respectively, which indicated that the first group of children showed a faster rate of increase at an earlier time point and a slower rate of deceleration than did the reference group.

A comparison of the second group of children (i.e., children who gained proficiency by the spring of kindergarten) with the reference group shows that a statistical difference between the two groups was found only in the intercept (*OR* = 0.81, $p < .001$), but not in the instantaneous growth rate (*OR* = 1.00, $p = .19$) and acceleration/deceleration rate (*OR* = 1.00, $p = .06$) for the probabilities of achieving Reading-Comprehension Proficiency. Specifically, the odds ratio of achieving Reading-Comprehension Proficiency for the second group in the spring of first grade was 0.81 (95% CI = 0.75, 0.86), indicating that the second group of children was 1.23 times less likely (1/0.81 = 1.23) than the reference group to achieve Reading-Comprehension Proficiency in the spring of first grade. However, there was no significant difference between the two groups in growth rates across time.

In a comparison between the third group (i.e., children who gained proficiency by the fall of first grade) and the reference group, a statistically significant difference were found between the two groups in the intercept (*OR* = 2.27e-19, $p < .001$), instantaneous growth rate (*OR* = 4.11, p < .001), and acceleration/deceleration rate (*OR* = 0.99, $p < .001$). The odds ratio of achieving Reading-Comprehension Proficiency for the second group in the spring of first grade was 2.27e-

19 (95% CI = 7.71e-21, 6.66e-18). The odds ratios for instantaneous growth rate and acceleration/deceleration rate for the first group were 4.11 (95% CI = 3.69, 4.59) and 0.99 (95% CI = 0.99, 0.99), respectively, indicating that the third group of children showed a faster rate of increase at an earlier time point and a slower rate of deceleration than did the reference group.

Comparing the fourth group of children (i.e., children who gained proficiency by the spring of first grade) with the reference group revealed that the two groups were significantly different in the intercept (*OR* = 1.22, $p < .001$), instantaneous growth rate (*OR* = 0.99, $p < .001$), and acceleration/deceleration rate (*OR* = 0.99, $p < .001$). The odds ratio of achieving Reading-Comprehension Proficiency for the fourth group in the spring of first grade was 1.22 (95% CI = 0.78, 0.86), indicating that, interestingly, the fourth group of children was 1.22 times more likely than the reference group to achieve Reading-Comprehension Proficiency in the spring of first grade. However, the odds ratios for instantaneous growth rate and acceleration/deceleration rate for the fourth group, 0.99 (95% CI = 0.99, 0.99) and 0.99 (95% CI = 0.99, 0.99), respectively, indicating that the fourth group of children had a slower instantaneous growth rate as well as a slower rate of deceleration across time as compared to the reference group.

Taken all together, differences in the probability of achieving Reading-Comprehension Proficiency in the spring of first grade and growth rates varied across all Time to Oral English-Language Proficiency subgroups. Compared to children who were fully proficient in oral English at kindergarten entry, those who became proficient throughout the kindergarten year and in the fall of first grade were less likely to achieve Reading-Comprehension Proficiency in the spring of first grade but tended to show faster growth rates by the end of eighth grades. However, surprisingly, children who acquired oral English proficiency by the end of first grade had a higher probability of achieving Reading-Comprehension Proficiency in the spring of first grade as compared to those with full oral English proficiency at kindergarten entry, whereas they had significantly slower growth rates than their peers who entered kindergarten with initially full oral English proficiency.

Summary of the Main Finding

The main conclusion was that the relationship between early Word-Reading Proficiency and Reading-Comprehension Proficiency growth was different for LM learners as compared to their NE peers, when children's gender, race/ethnicity, SES, and oral English proficiency were controlled for. On the whole, children with initially high Word-Reading Proficiency demonstrated more growth than children with initially low Word-Reading Proficiency, but the effect of initial Word-Reading Proficiency was especially impactful for LM learners as compared to NE students.

Language-minority learners and NE students with low Word-Reading Proficiency began at a similar, but statistically significantly different, level of Reading-Comprehension Proficiency attainment in the spring of first grade. However, LM learners with low Word-Reading Proficiency had a significantly slower initial growth of Reading-Comprehension Proficiency followed by a lower rate of acceleration than NE students with low Word-Reading Proficiency such that their growth trajectory was diverged from that of NE peers, leading to a large gap between the two groups by the end of eighth grade.

In contrast, for LM learners and NE students who had high Word-Reading Proficiency in the spring of first grade, the picture was quite different. Children with high Word-Reading Proficiency started out with a slightly higher level of Reading-Comprehension Proficiency attainment and showed a faster initial increase followed by a deceleration pattern as compared to those who had low Word-Reading Proficiency. Particularly noticeable was that among children who had initially high Word-Reading Proficiency, LM learners started at a slightly lower level of Reading-Comprehension Proficiency attainment than NE students, but Reading-Comprehension Proficiency growth trajectories of the two groups converged over time so that LM learners caught up with their counterparts by the end of eighth grade.

CHAPTER 5

CONCLUSION AND DISCUSSION

In the present chapter, the main conclusion drawn from the study is presented and discussed. The chapter is divided into five sections. First, the main study conclusion is described. The current study's limitations are discussed next. The next section offers a discussion of possible meanings of the conclusion and findings. Finally, implications related to the conclusion and findings are suggested for classroom instruction, theory, and research.

Conclusion

The main conclusion was that the relationship between early Word-Reading Proficiency and Reading-Comprehension Proficiency growth was different for language-minority (LM) learners as compared to their native-English-speaking (NE) peers, when children's gender, race/ethnicity, socioeconomic status (SES), and time to pass oral English-language proficiency were taken into account. On the whole, children with initially high Word-Reading Proficiency demonstrated more growth than children with initially low Word-Reading Proficiency, but the effect of initial Word-Reading Proficiency was especially impactful for LM learners as compared to NE learners.

Specifically, LM learners with initially high Word-Reading Proficiency had relatively lower Reading-Comprehension Proficiency than their NE peers with high Word-Reading Proficiency in first grade, but Reading-Comprehension Proficiency growth trajectories of the two groups converged by the end of eighth grade. In contrast, as compared to NE students with low Word-Reading Proficiency, LM learners with initially low Word-Reading Proficiency had a relatively lower Reading-Comprehension Proficiency in first grade, slower initial growth, and less acceleration over time, thereby leading to a large gap between the two groups by the end of eighth grade.

Limitations

The present study has several limitations to be acknowledged. The major limitations are inherent in the nature of using secondary data. First, while the ECLS-K data offers a broad view of the population and nationally representative trends, no information was available to determine students' native-language reading ability. Second, the sample for the present study consisted of LM learners who had passed an oral English proficiency assessment in first grade. Consequently, the results are relevant to similar students rather than to the LM learner population in general. Third, as is typical in studies of school-aged LM learners in the U.S., the vast majority of LM learners was from Spanish-speaking backgrounds. However, the Early Childhood Longitudinal Study (ECLS-K) sample was obtained to represent LM learners and ethnic groups in proportion to the population.

Discussion

In the following sections of the current chapter, the major study findings are first discussed. Next, a discussion of the control variables is presented.

The Relationship between Early Word Reading and Reading Comprehension Growth: The Moderating Effect of Language Status

The current study is among the first to examine the association of early English-word reading with English-reading comprehension growth for a large sample of LM learners and NE students from first through eighth grade. The findings of the current study about the predictive power of early word-reading ability on reading comprehension development not only converged with substantial prior research conducted with monolingual children (e.g., Carr, Brown, Vavrus,

& Evans, 1990; Cunningham & Stanovich, 1997; Juel, 1988; Snow, Porche, Tabors, & Harris, 2007; Vellutino, Tunmer, Jaccard, & Chen, 2007), but also provided equally strong support for the importance of early word-reading ability for LM learners as a foundation for second-language reading-comprehension development through the elementary and middle school grades.

The interaction effect between children's language status and early word-reading ability adds to a growing literature on LM learners' reading performance as compared to monolingual students' performance. First, the present study suggested that selected prior findings may be moderated by early word-reading ability. Previous comparative studies reported LM learners' substantially lower performance than NE peers' performance on reading comprehension outcomes (Gottardo & Mueller, 2009; Hutchinson, Whiteley, Smith, & Conors, 2003; Lesaux, Koda, Siegel, & Shanahan, 2006, for a review). However, the current study results suggested that for LM learners who have developed strong English-word reading skills by first grade, LM learners had opportunities to facilitate reading comprehension development and catch up their NE peers who also have strong initial word-reading skills by the end of middle school. That was the case despite their lesser exposure to English at home or community as compared to NE students. In contrast, LM learners who did not reach a sufficient level of word-reading skills in first grade had persistent and growing disparities in English-reading comprehension as compared to NE students through the course of the elementary and middle school grades.

Recall that all of the LM learners in the current sample developed a sufficient level of oral English proficiency by first grade to participate in English-reading assessment. Even children with initially low Word-Reading Proficiency had passed the oral English proficiency cut score. Thus, LM learners who had low Word-Reading Proficiency *and* who did not pass the oral

English proficiency test in first grade might have experienced more delay in reaching reading comprehension proficiency.

Second, the current findings are only partially consistent with previous research evidence that LM learners and NE peers demonstrated more similarities rather than differences when long-term reading comprehension growth patterns between the two populations was compared (e.g., Chiappe, Glaeser, & Ferko, 2007; Fitzgerald, Amendum, & Guthrie, 2008; Lesaux & Siegel, 2003; Proctor, Carlo, August, & Snow, 2005; Weber & Longhi-Chirlin, 2001). In the present study, the similarities in growth trajectories of reading comprehension between LM learners and NE counterparts were evident only when the two populations initially had comparable and similar profiles in early word-reading ability. Specifically, consistent with the findings from the two previous studies in which LM learners' English-reading comprehension growth was modeled in a relatively shorter period of time (e.g., Mancilla-Martinez et al., 2011; Nakamoto et al.'s, 2007), the decelerating quadratic growth patterns (i.e., initial linear increase followed by a gradual deceleration) were observed in the current study among LM learners as well as NE students. However, that was only in case when both LM learners and NE students had initially high Word-Reading Proficiency in first grade.

In evaluating whether the cumulative growth model or the developmental lag model best characterized the growth trajectories of reading-comprehension proficiency, the findings indicate that different developmental patterns of reading comprehension growth may result as a function of children's word-reading ability in first grade and their language status, partially supporting both models. First, the growth patterns comparing children with initially high Word-Reading Proficiency and those with initially low Word-Reading Proficiency, regardless of language status, provided support for the developmental lag model in Reading-Comprehension Proficiency growth over time. That is, despite the appearance of early increasing gaps between the two word-reading-proficiency groups, the initial differences between the two groups gradually decreased as children with low Word-Reading Proficiency gradually escalated to acquire Reading-Comprehension Proficiency and began to approach those with high Word-Reading Proficiency through by the end of eighth grade.

Second, the pattern of the developmental lag model was also found in comparing the growth trajectories of LM learners and NE students who had initially high Word-Reading Proficiency. LM learners with high Word-Reading Proficiency had relatively lower Reading-Comprehension Proficiency attainment in the spring of first grade, but they caught up and closed the gap with NE students who had initially high Word-Reading Proficiency by the end of eighth grade, although it took some time for them to do it. A plausible explanation for the lag through fifth grade may be that LM learners' oral and academic English proficiency was insufficiently advanced to bring them to the level of their peers—until eighth grade, but LM learners' initially high level of word-reading ability in English became increasingly salient for success in reading-comprehension development in later years. The lag has practical significance in that educators might be especially cautious in their expectations for rapid comprehension growth advancement for LMs with high Word-Reading Proficiency.

Finally, in contrast, when describing the developmental patterns of reading comprehension among LM learners and NE students who had initially low Word-Reading Proficiency, the cumulative growth model was most applicable. Again, both groups followed the similar accelerating trend, but LM learners with low Word-Reading Proficiency had significantly lower Reading-Comprehension Proficiency in first grade and fell increasing further behind NE learners with low Word-Reading Proficiency.

Comparing the LM Learners' Relationship between Early Word Reading and Comprehension Growth to Prior Findings

Only one prior study addressed the relationship of early word reading to comprehension growth—though only for middle grades. Several comparisons can be made for selected findings from the present study to the Mancilla-Martinez and colleagues' study of middle-school Spanish-speaking LM learners' English-reading comprehension growth in relation to initial word reading.

First, in the current study and Mancilla-Martinez and colleagues' (2011) study, early word reading was related to comprehension at each time point where comprehension was measured. Second, however, findings from the two studies diverged about the relationship between word reading and reading comprehension *growth*. Specifically, in the present study, LM learners' first-grade word-reading proficiency was significantly associated with reading comprehension growth, such that LM learners with initially high word reading had different instantaneous rates of change and acceleration/deceleration in reading comprehension as compared to LM learners with initially low word reading. In contrast, Mancilla-Martinez and colleagues (2011) found no significant effect of word reading in fifth grade on reading comprehension growth rates across fifth and seventh grade. Thus in the prior study, the quadratic growth trajectories of reading comprehension for both LM learners with initially high and low word reading remained parallel throughout the middle school grades. The divergent results are likely due to three factors: (a) differences in range of ages studied, (b) sample demographics (native-Spanish only versus diverse LM subgroups), and (c) the relative importance of emergent word-reading ability versus word-reading ability in fifth grade.

The Relationship between Early Word Reading and Comprehension Growth, *Regardless of Language Status*

In the present study, for both language groups taken together, that is, irrespective of language status, the pattern of word-reading ability correlation with comprehension at each time point is similar to prior research results, but the relationship between early word reading and later comprehension *growth* is different. The correlation patterns in the present study revealed that initial word reading had a stronger correlation with reading comprehension in the later grades than in first grade and that the magnitudes of the correlation were sustained across time points was in line with prior longitudinal studies for monolingual children (e.g., Cain & Oakhill, 2011; Cain, Oakhill, & Bryant, 2004; Oakhill, Cain, & Bryant, 2003; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997). However, the pattern stands in opposition to a few other research findings showing that the predictive power of early word-level reading on later reading comprehension declined among monolingual children (e.g., Abbott, Berninger, & Fayol, 2010; Hoover & Gough, 1990; Droop & Verhoeven, 2003; Verhoeven & van Leeuwe, 2008) and Spanish-speaking LM learners who only followed from fourth through fifth grade (e.g., Lesaux, Crosson, Kieffer, & Pierce, 2010). A possible explanation for the disparity between the research findings on the change in the relationship may be due to the variability in the age range of the sample and the nature of assessment for word reading and reading comprehension.

The Effects of Control Variables

There were also other findings associated with control variables that were not the primary focus of the current study but still warrant discussion. First, with respect to gender differences, the growth trajectories of Reading-Comprehension Proficiency attainment significantly varied between boys and girls. In the first grade, boys, on average, significantly but slightly lower probability to achieve Reading-Comprehension Proficiency than girls. The finding is consistent with previous studies indicating that school-age girls outscore boys in various aspects of reading competence (e.g., Brophy, 1985; Denton & West, 2002; Diamond & Onwuegbuzie, 2004) although the evidence is not entirely consistent. Prior research has suggested a reason for the gender pattern differences—boys were found more affected than girls by level of interest of the texts (Anderson, Shirey, Wilson, & Fielding, 1987; Oakhill & Petrides, 2007) and motivation (Becker, McElvany, & Kortenbruck, 2010; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). The extent to which that was true in the present study is not knowable.

Second, consistent with prior research on a race/ethnicity achievement gap in reading (e.g., Chatterji, 2006; Kainz & Vernon-Feagans, 2007; Lee, 2002), race/ethnicity in the current study was significantly related to Reading-Comprehension Proficiency growth. Although racial and ethnic differences in the reading achievement gap have been the subject of much discussion and controversy (Jencks & Phillips, 1998; Meece & Kurtz-Costes, 2001), the current study provides evidence that the early differences in Reading-Comprehension Proficiency across race/ethnicity categories were likely to persist over time.

Third, the effect of children's family SES on Reading-Comprehension Proficiency growth over the eight years was substantial. Convergent with much of the research on the relationship between family SES and reading achievement in the general school-aged population (e.g., Aikens & Barbarin; 2008, Chatterji, 2006; Entwisle & Alexander, & Olson, 2005; Fryer & Levitt, 2004; Kaplan & Walpole, 2005; Perie, Grigg, & Donahue, 2005; Snow, Burns, & Griffin, 1998), the findings indicated that children of higher SES made greater gains in reading comprehension relative to those of lower SES over the course of elementary and middle school grades, such that the gap between high- and low-SES children continued to increase. One explanation is that children's family income is closely associated with reading development because those from low SES families often have parents with lower education levels, lack of home/family literacy experiences, and inadequate access to educational resources, leading to negatively reading performance (Cobo-Lewis, Pearson, Eilers, & Umbel, 2002; Goldenberg, 1987; Hus, 2001; McLoyd, 1998).

Finally, consistent with Kieffer's (2008) results, the growth trajectories of Reading-Comprehension Proficiency varied across all Time to Oral English-Language Proficiency subgroups. Extending previous longitudinal study conducted with LM learners throughout the primary grades (e.g., Fitzgerald et al., 2015), the present study found that LM learners who acquired oral English proficiency throughout the kindergarten year and first grade as compared to those who were fully proficient in oral English at kindergarten entry continued a trend of slower growth in reading comprehension across the elementary and middle school years.

Implications

In the current section, implications are discussed for instruction, theory, and research.

Implications for Instruction

The findings of the present study have several important instructional implications. First, children's levels of word-reading skills in the first grade can provide valuable information for screening purposes to predict difficulties in later reading-comprehension development. Language-minority learners who struggle with developing reading comprehension in the upper elementary and middle school years might be identified much earlier on a basis on their first-grade word reading. Accurate assessment to determine pertinent risk factors for later grades can occur in the first grade (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Hurford, Potter, & Hart, 2002; O'Connor & Jenkins, 1999; Torgesen, Burgess, Wagner, & Rashotte, 1996). Although children with reading-comprehension deficits are usually identified based on their performance on comprehension measures, the findings from this study suggest that they might be identified on the basis of their early poor word-reading skills rather than waiting to assess their comprehension (Mancilla-Martinex & Lesaux, 2010). That is, LM learners' low levels of word reading by the end of first grade indicate that educators might be seriously concerned about corresponding reading comprehension outcomes in later grades.

A second practical implication is the emphasis on enhanced instructional opportunities for LM learners that focus on promoting strong word-reading skills in the first grade. In the absence of explicit and systematic instruction, arguably in word-level reading processes, children, in particular, LM learners, may experience substantial difficulties in developing sophisticated levels of reading comprehension in later grades.

Although the current study suggests that both LM learners and NE students who have similar initial word-level reading ability also show comparable reading-comprehension growth patterns, it does not mean that the two groups of children would respond to instruction or intervention to a similar extent (Lesaux & Kieffer, 2010). While children will benefit from early exposure and effective instruction, instruction may need to be modified and individualized rather than a one-size-fits-all approach (Connor, Morrison, & Katch, 2004; Fitzgerald, et al., 2015; Gutiérrez, Zepeda, & Castro, 2010). The current study suggests that for LM learners who had relatively lower word-reading skills in the first grade, their possible persistent exposure to instruction may not have been sufficient to accelerate their reading-comprehension growth. They were the most likely candidates for more intensive, systematic, and sustained reading instruction.

It is important to note that explicit and systematic reading instruction should be differentiated from "skill and drill" and/or skills-based scripted reading instruction in the early grades. In scripted reading instruction, practitioners tend to implement a scripted commercial curriculum without making adjustments for the instructional needs of the children in the classroom (Allington, 2002; Dresser, 2012). Moreover, there is an over-emphasis on decodable text with little or no interaction with authentic materials. For the efficacy of explicit and systematic word-reading instruction, educators should address individual developmental differences and needs by using a variety of instructional materials and authentic tasks (McIntyre, Rightmyer, & Petrosko, 2008). Most importantly, children's word reading instruction should be integrated with a broader comprehension-oriented approach to create a balanced reading instruction (National Reading Panel, 2000).

Ehri's (1998, 2009) theory of sight word learning process for monolingual children provides influential and practical implications on teaching practices that could be applied to LM learners with low word-reading skills. The theory posits that children learn sight words through a connection-forming process between letters in spellings and sounds in pronunciations of the words in memory. The connection process involves knowledge of grapheme–phoneme relations, phonemic awareness, and spelling patterns. Once the connections are enhanced, children can build a sight vocabulary. However, the use of faulty strategies including the use of selective visual cues or a few sound-letter correspondences is often observed among readers. In those cases, practitioners may need to provide experiences for developing an awareness of systematic nature of sounds-letter relationships by analyzing words (Ehri, 1992; Perfetti, 1991). Once attention is adequate and consolidated through ample practices, children can develop knowledge of the form and function of words in text and apply their word knowledge to understanding the text (Gaskins, 1998).

In addition to instruction supporting children's attention to word-level reading, attending to reading-comprehension instruction especially for low-word-reading-performing LM learners is critical. Although research evidence about effective reading instruction for monolingual NE students can hold true for LM learners learning to read in English (Goldenberg, 2011), there are two additional factors to consider in instructional supports for LM learners: comprehension strategies and background knowledge. First, teachers need to provide opportunities for LM learners to engage in explicit comprehension strategy instruction. Children learning to read in second language tend to use fewer metacognitive strategies and more slowly monitor comprehension (Fitzgerald, 1995). Thus, it is important that metacognitive strategies should be discussed, modeled, and effectively implemented for those children through a wide range of activities, which in turn enables them to monitor and assess their on-going performance in understanding what is being read.

Second, for LM learners, it is especially important to provide relevant background knowledge about a topic to be read and discussed in reading instruction. LM learners coming from diverse educational and cultural backgrounds are more likely than their NE peers to have a lack of background knowledge necessary for understanding texts. LM learners' prior educational experiences may also have been substandard or interrupted, resulting in difficulties with reading comprehension. Thus, teachers need to help LM learners activate their existing knowledge of a topic that is prerequisite for understanding the text and identify and fill the gaps to facilitate reading comprehension (Dochy, Segers, & Buehl, 1999).

Implications for Theory

Features of the present result tend to affirm aspects of prior theory. An important theoretical implication is that prior theory could be expanded to include young LM learners. Children who have the ability to read words quickly, accurately, and effortlessly possess greater mental resources that affect an individual's cognitive processes involved in constructing a representation of the meaning from text (e.g., Cain, Oakhill, & Bryant, 2004; Just & Carpenter, 1987; Perfetti, 1985, 1992; LaBerge & Samuels, 1974; Stanovich, 1994). In accordance with this theory, LM learners who had initially low word-reading proficiency may have experienced significant cognitive demands while allocating almost entire processing capacity toward decoding text with relatively little attention to reading comprehension or other higher-order processes. By contrast, those LM learners who had initially high word-reading proficiency may have increasingly reduced the cognitive load associated with lower-level processing skills (e.g., word identification) and utilized remaining cognitive resources for integration of new information with background knowledge and critical evaluation of the information being read. Thus the role of early word-level reading skills is potentially more prominent for LM learners than for NE students to success with second-language reading comprehension development through the elementary and middle school grades.

In a similar vein, the current findings support a theory in which children's reading development is influenced more significantly by early word-reading ability rather than their language status. As compared to monolingual children, LM learners may lack sufficient knowledge of the oral English language due to relatively limited exposure to English at home (Koda, 2007), thus experience greater difficulties with the task of learning to read in a language that they have yet to be proficient. However, given that those LM learners who initially acquire strong word-reading skills demonstrated similar reading comprehension growth to that of their monolingual peers, the role of early word-reading ability is even stronger for LM learners than oral English-language proficiency in reading comprehension development.

Implications for Research

The current study makes unique contributions to growing knowledge of how LM learners' early word-reading ability can contribute to reading comprehension growth as compared to their monolingual NE peers. The study findings raise questions that warrant further investigation to advance knowledge in area of LM learners' reading comprehension development. First, although the findings add to the literature on the relationship between word reading and reading comprehension providing more detailed information than previously available research, further research that explores the impact of LM learners' other early reading sub-skills such as vocabulary and morphological and syntactic skills in comparison to those for NE students would provide a fuller picture of potential complexities involved in reading comprehension development.

Second, another important direction would be to include LM learners' native-language oral and reading measures to take into account how first- and second-language factors play different roles across time points, allowing for a more nuanced understanding of their English-reading comprehension development. Several authors of empirical longitudinal studies on cross-linguistic influence argued that dual-language children's initial first-language word-level skills contributed to later second-language reading comprehension (e.g., Jared, Cormier, Levy, & Wade-Woolley, 2011; Nakamoto, Lindsey, & Manis, 2007; Gottardo & Mueller, 2009).

Third, for LM learners, through intervention studies, researchers could investigate the effect of added instructional emphasis on early word-reading ability that may influence reading comprehension outcomes. Variability and effectiveness in the amount, types, and quality of instruction and strategies (e.g., Connor, Morrison, & Petrella, 2004) for monolinguals have been well documented and may apply equally to LM learners.

Fourth, future studies could account for school-level control variables in order to portray a holistic representation of LM learners. School-level characteristics such as school resources, poverty level, school minority representations can have a significant impact on students' academic achievement and learning patterns (Entwistle & Alexander, 1989, 1993).

Finally, more future reading research attention is needed with LM learners at the secondary level, and longitudinal studies extending into high school and even college are needed. With most literacy research emphasis placed on LM learners in the elementary level, there is a relative paucity of research information pertaining to the middle- and high-school LM learners.

Table 3.1. *Number (Percentage) of Children Who Met and Did Not Meet Each Inclusion Criterion by Language-Status Groups*

Criterion	Language-minority learners		Native-English-speaking students	
	Children meeting inclusion criteria *n* (%[a])	Children eliminated *n*	Children meeting inclusion criteria *n* (%[a])	Children eliminated *n*
1. Non-missing home-language data	2,927	-	17,472	-
2. Non-missing data on Word-Reading Proficiency	1,831 (62.56)	1,096	12,982 (74.30)	3,464
3. Valid data on Reading-Comprehension Proficiency at one or more occasions	1,620 (55.35)	211	10,858 (62.15)	1,751
4. Low or High Word-Reading Proficiency	992 (33.89)	628	7,188 (41.14)	756

Note. [a]A percentage of children meeting the inclusion criterion in the initial sample size of 2,927 for LM learners and 17,472 for native-English-speaking students

Table 3.2. *Percentage Distribution of ECLS-K Full Sample, Full Final Analytic Sample, and Language-Status Sub-Samples (Language-Minority Learners and Native-English-Speaking Students) by Child Characteristics in the Spring of First Grade*

			Language status	
Characteristics	ECLS-K full sample (*N*=21,409; %)	Full analytic sample (*N*=8,180; %)	Language-minority learner (*n*=992; %)	Native-English-speaking student (*n*=7,188; %)
Age in months	87.03	87.00	86.10	87.11
Gender				
Female	51.74	46.46	50.60	49.30
Male	48.26	50.54	49.40	50.70
Race/ethnicity				
White, non-Hispanic	57.29	61.54	10.70	67.59
Black, non-Hispanic	16.21	14.17	1.18	15.72
Hispanic	18.87	16.63	68.71	10.43
Asian/Pacific Islander/Other	5.22	7.66	19.41	6.26
SES				
1st Quintile	19.44	14.92	39.80	12.11
2nd Quintile	20.24	17.92	23.74	17.26
3rd Quintile	20.23	19.96	14.76	20.55
4th Quintile	20.15	21.11	10.19	22.35
5th Quintile	19.93	26.09	11.51	27.74
Time to oral English-language proficiency				
PreLAS assessment not needed	86.87	89.36	28.39	96.64
Passed *PreLAS* in fall of K	4.83	5.32	29.85	2.40
Passed *PreLAS* in spring of K	3.00	2.52	19.23	0.53
Passed *PreLAS* in fall of G1	0.52	0.33	2.61	0.06
Passed *PreLAS* in spring of G1	4.77	2.46	19.93	0.38

Note. Estimates were weighted by child-level sampling weights to compensate for unequal probability of selection in the sample design. *PreLAS*= *Pre-Language Assessment Scales* (Oral English-language proficiency assessment), K = Kindergarten, G1 = First grade; SES = Socioeconomic status

Table 3.3. *English-Reading Proficiency Levels and Descriptions*

Proficiency level	Description
0	Students did not achieve Level 1
1	Students scoring at Level 1 can identify upper- and lower-case letters by name
2	Students scoring at Level 2 can associate letters with sounds at the beginning of words
3	Students scoring at Level 3 can associate letters with sounds at the end of words
4	Students scoring at Level 4 can recognize common words by sight.
5	Students scoring at Level 5 can read words in context
6	Students scoring at Level 6 can make inferences using cues that are directly stated with key words in text (for example, recognizing the comparison being made in a simile)
7	Students scoring at Level 7 can identify clues used to make inferences, and use background knowledge combined with cues in a sentence to understand use of homonyms.
8	Students scoring at Level 8 can demonstrate understanding of author's craft (how does the author let you know…), and make connections between a problem in the narrative and similar life problems.
9	Students scoring at Level 9 can critically evaluate, compare and contrast, and understand the effect of features of expository and biographical texts.
10	Students scoring at Level 10 can evaluate complex syntax and understand high-level nuanced vocabulary in biographical text.

Note. Table adapted from *Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K) Psychometric Report for the Eighth Grade* by M. Najarian, J. Pollack, A. G. Sorongon, and E. G. Hausken, 2009 by U.S. Department of Education. (Also, the ECLS-K psychometricians included a theta score for overall reading ability—not used in the present study.).

Table 3.4. *Parent Interview Questions on Indicators of Socioeconomic Status (SES) and Response Options: Spring-First grade (Spring 2000)*

Indicator	Question	Response option
Income	(PAQ.100) In studies like this, households are sometimes grouped according to income. What was the total income of all persons in your household over the past year, including salaries or other earnings, interest, retirement, and so on for all household members?	Range Don't Know Refused
Education	(PEQ.020) Now I have a few questions about education and job training. What {is/was} the highest grade or year of school that {you/{NAME}/{CHILD}'s {biological/adoptive} {mother/father}} {have/has/had} completed?	Never went to school 1st grade 2nd grade 3rd grade 4th grade 5th grade 6th grade 7th grade 8th grade 9th grade 10th grade 11th grade 12th grade but no diploma High school Diploma/equivalent or Voc/tech program after high school but no Voc/tech diploma Voc/tech program after high school Some college but no degree Associate's degree Bachelor's degree Graduate or professional school but no degree Master's degree (MA, MS) Doctorate degree (Ph.D., Ed.D. Professional degree after bachelor's degree (Medicine/MD; Dentistry/DDS; LAW/JD/LLB; etc.) Refused Don't know

Table 3.4, continued

Occupational prestige	(EMQ. 120) For whom {do/does/did} {you/{NAME}} work {when {you/{he/she}} last worked}?	Enter Employer Name Refused Don't Know
	(EMQ. 130) What kind of business or industry {is/was} this?	Enter Industry Description Refused Don't Know
	(EMQ. 140) What kind of work {are/is/were/was} {you/{NAME}} doing?	Enter Job Title Refused Don't Know
	(EMQ. 150) What {are/is/were/was} {your/{NAME}'s} most important activities or duties on this job? What {do/does/did} {you/{NAME}} actually do at this job?	Enter Job Duties Refused Don't Know

Note. Voc = vocational

Table 3.5. *Present Study Variables, Level in the HGLM Analysis, Definitions, Coding Scheme, Measurement Scale, and Corresponding ECLS-K Variables*

Present Study Variable	Level[a]	Operational Definition	Coding Scheme	Measurement	ECLS-K Variables Names
Child ID	Individual	Student identifier	Integer	Ordinal	CHILDID
Age (Time)	Within-individual	A variable representing individual student's actual age in months on the day assessment was administered and centered on the average child's age at the testing date in the spring of first grade.	Integer		R4AGE R5AGE R6AGE R7AGE
Reading-Comprehension Proficiency	Individual	A dichotomous dependent variable referring to whether students reached Reading-Comprehension Proficiency (Proficiency Level 8)	0 = Not achieved Proficiency Level 8 1 = Achieved Proficiency Level 8	Nominal	C4R4RPF C5R4RPF C6R4RPF C7R4RPF
Word-Reading Proficiency	Individual	A dichotomous predictor variable representing whether students had a low or high Word-Reading Proficiency	0 = Low Word-Reading Proficiency 1 = High Word-Reading Proficiency	Nominal	C4R4RPF
Language Status	Individual	A dichotomous predictor variable representing whether a student was a language-minority learner or native-English-speaking student	0 = Native-English-speaking student 1 = Language-minority learner	Nominal	P1ANYLNG P1PRMLNG
Language Status by Word-Reading Proficiency	Individual	Interaction term between Language Status and Word-Reading Proficiency variables	Integer	Scale	

Table 3.5, continued

Female	Individual	A demographic control variable representing student's gender	0 = Male 1 = Female	Nominal	GENDER
Black	Individual	A demographic control variable representing whether or not a student is an African-American	0 = Non-Black 1 = Black	Nominal	RACE
Hispanic	Individual	A demographic control variable representing whether or not a student is a Hispanic	0 = Non-Hispanic 1 = Hispanic	Nominal	RACE
Asian	Individual	A demographic control variable representing whether or not a student is an Asian, Pacific Island, and Other	0 = Non- Asian, Pacific Island, and Other 1 = Asian, Pacific Island, and Other	Nominal	RACE
SES	Individual	A demographic control variable representing student's household SES	-2.96 to 2.88	Scale	W1SESL
Time to Oral English-Language Proficiency	Individual	A control variable representing time that students passed a cut-score of oral English proficiency on *PreLAS assessment*	0 = *PreLAS* assessment not needed 1 = Passed *PreLAS* in fall of K 2 = Passed *PreLAS* in spring of K 3 = Passed *PreLAS* in fall of G1 4 = Passed *PreLAS* in spring of G1	Nominal	CPSOLDS

Note. SES = Socioeconomic status; *PreLAS*= *Pre-Language Assessment Scales* (Oral English-language proficiency assessment), K = Kindergarten, G1 = First grade.
[a]Within-individual = Level 1, Individual = Level 2.

Table 3.6. *Number (Percentage) of Students in Two Groups According to Word-Reading Proficiency by Full Sample and Subsamples*

		Subsamples	
Word-Reading Proficiency	Full Sample *N* (%)	Language-minority Learners *n* (%)	Native-English-speaking Students *n* (%)
Low Word-Reading Proficiency[a]	2,311 (28.25)	435 (43.85)	1,876 (26.10)
High Word-Reading Proficiency[b]	5,869 (71.72)	557 (56.15)	5,312 (73.90)
Total	8,180 (100.00)	992 (100.00)	7,188 (100.00)

Note.
[a]Children passed reading Proficiency Level 1, 2, or 3, but did not yet pass Level 4 (i.e., ability to recognize common words by sight) or above. [b]Children passed reading Proficiency Level 5 (i.e., ability to read words in context), or above.

Table 3.7. *Taxonomy of the Four Multilevel Logistic Models for Change*

Model	Level-1/Level-2 Sub-model Specification	
	Level-1 model	Level-2 model
A	$\eta_{ti} = \beta_{0i}$	$\beta_{0i} = \gamma_{00} + \zeta_{0i}$
B	$\eta_{ti} = \beta_{0i} + \beta_{1i}\,TIME_{ti}$	$\beta_{0i} = \gamma_{00} + \zeta_{0i}$ $\beta_{1i} = \gamma_{10}$
C	$\eta_{ti} = \beta_{0i} + \beta_{1i}\,TIME_{ti} + \beta_{2i}\,TIME^2_{ti}$	$\beta_{0i} = \gamma_{00} + \zeta_{0i}$ $\beta_{1i} = \gamma_{10}$ $\beta_{2i} = \gamma_{20}$
D	$\eta_{ti} = \beta_{0i} + \beta_{1i}\,TIME_{ti} + \beta_{2i}\,TIME^2_{ti}$	$\beta_{0i} = \gamma_{00} + \gamma_{01}FEMALE_{ti} + \gamma_{02}BLACK_{ti} + \gamma_{03}HISPANIC_{ti} + \gamma_{04}ASIAN_{ti} + \gamma_{05}SES_{ti} +$ $\gamma_{06}ORAL_{ti} + \gamma_{07}ORALFK_{ti} + \gamma_{08}ORALSK_{ti} + \gamma_{09}ORALFG1_{ti} + \gamma_{010}ORALSG1_{ti} +$ $\gamma_{11}LANGSTATUS_{ti} + \gamma_{12}WORDPROF_{ti} + \gamma_{13}LANG{*}WORD_{ti} + \zeta_{0i}$ $\beta_{1i} = \gamma_{10} + \gamma_{11}FEMALE_{ti} + \gamma_{12}BLACK_{ti} + \gamma_{13}HISPANIC_{ti} + \gamma_{14}ASIAN_{ti} + \gamma_{15}SES_{ti} +$ $\gamma_{16}ORAL_{ti} + \gamma_{17}ORALFK_{ti} + \gamma_{18}ORALSK_{ti} + \gamma_{19}ORALFG1_{ti} + \gamma_{110}ORALSG1_{ti} +$ $\gamma_{111}LANGSTATUS_{ti} + \gamma_{112}WORDPROF_{ti} + \gamma_{113}\,LANG{*}WORD_{ti}$ $\beta_{2i} = \gamma_{20} + \gamma_{21}FEMALE_{ti} + \gamma_{22}BLACK_{ti} + \gamma_{23}HISPANIC_{ti} + \gamma_{24}ASIAN_{ti} + \gamma_{25}SES_{ti} +$ $\gamma_{26}ORAL_{ti} + \gamma_{27}ORALFK_{ti} + \gamma_{28}ORALSK_{ti} + \gamma_{29}ORALFG1_{ti} + \gamma_{210}ORALSG2_{ti} +$ $\gamma_{211}LANGSTATUS_{ti} + \gamma_{212}WORDPROF_{ti} + \gamma_{213}LANG{*}WORD_{ti}$

Note. Control variables are *FEMALE, BLACK, HISPANIC, ASIAN, SES, ORAL, ORALFK, ORALSK, ORALFG1*, and *ORALSG1*. *SES* = Socioeconomic Status, *ORAL* = *PreLAS* (*Pre-Language Assessment Scales* [Oral English-language proficiency assessment]) was not needed, *ORALFK* = Passed *PreLAS* in the fall of Kindergarten, *ORALSK* = Passed *PreLAS* in the spring of Kindergarten, *ORALFG1* = Passed *PreLAS* in the fall of Grade 1, *ORALSG1* = Passed *PreLAS* in the spring of Grade 1, *LANGSTATUS* = Language Status, *WORDPROF* = Word-Reading Proficiency, and *LANG*WORD* = The interaction term between *LANGSTATUS* and *WORDPROF.*

Table 4.1. *Proportions (Standard Deviations) of Achieving Reading-Comprehension Proficiency in the First, Third, Fifth, and Eighth Grades by Full Sample, Language-Status Subsamples, and Word-Reading Proficiency Groups*

	Full sample (N = 8,180)			Subsamples by Language Status					
				Language-minority learners (*n* = 992)			Native-English-speaking speakers (*n* = 7,188)		
Grade	Low Word-Reading Proficiency (*n* = 2,311)	High Word-Reading Proficiency (*n* = 5,869)	Marginal Mean	Low Word-Reading Proficiency (LM-Low; *n* = 435)	High Word-Reading Proficiency (LM-High; *n* = 557)	Marginal Mean	Low Word-Reading Proficiency (NE-Low; *n* = 1,876)	High Word-Reading Proficiency (NE-High; *n* = 5,312)	Marginal Mean
G1	0.00 (0.00)	0.02 (0.13)	0.01 (0.11)	0.00 (0.00)	0.01 (0.10)	0.00 (0.07)	0.00 (0.00)	0.02 (0.13)	0.01 (0.11)
G3	0.05 (0.21)	0.38 (0.49)	0.28 (0.45)	0.03 (0.16)	0.27 (0.44)	0.15 (0.35)	0.05 (0.22)	0.39 (0.49)	0.29 (0.45)
G5	0.18 (0.38)	0.56 (0.50)	0.44 (0.50)	0.13 (0.34)	0.40 (0.49)	0.26 (0.44)	0.19 (0.39)	0.57 (0.49)	0.46 (0.50)
G 8	0.37 (0.48)	0.81 (0.39)	0.68 (0.47)	0.36 (0.49)	0.81 (0.39)	0.61 (0.49)	0.41 (0.48)	0.81 (0.39)	0.68 (0.47)

Note. Estimates were weighted by child-level sampling weights to compensate for unequal probability of selection in the sample design. Proportion is equivalent to the mean of a variable with the value of 0 and 1 and can therefore be interpreted as a probability.

Table 4.2. *Number (Percentage) of Students in Two Groups According to Time to Oral English-Language Proficiency by Full Sample and Subsamples*

Time to Oral English-Language Proficiency	Full Sample *N* (%)	Subsamples: Low Word-Reading Proficiency *n* (%)	Subsamples: High Word-Reading Proficiency *n* (%)
PreLAS not needed	7,186 (87.85)	1,879 (81.31)	5,307 (90.42)
Passed *PreLAS* in fall of K	519 (6.34)	153 (6.62)	366 (6.24)
Passed *PreLAS* in spring of K	259 (3.17)	130 (5.63)	129 (2.20)
Passed *PreLAS* in fall of G1	29 (0.35)	19 (0.82)	10 (0.17)
Passed *PreLAS* in spring of G1	187 (2.29)	130 (5.62)	57 (0.97)
Total	8,180 (100.00)	2,311 (100.00)	5,869 (100.00)

Note.
[a]*PreLAS*= Pre-Language Assessment Scales (Oral English-language proficiency assessment), K = Kindergarten, G=Grade.

Table 4.3. *Correlation Coefficients among Predictor and Outcome Variable at Each Time Point*

Variable	1	2	3	4
1. Word-Reading Proficiency (G1)	-			
2. Reading-Comprehension Proficiency (G1)	0.07 ***	-		
3. Reading-Comprehension Proficiency (G3)	0.32 ***	0.10 ***	-	
4. Reading-Comprehension Proficiency (G5)	0.32 ***	0.10 ***	0.36 ***	-
5. Reading-Comprehension Proficiency (G8)	0.39 ***	0.05 ***	0.28 ***	0.30 ***

Note. G=Grade. The correlation coefficients are phi-coefficients.
†*p* = .10, **p* < .05, ***p* < .01, ****p* < .001 (two-tailed tests)

Table 4.4. *Correlation Coefficients, Tolerance, and Variance Inflation Factor (VIF) Values for Predictor and Control Variables*[a]

Variable	1	2	3	4	5	6	7	8	9	10	11	12	Tolerance	VIF
1. Female	-												0.98	1.02
2. White	0.01	-											Ref.	Ref.
3. Black	-0.001	-0.46 ***	-										0.87	1.15
4. Hispanic	-0.01	-0.52 ***	-0.15 ***	-									0.67	1.50
5. Asian	0.003	-0.47 ***	-0.14 ***	-0.16 ***	-								0.81	1.24
6. SES	*0.01*	*0.31* ***	*-0.23* ***	*-0.22* ***	*-0.00*	-							0.78	1.29
7. *PreLAS* not needed	0.003	0.41 ***	0.12 ***	-0.44 ***	-0.24 ***	*0.19* ***	-						Ref.	Ref.
8. Passed *PreLAS* in fall of K	0.01	-0.26 ***	-0.08 ***	0.26 ***	0.19 ***	*-0.04* ***	-0.70 ***	-					0.68	1.47
9. Passed *PreLAS* in spring of K	-0.002	-0.21 ***	-0.06 ***	0.24 ***	0.11 ***	*-0.14* ***	-0.48 ***	-0.05 ***	-				0.69	1.45
10. Passed *PreLAS* in fall of G1	-0.02	-0.07 ***	-0.02 *	0.10 ***	0.02	*-0.06* ***	-0.16 ***	-0.02	-0.01	-			0.93	1.06
11. Passed *PreLAS* in spring of G1	-0.01	-0.18 ***	-0.06 ***	0.22 ***	0.09 ***	*-0.16* ***	-0.41 ***	-0.04 ***	-0.03 *	-0.01	-		0.73	1.37
12. Language Status[b]	-0.01	-0.40 ***	-0.12 ***	0.39 ***	0.29 ***	*-0.19* ***	-0.70 ***	0.40 ***	0.39 ***	0.14 ***	0.37 ***	-	0.46	2.17
13. Word-Reading Proficiency[c]	0.13 ***	0.21 ***	-0.15 ***	-0.14 ***	-0.01	*0.36* ***	0.13 ***	-0.01	-0.09 ***	-0.05 ***	-0.14 ***	-0.13 ***	0.84	1.19

Note. SES = Socioeconomic Status, *PreLAS*= *Pre-Language Assessment Scales* (Oral English-language proficiency assessment), K = Kindergarten, G=Grade.
[a]The correlation coefficients are phi-coefficients. Point-biserial correlation coefficients between a dichotomous variable and a continuous variable (i.e., SES) are shown in italics.
[b]The reference category is Language-Minority learners.
[c]The reference category is High Word-Reading Proficiency.
†p = .10, *p < .05, **p < .01, ***p < .001 (two-tailed tests)

Table 4.5. *Results of Fitting a Taxonomy of Hierarchical Generalized Linear Models (HGLM)*

		Model A: Unconditional means model		Model B: Unconditional linear growth model		Model C: Unconditional quadratic growth model		Model D: Final model	
		β (SE)	*OR*	*β (SE)*	*OR*	*β (SE)*	*OR*	*β (SE)*	*OR*
Fixed effects									
Initial status									
Intercept	γ_{00}	-0.590*** (0.001)	0.554	-3.334*** (0.003)	0.036	-4.767*** (0.005)	0.009	-6.182*** (0.016)	0.002
Gender									
Female	γ_{01}							-0.224*** (0.008)	0.799
Race									
White, non-Hispanic	γ_{02}							Ref.	Ref.
Black, non-Hispanic	γ_{03}							-1.222*** (0.016)	0.295
Hispanic	γ_{04}							-1.038*** (0.016)	0.354
Asian/Pacific Islander/ and Other	γ_{05}							-0.306*** (0.015)	0.011
SES	γ_{06}							0.422*** (0.005)	1.525
Time to Oral English-Language Proficiency									
PreLAS assessment not needed	γ_{07}							Ref.	Ref.
Passed *PreLAS* in fall of K	γ_{08}							-0.200*** (0.023)	0.819
Passed *PreLAS* in spring of K	γ_{08}							-0.208*** (0.038)	0.812
Passed *PreLAS* in fall of G1	γ_{010}							-42.931*** (1.725)	2.27e-19
Passed *PreLAS* in spring of G1	γ_{011}							0.200*** (0.053)	1.221
Language Status									
Language-minority learners	γ_{012}							0.734*** (0.022)	2.084
Word-Reading Proficiency									
	γ_{013}							2.581*** (0.016)	13.216

Table 4.5, continued

Language status × Word-Reading Proficiency	γ_{014}					-0.615*** (0.051)	0.541
Instantaneous rate growth rate							
Intercept	γ_{10}	0.058*** (.000)	1.060	0.141*** (0.000)	1.152	0.150*** (0.001)	1.161
Gender							
Female	γ_{11}					0.023*** (0.000)	1.024
Race							
White, non-Hispanic	γ_{12}					Ref.	Ref.
Black, non-Hispanic	γ_{13}					0.004*** (0.001)	1.004
Hispanic	γ_{14}					0.020*** (0.001)	1.020
Asian/Pacific Islander/Other	γ_{15}					-0.003*** (0.001)	0.997
SES	γ_{16}					0.011*** (0.000)	1.011
Time to Oral English-Language Proficiency							
PreLAS assessment not needed	γ_{17}					Ref.	Ref.
Passed *PreLAS* in fall of K	γ_{18}					0.014*** (0.001)	1.014
Passed *PreLAS* in spring of K	γ_{19}					-0.002 (0.002)	0.998
Passed *PreLAS* in fall of G1	110					1.414*** (0.056)	4.114
Passed *PreLAS* in spring of G1	γ_{111}					-0.007*** (0.002)	0.993
Language Status							
Language-minority learners	γ_{112}					-0.052*** (0.002)	0.949
Word-Reading Proficiency							
High Word-Reading Proficiency	γ_{113}					0.028*** (0.001)	1.073
Language status × Word-Reading Proficiency	γ_{114}					0.008*** (0.002)	1.008
Acceleration/deceleration rate							
Intercept	γ_{20}			-0.001*** (1.58e-06)	0.999	-0.001*** (5.39e-06)	0.999

Table 4.5, continued

Gender									
Female	γ_{21}							-0.0002*** (3.11e-06)	0.999
Race									
White, non-Hispanic	γ_{22}							Ref.	Ref.
Black, non-Hispanic	γ_{23}							4.59e-06 (5.71e-06)	1.000
Hispanic	γ_{24}							-0.000*** (5.97e-06)	1.000
Asian/Pacific Islander/Other	γ_{25}							0.000*** (6.16e-06)	1.000
SES	γ_{26}							-0.000*** (2.07e-06)	1.011
Time to Oral English-Language Proficiency									
PreLAS assessment not needed	γ_{27}							Ref.	Ref.
Passed *PreLAS* in fall of K	γ_{28}							-0.000*** (9.13e-06)	1.000
Passed *PreLAS* in spring of K	γ_{29}							0.000 (0.000)	1.000
Passed *PreLAS* in fall of G1	γ_{210}							-0.011*** (0.000)	0.989
Passed *PreLAS* in spring of G1	γ_{211}							0.000*** (0.000)	1.000
Language status									
Language-minority learners	γ_{212}							0.001*** (0.000)	1.001
Word-Reading Proficiency									
High Word-Reading Proficiency	γ_{213}							0.0002*** (5.52e-06)	1.0001
Language status × Word-Reading Proficiency	γ_{214}							-0.0001*** (0.000)	0.999
Variance component		*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Within-child		-1.330***	0.006	0.994***	0.003	1.124***	0.003	0.285***	0.004
Goodness of fit									
Deviance (-2LL)		11,722,700.2		8,561,193.6		8,212,451.6		7,030,645.8	
AIC		1.17e+07		8,561,200		8,212,460		7,030,726	

Table 4.5, continued

BIC	1.17e+07	8,561,223	8,212,491	7,031,041

Note. The continuous control variable (i.e., SES) was centered at the grand means. OR = odds ratio, Ref. = Reference category, SES = Socioeconomic status, *PreLAS* = *Pre-Language Assessment Scales* (Oral English-language proficiency assessment), K= Kindergarten, G1 = Grade 1, -2LL=-2×(Log Likelihood), AIC = Akaike information criterion, BIC = Bayesian information criterion

† $p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed tests).

Figure 3.1. *Levels and Items Administered for Associated Grades*

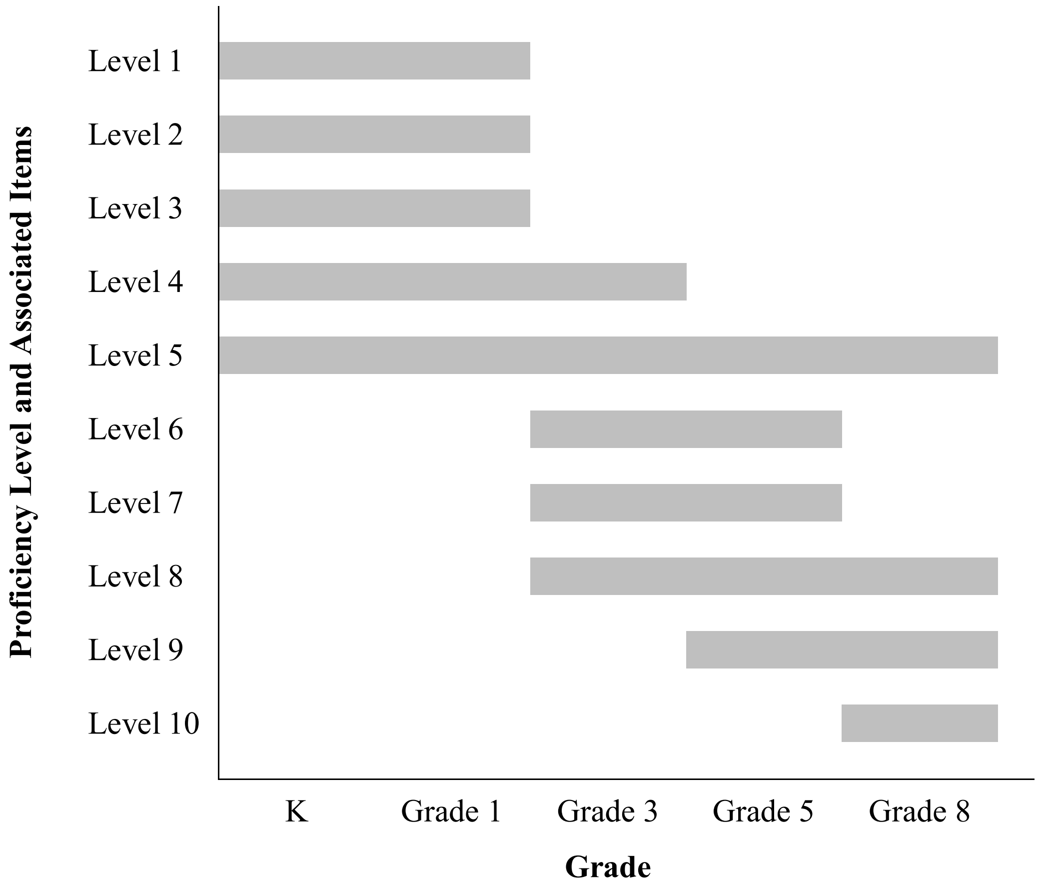


Figure 4.1. *Observed Proportions of Achieving Reading-Comprehension Proficiency for Language-Minority Learners and Native-English-speaking Students in First, Third, Fifth, and Eighth Grades*

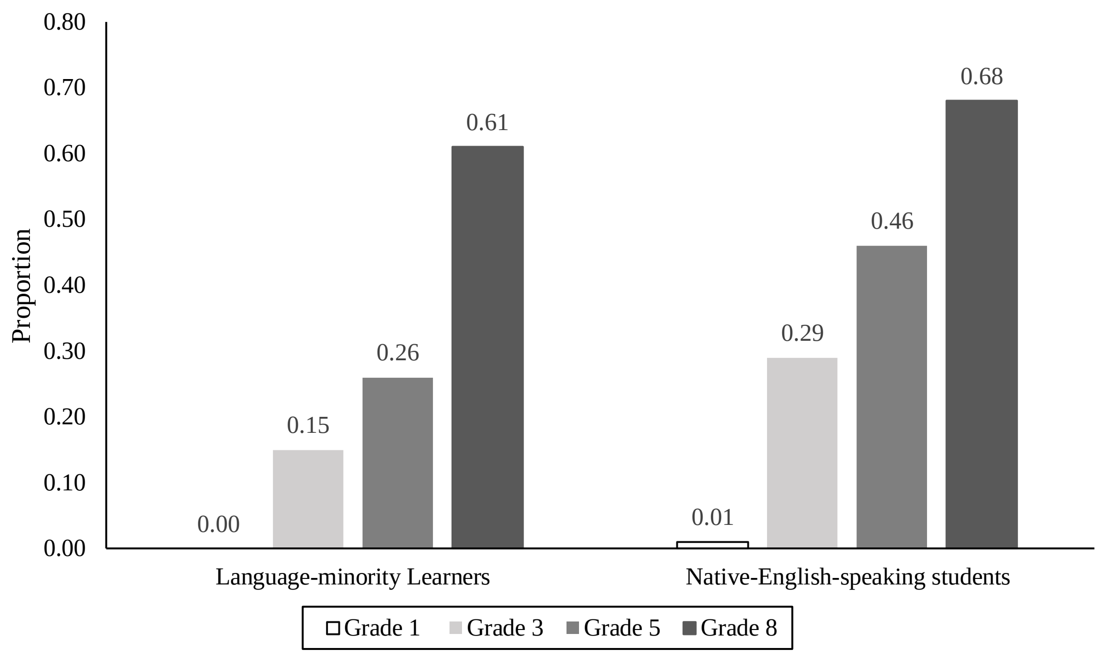
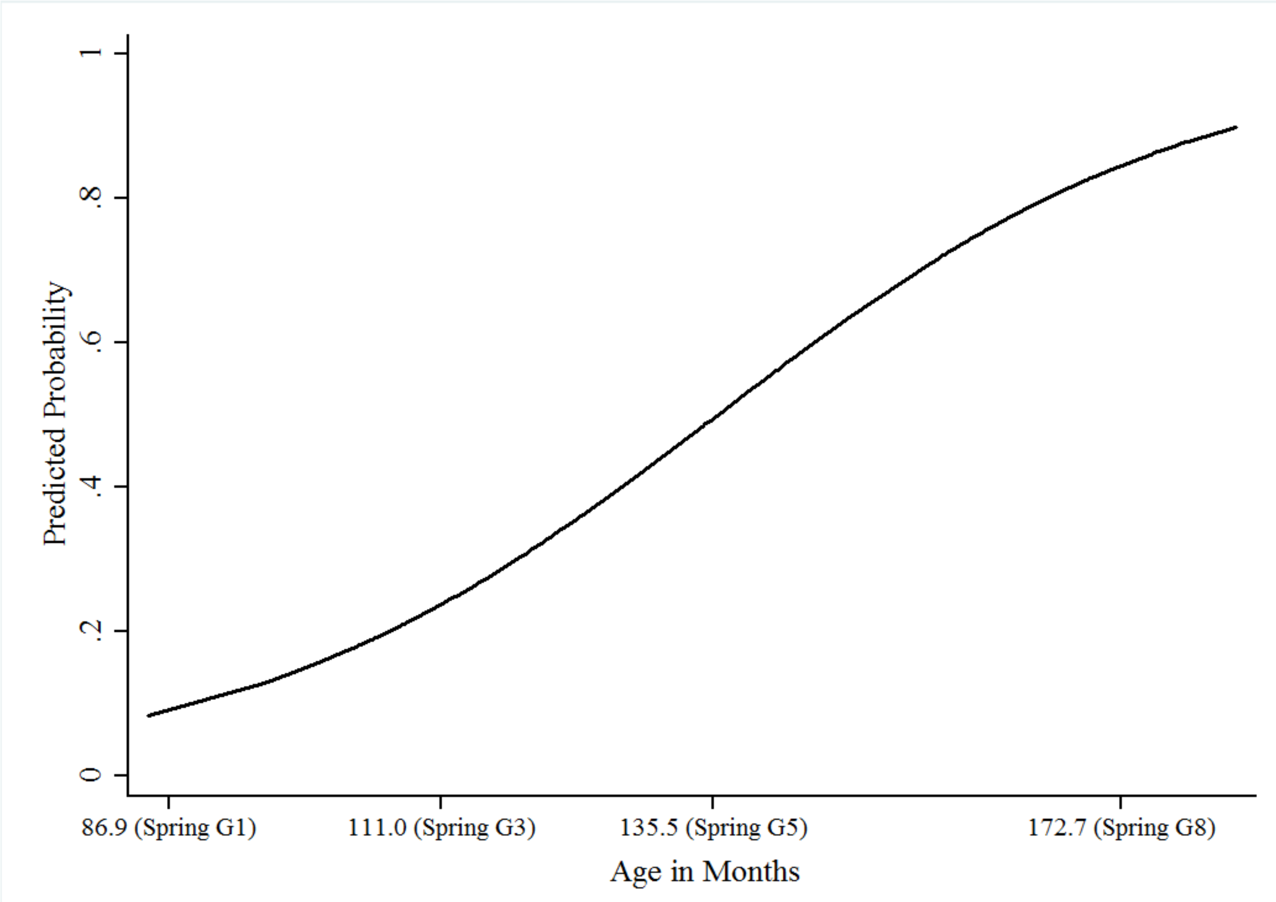
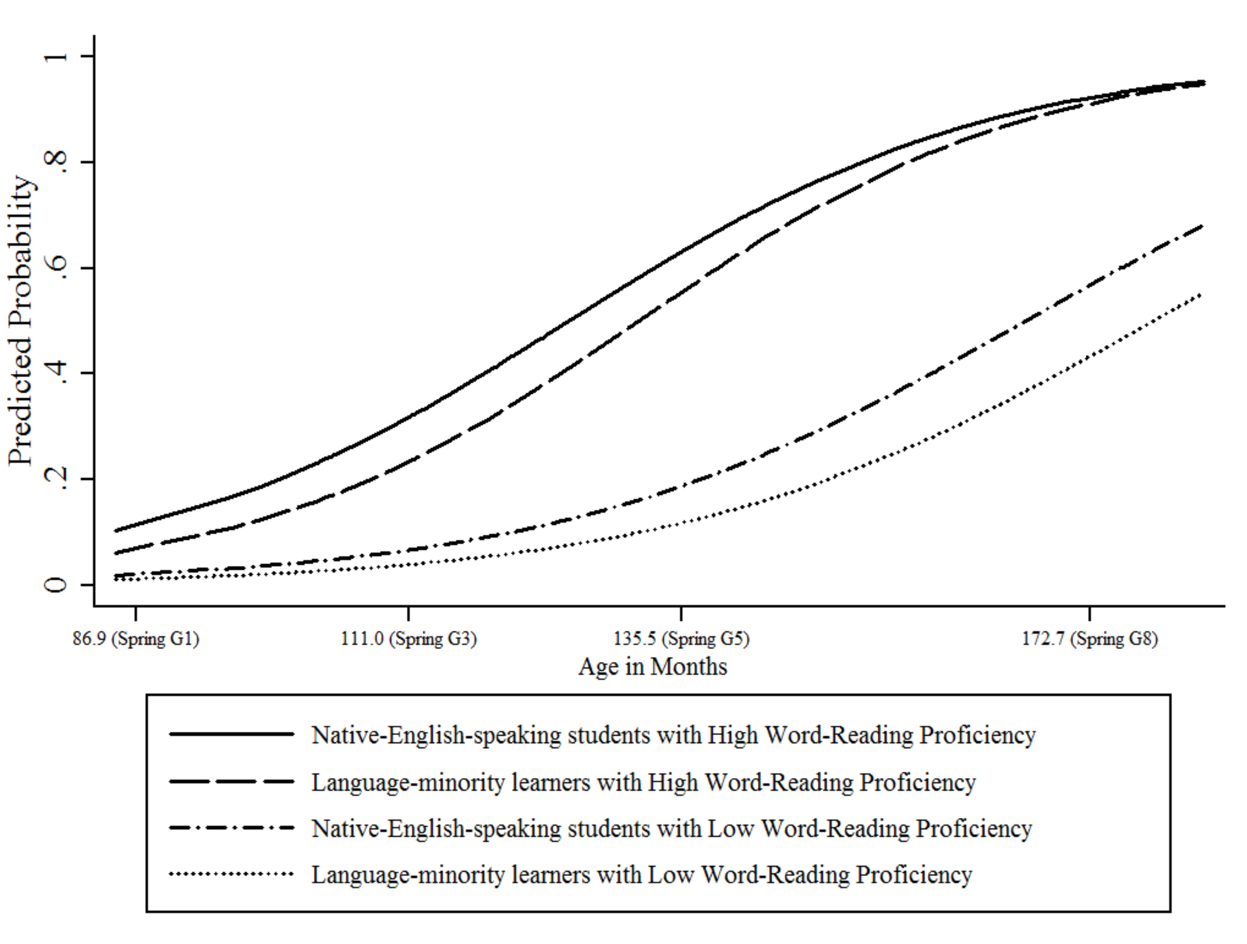


Figure 4.2. *Predicted Growth in the Probabilities of Achieving Reading-Comprehension Proficiency Over Time (N = 8,180).*



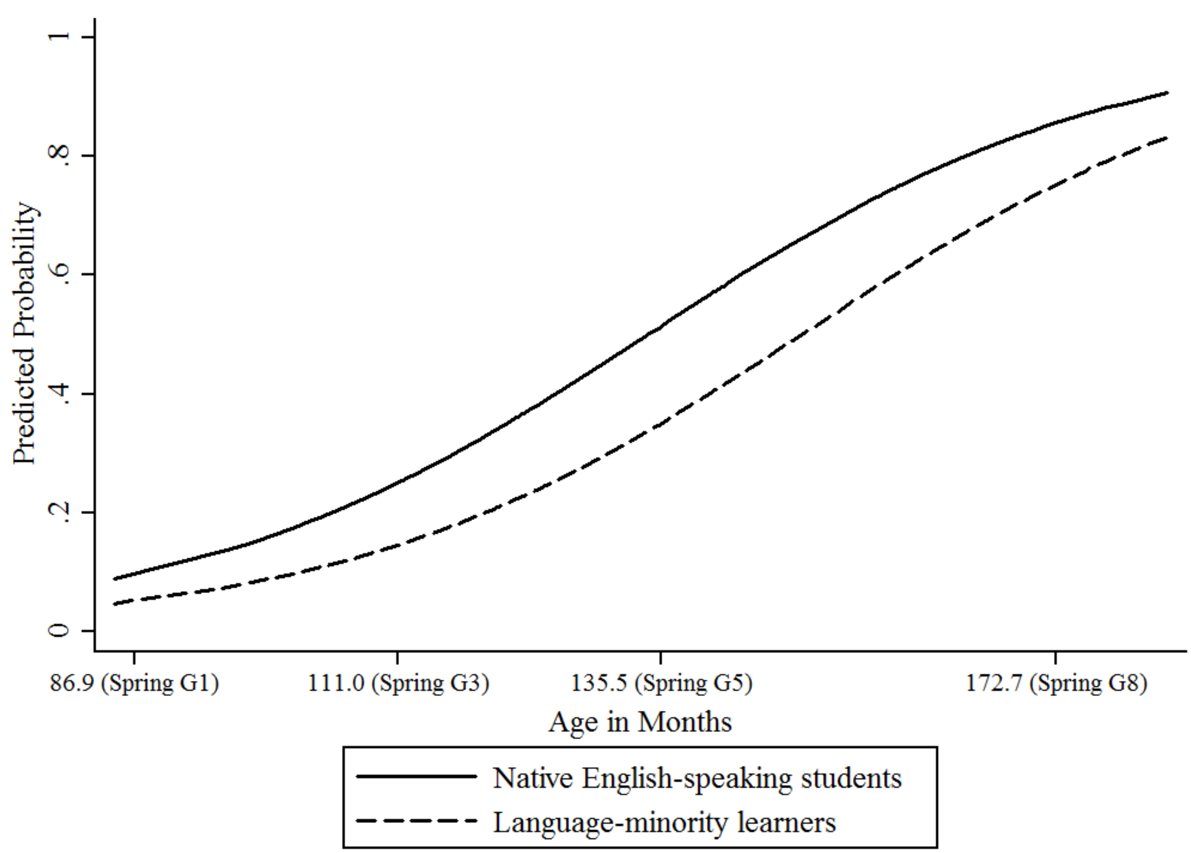
Note. G1 = first grade, G3 = third grade, G5 = fifth grade, and G8 = eighth grade

Figure 4.3. *Effects of Language Status and Word-Reading Proficiency on Expected Growth in the Probabilities of Achieving Reading-Comprehension Proficiency (N = 8,180).*



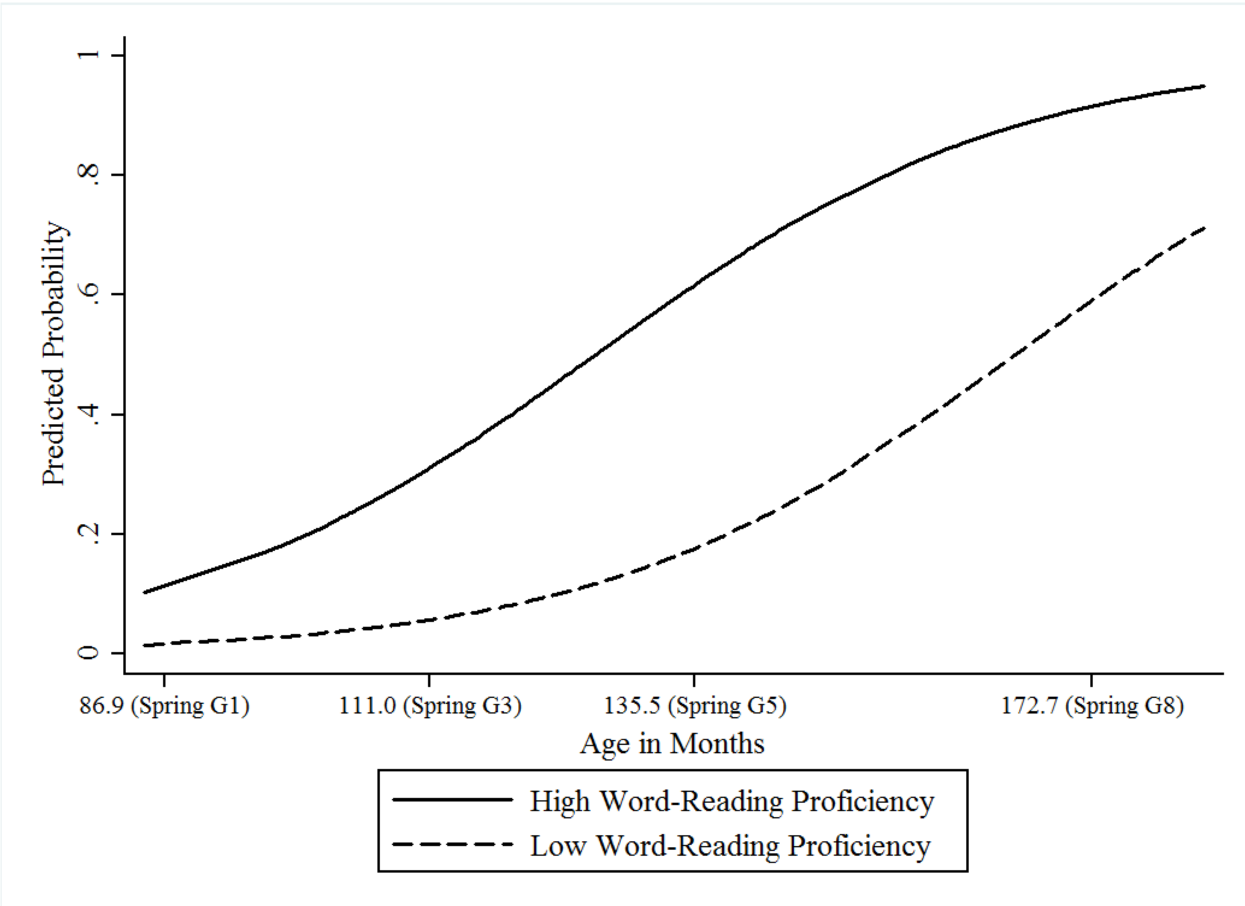
Note. G1 = first grade, G3 = third grade, G5 = fifth grade, and G8 = eighth grade.

Figure 4.4. *Predicted Growth in the Probabilities of Achieving Reading-Comprehension Proficiency for Language-Minority Learners and Native-English-peaking Students (N = 8,180).*



Note. G1 = first grade, G3 = third grade, G5 = fifth grade, and G8 = eighth grade.

Figure 4.5. *Predicted Growth in the Probabilities of Achieving Reading-Comprehension Proficiency for Children with High Word-Reading Proficiency and Children with Low Word-Reading Proficiency.*



Note. G1 = first grade, G3 = third grade, G5 = fifth grade, and G8 = eighth grade.

REFERENCES

Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in Grades 1 to 7. *Journal of Educational Psychology, 102*, 281–298. doi:10.1037/a0019318

Abedi, J. (2006). The No Child Left Behind Act and English language learners: Assessment and accountability issues. *Educational Researcher, 33*(1), 4-14.

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Aikens, N. L., & Barbarin, O. (2008). Socioeconomic differences in reading trajectories: The contribution of family, neighborhood, and school contexts. *Journal of Educational Psychology, 100*(2), 235−251.

Akaike, H. (1973). Information theory and an extension of the maximum likelihood principle. In B. N. Petrov & F. Csaki (eds.), *Second International Symposium on Information Theory* (pp. 267-281). Budapest: Akademiai Kiado.

Al Otaiba, S., Petscher, Y., Pappamihiel, N. E., Williams, R. S., Dyrlund, A. K., & Connor, C. (2009). Modeling oral reading fluency development in Latino students: A longitudinal study across second and third grade. *Journal of Educational Psychology, 101*(2), 315-329.

Alexander, K. L., Entwisle, D. R., & Horsey, C. (1997). From first grade forward: Early foundations of high school dropout. *Sociology of Education, 70*, 87-107.

Allington, R. L. (2002). What I've learned about effective reading instruction. *Phi Delta Kappan*, 740-747.

Allison, P. D. (2002). *Missing data*. Thousand Oaks, CA: Sage.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (Ed.), *Comprehension and teaching: Research reviews* (pp. 77-117). Newark, DE: International Reading Association.

Anderson, R. C., Shirey, L. L., Wilson, P. T., & Fielding, L. G. (1987). Interestingness of children's reading material. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, learning, and instruction: Conative and affective process analyses* (Vol. 3, pp. 287-299). Hillsdale, NJ: Erlbaum.

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., & Tahan, K. (2011). *The Condition of Education 2011 (NCES 2011-033).* U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

August, D. & Hakuta, K. (1997). *Improving schooling for language-minority children*. Washington, DC: National Academy Press.

August, D., & Shanahan, T. (2006). *Developing literacy in second language learners. Report of the national literacy panel on minority-language children and youth*. Mahwah, NJ: Lawrence Erlbaum.

Aunola, K., Leskinen, E., Lerkkanen, M.-K. & Nurmi, J.-E. (2004). Developmental dynamics of math performance from preschool to grade 2. *Journal of Educational Psychology, 96* (4) 699-713.

Bailey A. (2007). *The language demands of school: Putting academic English to the test.* Yale University Press; New Haven, CT.

Bast, J., & Reitsma, P. (1998). Analyzing the development of individual differences in terms of Matthew effects in reading: Results from a Dutch longitudinal study. *Developmental Psychology, 34*, 1373-1399.

Baumann, J. F. (2005). Vocabulary-comprehension relationships. In B. Maloch, J. V. Hoffman, D. L. Schallert, C. M. Fairbanks & J. Worthy (Eds.), *Fifty-fourth yearbook of the National Reading Conference* (pp. 117-131). Oak Creek, WI: National Reading Conference.

Beck, I. L., & McKeown, M. G., (2007). Increasing young low-income children's oral vocabulary repertoires through rich and focused instruction. *Elementary School Journal, 107*(3), 251-271.

Beck, I. L., Perfetti, C. A., & McKeown, M. G. (1982). Effects of long-term vocabulary instruction on lexical access and reading comprehension. *Journal of Educational Psychology, 74*(4), 506-521.

Becker, M., McElvany, N., & Kortenbruck, M. (2010). Intrinsic and extrinsic reading motivation as predictors of reading comprehension: A longitudinal study. *Journal of Educational Psychology, 102*(4), 773-785. doi:10.1037/a0020084

Beebe, M. J. (1980). The effect of different types of substitution miscues on reading. *Reading Research Quarterly, 15*, 324-336.

Bentler, P. M. (1990). Comparative fit indexes in structural models. Psychological Bulletin, 107, 238-246. Hu, L. T., & Bentler, P. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 76-99). London: Sage.

Bernhardt, E. B. (2011). *Understanding advanced second-language reading.* New York: Routledge.

Berninger, V., Abbott, R., Vermeulen, K., & Fulton, C. (2006). Paths to reading comprehension in at-risk second-grade readers. *Journal of Learning Disabilities, 39*(4), 334-351.

Best, R. M., Floyd, R. G., & McNamara, D. S. (2008). Differential competencies contributing to children's comprehension of narrative and expository texts. *Reading Psychology, 29*, 137–164.

Biemiller, A. (1970). The development of the use of graphic and contextual information as children learn to read. *Reading Research Quarterly, 6*, 76-96.

Blanchard, J (1980). Preliminary investigation of transfer between single-word decoding ability and contextual reading comprehension by poor readers in Grade six. *Perceptual and Motor Skills, 51*, 1271-1281.

Bollen, K. A., & Curran, P. J. (2006). *Latent curve models: A structural equation approach*. New York: Wiley.

Breslow, N. E. & Clayton, D. G. (1993). Approximate inference in generalized linear mixed models. *Journal of American Statistical Association, 88*, 9-25.

Brophy, J., Evertson, C, Anderson, L, Baum, M., & Crawford, J. (1981). *Student characteristics and teaching*. New York: Longman.

Brown, C. L. (2001). *The equitability of the Maryland school performance assessment program for limited English proficient students: A study of third graders.* Unpublished doctoral dissertation, The George Washington University, Washington, DC.

Bryk, A., & Raudenbush, S. W. (1992). *Hierarchical linear models for social and behavioral research: Applications and data analysis methods*. Newbury Park, CA: Sage.

Bryk, A.S., & Raudenbush, S.W. (1987). Application of hierarchical linear models to assessing change. *Psychological Bulletin, 101*, 147-158.

Burgoyne, K., Whiteley, H., & Hutchinson, J. (2011). The development of comprehension and reading-related skills in children learning English as an additional language and their monolingual, English-speaking peers. *British Journal of Educational Psychology, 81*, 344–354. doi:10.1348/000709910X504122

Cain, K. (2006). Children's reading comprehension: The role of working memory in normal and impaired development. In S. J. Pickering (Ed.), *Working memory and education* (pp. 62-91). San Diego: Academic Press.

Cain, K., Oakhill, J. V., & Bryant, P. E. (2000). Phonological skills and comprehension failure: A test of the phonological processing deficit hypothesis. *Reading and Writing, 13*, 31-56.

Cain, K., Oakhill, J., & Bryant, P. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills. *Journal of Educational Psychology, 96*(1), 31-42.

Calfee, R. C., & Piontkowski, D. C. (1981). The reading diary: Acquisition of decoding. *Reading Research Quarterly, 16*, 346-373.

Carlisle, J. F., Beeman, M. M., Davis, L. H., & Spharim, G. (1999). Relationship of metalinguistic capabilities and reading achievement for children who are becoming bilingual. *Applied Psycholinguistics, 20*, 459-478.

Carlo, M., August, D., McLaughlin, B., Snow, C., Dressler, C., Lippman, D., Lively, T., & White, C.E. (2004). Closing the gap: Addressing the vocabulary needs of English-language learners in bilingual and mainstream classrooms. *Reading Research Quarterly, 39*(2), 188-215.

Carr, T. H., Brown, T. L., Vavrus, L. G., & Evans, M. A. (1990). Cognitive skill maps and cognitive skill profiles: Componential analysis of individual differences in children's reading efficiency. In T. H. Carr & B. A. Levy (Eds.), *Reading and its development: Component skills approaches* (pp. 1-55). London: Academic Press.

Carver, R. P., & David, A. H. (2001). Investigating reading achievement using a causal model. *Scientific Studies of Reading, 5*, 107-140.

Cassidy, J., & Grote-Garcia, S. (Eds.). (2012). *Literacy trends and 9ssues: What's hot.* Dubuque, Iowa: Kendall Hunt.

Catts, H., Bridges, M., Little, T., & Tomblin, J. B. (2008). Reading achievement growth in children with language impairments. *Journal of Speech, Language, and Hearing Research, 51*, 1569-1579.

Chall, J. S. (1983). *Stages of reading development*. New York: McGraw-Hill.

Chall, J. S. (1996). *Stages of reading development* (2nd Ed.). Fort Worth, TX: Harcourt-Brace.

Chall, J. S., Jacobs, V. A., & Baldwin, L. E. (1990). *The reading crisis: Why poor children fall behind*. Cambridge, Mass.: Harvard University Press.

Chan, D. (1998). The conceptualization and analysis of change over time: An integrative approach incorporating longitudinal mean and covariance structures analysis (LMACS) and multiple indicator latent growth modeling (MLGM). *Organizational Research Methods, 1*, 421-483.

Chatterji, M. (2006). Reading achievement gaps, correlates and moderators of early reading achievement: Evidence from the Early Childhood Longitudinal Study (ECLS) kindergarten to first grade sample. *Journal of Educational Psychology, 98*(3), 489-507.

Chen, R., & Vellutino, F. R. (1997). Prediction of reading ability: A cross-validation study of the simple view of reading. *Journal of Literacy Research, 29*, 1–24.

Chiappe, P., & Siegel, L. S. (1999). Phonological awareness and reading acquisition in English- and Punjabi-speaking Canadian children. *Journal of Educational Psychology, 9*1, 20-28.

Chiappe, P., Glaeser, B., & Ferko, D. (2007). Speech perception, vocabulary and the development of reading skills in English among Korean- and English-speaking children. *Journal of Educational Psychology, 99*, 154-166.

Chiappe, P., Siegel, L. S., & Gottardo, A. (2002). Reading-related skills of kindergartners from diverse linguistic backgrounds. *Applied Psycholinguistics, 23*, 95-116.

Chiappe, P., Siegel, L. S., & Wade-Woolley, L. (2002). Linguistic diversity and the development of reading skills: A longitudinal study. *Scientific Studies of Reading, 6*, 369-400.

Cloud, Genesee, & Hamayan (2000). *Dual language instruction: A handbook for enriched education*. Boston, MA: Heinle & Heinle Publishers.

Cobo-Lewis, A., Pearson, B. Z., Eilers, R., & Umbel, V. (2002). Effects of bilingualism and bilingual education on oral and written English skills: A multifactor study of standardized test outcomes. In D. K. Oller & R. Eilers (Eds.), *Language and literacy in bilingual children* (pp. 64-96). Clevedon, England: Multilingual Matters.

Compton, D. L. (2000). Modeling the growth of decoding skills in first-grade children. *Scientific Studies of Reading, 4*, 219-259.

Compton, D. L., Fuchs, D., Fuchs, L. S., Elleman, A. M., & Gilbert, J. K. (2008). Tracking children who fly below the radar: Latent transition modeling of students with late-emerging reading disability. *Learning and Individual Differences, 18*, 329–337. doi:10.1016/j.lindif.2008.04.003

Conner, C. M., Morrison, F. J., & Petrella, J. N. (2004). Effective reading comprehension instruction: Examining child and instruction interactions. *Journal of Educational Psychology, 96*(4), 682-698.

Connor, C. M., Morrison, F. J., Katch, E. L. (2004). Beyond the reading wars: The effect of classroom instruction by child interactions on early reading. *Scientific Studies of Reading, 8*(4), 305–336.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33*(6), 934-945.

Cunningham, A. E., & Stanovich, K. E. (2001). What reading does for the mind. *Journal of Direct Instruction, 1*(2), 137-149.

Cunningham,A. E., & Stanovich, K. E. (1990). Assessing print exposure and orthographic processing skill in children: A quick measure of reading experience. *Journal of Educational Psychology, 82*, 733-740.

Cutting, L.E. & Scarborough, H.S. (2006). Prediction of reading comprehension: Relative contributions of word recognition, language proficiency, and other cognitive skills can depend on how comprehension is measured. *Scientific Studies of Reading, 10*(3), 277-300.

D'Angiulli, D., Siegel, L. S., & Maggi, S. (2004). Literacy instruction, SES, and word-reading achievement in English-language learners and children with English as a first language: a longitudinal study. *Learning Disabilities Research & Practice, 19*, 202-213.

Davis, J. A., Smith, T. W., Hodge, R. W. (1991). *Occupational prestige ratings from the 1989 General Social Survey.* Chicago, IL: National Opinion Research Center.

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics, 25,* 223–238. doi:10.1017/S0142716404001110

Denton, K., & West, J. (2002). *Children's Reading and Mathematics Achievement in Kindergarten and First Grade* (NCES 2002–125). U.S. Department of Education, NCES. Washington, DC: U.S. Government Printing Office

Diamond, P. J., & Onwuegbuzie, A. J. (2001). Factors associated with reading achievement and attitude among elementary school-aged students. *Research in the Schools, 8*(1), 1-11.

Dochy, F., Segers, M., & Buehl, M. (1999). The Relation between assessment practices and outcomes of studies: The case of research on prior knowledge. *Review of Educational Research, 69*(2), 147-188.

Dochy, F., Segers, M., & Buehl, M. (1999). The Relation between assessment practices and outcomes of studies: The case of research on prior knowledge. *Review of Educational Research, 69*(2), 147-188.

Dresser, R. (2012). The impact of scripted literacy instruction on teachers and students. *Issues in Teacher Education, 21*(1), 71-87.

Droop, M., & Verhoeven, L. (2003). Language proficiency and reading ability in first- and second-language learners. *Reading Research Quarterly, 38*, 78-103.

Duncan, S. C., & Duncan, T. E. (1996). A multivariate latent growth curve analysis of adolescent substance use. *Structural Equation Modeling, 4*, 323-347.

Duncan, S. E., & DeAvila, E. A. (1998). *PreLAS*. Monterey, CA: CTB/McGraw-Hill.

Duncan, T. E., Duncan, S. C., Strycker, A. L., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications.* New Jersey, Mahwah: Lawrence Erlbaum Associates, Inc.

Dunn, L., & Dunn, L. (1981). *The Peabody Picture Vocabulary Test-Revised*. Circle Pines, MN: American Guidance Service.

Ehri, L., & Snowling, M.J. (2004). Developmental variation in word recognition. In Stone, C. A., Silliman, E. R., Ehren, B. J., and Apel, K. (Eds.), *Handbook of language and literacy: Development and disorders* (pp. 433-460). New York: Guilford.

Ehri, L.C. & Robbins, C. (1992). Beginners need some decoding skill to read words by analogy. *Reading Research Quarterly, 27*, 12-26.

Ehri, L.C. (1994). Development of the ability to read words: Update. In R. Ruddell, M. Ruddell & H. Singer (Eds.), *Theoretical models and processes of reading*. (4th Ed, pp. 323-358). Newark, Del: International Reading Association.

Ehrlich, M., Remond, M., & Tardieu, H. (1999). Processing of anaphoric devices in young skilled and less skilled comprehenders: Differences in metacognitive monitoring. *Reading and Writing: An Interdisciplinary Journal, 11*, 29-63.

Entwisle, D. R., & Alexander, K. L. (1989). Early schooling as a "critical period" phenomenon. In K. Namboodiri & R. Corwin (Eds.), *Sociology of education and socialization* (pp. 27-55). Greenwich, CT: JAI Press.

Entwisle, D. R., & Alexander, K. L. (1989). Early schooling as a "critical period" phenomenon. In K. Namboodiri & R. Corwin (Eds.), *Sociology of education and socialization* (pp. 27-55). Greenwich, CT: JAI Press.

Entwisle, D. R., & Alexander, K. L. (1993). Entry into schools: The beginning school transition and educational stratification in the United States. In *Annual Review of Sociology* (Vol. 19, pp. 401-423). Palo Alto, CA: Annual Reviews.

Entwisle, D. R., Alexander, K. L., & Olson, L. S. (2005). First grade and educational attainment by age 22: A new story. *American Journal of Sociology, 110*, 1458 -1502.

Erdos, C., Genesee, F., Savage, R., & Haigh, C. (2011). Individual differences in second language reading outcomes. *International Journal of Bilingualism, 15*(1), 3-25.

Ferrer, E., Balluerka, N., & Widaman, K. F. (2008). Factorial Invariance and the specification of second-order latent growth models. *Methodology, 4,* 22-36.

Fitzgerald, J. (1995). English-as-a-second-language reading instruction in the United States: A research review. *Journal of Reading Behavior, 27*, 115-152.

Fitzgerald, J., & Noblit, G. (2000). Balance in the making: Learning to read in an ethnically diverse first-grade classroom. *Journal of Educational Psychology, 92*(1), 1-20.

Fitzgerald, J., Amendum, S. J., Relyea, J. E., & Garcia, S. (2015). Is overall oral-English ability related to young Latinos' English-reading trajectory? *Reading & Writing Quarterly*.

Foorman, B. R., Francis, D. J., Fletcher, J. M., Schatschneider, C., & Mehta, P. (1998). The role of instruction in learning to read: Preventing reading failure in at-risk children. *Journal of Educational Psychology, 9*0(1), 37-55.

Francis, D. J., Fletcher, J. M., Catts, H. W., & Tomblin, J. B. (2005). Dimensions affecting the assessment of reading comprehension. In S. A. Stahl & S. G. Paris (Eds.), *Children's reading comprehension and assessment* (pp. 369-394). Mahwah, NJ: Erlbaum.

Francis, D. J., Schatschneider, C., & Carlson, C. D. (2000). Introduction to individual growth curve analysis. In D. Drotar (Ed.), *Handbook of Research in Pediatric and Clinical Child Psychology* (pp. 51-73). New York: Plenum.

Francis, D. J., Shaywitz, S. E., Stuebing, K. K., Shaywitz, B. A., & Fletcher, J. M. (1996). Developmental lag versus deficit models of reading disability: a longitudinal, individual growth curves analysis. *Journal of Educational Psychology, 88*, 3-17.

Frederiksen, J. R., & Warren, B. M. (1987). A cognitive framework for developing expertise in reading. In R. Glaser (Ed.), *Advances in instructional psychology.* Hillsdale, N.J: Lawrence Erlbaum Associates.

Fry, R. (2007). *How far behind in math and reading are English language learners?* Washington, DC: Pew Hispanic Center.

Fryer, R., & Levitt, S. (2004). Understanding the black-white test score gap in the first two years of school. *The Review of Economics and Statistics, 86*(2), 447-464.

Fuchs, D., & Fuchs, L. S. (2006). Introduction to responsiveness-to-intervention: What, why, and how valid is it? *Reading Research Quarterly, 4*, 93-99.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., & Stecker, P. M. (1990). The role of skills analysis in curriculum-based measurement in math. *School Psychology Review, 19*, 6-22.

Gaskins, I.W. (1998). A beginning literacy program for at-risk and delayed readers. In J. L. Metsala & L.C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 209-232). Mahwah, NJ: Lawrence Erlbaum Associates.

Genesee, F., Lindholm-Leary, K. J., Saunders, W., & Christian, D. (2006). *Educating English language learners*. NY: Cambridge University Press.

Georgiou, G. K., Das, J. P., & Hayward, D. (2009). Revisiting the "simple view of reading" in a group of children with poor reading comprehension. *Journal of Learning Disabilities, 42*(1), 76–84. doi: 10.1177/0022219408326210

Geva, E., & Farnia, F. (2011). Developmental changes in the nature of language proficiency and reading fluency paint a more complex view of reading comprehension in ELL and EL1. *Reading and Writing: An Interdisciplinary Journal, Special Issue*. doi:10.1007/s11145-011-9333-8

Geva, E., Wade-Woolley, L., & Shany, M. (1993). The concurrent development of spelling and decoding in two different orthographies. *Journal of Reading Behavior, 25*, 383-406.

Geva, E., Yaghoub-Zadeh, Z., & Schuster, B. (2000). Understanding differences in word recognition skills of ESL children. *Annals of Dyslexia, 50*, 123-154.

Goldenberg, C. (1987). Low-income Latino parents' contributions to their first-grade children's word-recognition skills. *Anthropology and Education Quarterly, 18*, 149-179.

Goldenberg, C. (2008). Teaching English language learners: What the research does—and does not—say. *American Educator, 32*(2), 8-44.

Goldenberg, C. (2011). Reading instruction for English language learners. In M. L. Kamil, P. D. Pearson, E. B. Moje, & P. P. Afflerbach (Eds.), *Handbook of reading research* (Vol 4, pp. 684-710). New York: Routledge.

Goldenberg, C., Rueda, R. S., & August, D. (2006). Social and cultural influences on the literacy attainment of language-minority children and youth. In D. August & T. Shanahan (Eds.), *Developing literacy in second-language learners: Report of the national literacy panel on language minority children and youth* (pp. 269-318). Mahwah, NJ: Lawrence Erlbaum.

Goldenberg, C., Rueda, R., & August, D. (2006). Synthesis: Sociocultural contexts and literacy development. In D. August & T. Shanahan (Eds.), *Report of the national literacy panel on language minority youth and children*. Mahwah, NJ: Lawrence Erlbaum Associates.

Gottardo, A., & Mueller, J. (2009). Are first- and second-language factors related in predicting second-language reading comprehension? A study of Spanish-speaking children acquiring English as a second language from first to second grade. *Journal of Educational Psychology, 101*(2), 330-344.

Gough, P.B., Hoover, W.A., & Peterson, C.L. (1996). Some observations on a simple view of reading. In C. Cornoldi & J. Oakhill (Eds.), *Reading comprehension difficulties* (pp. 1-13). Mahwah, NJ: Erlbaum.

Grabe, W. (2009). *Reading in a second language: Moving from theory to practice*. New York, NY: Cambridge University Press.

Grabe, W., & Stoller, F. L. (2002). *Teaching and researching reading.* New York: Pearson Education.

Guglielmi, R. S. (2008). Native language proficiency, English literacy, academic achievement, and occupational attainment in Limited English Proficient students: A latent growth modeling perspective. *Journal of Educational Psychology, 100*, 322-342.

Gutiérrez, K. D., Zepeda, M., & Castro, D. C. (2010). Advancing early literacy learning for all children: Implications of the NELP report for dual-language learners. *Educational Researcher, 39*, 334-339.

Guttentag, R. E., & Haith, M. M. (1978). Automatic processing as a function of age and reading ability. *Child Development, 49*, 707–716.

Guttman, L. (1950). The basis for scalogram analysis. In S. A. Stouffer, L. Guttman, E. A. Suchman, P. F. Lazarsfeld, S. A. Star & J. A. Clausen (Eds.), *Measurement and prediction* (pp. 60-90). Princeton NJ: Princeton University Press.

Hacquebord, H. (1994). Academic literacy reading in the content areas: text comprehension in secondary education in the Netherlands. *Journal of Research in Reading, 17*, 83-98.

Hacquebord, H. (1994). L2-reading in the content areas: Text comprehension in secondary education in the Netherlands. *Journal of Research in Reading, 17*, 83–98. doi: 10.1111/j.1467-9817.1994.tb00056.x

Halle, T., Hair, E., Wandner, L., McNamara, M., & Chien, N. (2012). Predictors and outcomes of early vs. later English language proficiency among English language learners in the ECLS-K. *Early Childhood Research Quarterly, 27*(1), 1-20.

Han, W.-J. (2012). Bilingualism and academic achievement. *Child Development, 83*(1), 300-321.

Han, W.-J., & Bridglall, B. (2009). Assessing school supports for ELL students using the ECLS-K. *Early Childhood Research Quarterly, 24*(4), 445-462.

Hancock, G. R., Kuo, W. L., & Lawrence, F. R. (2001). An illustration of second-order latent growth models. *Structural Equation Modeling, 8,* 470 - 489.

Herman, P. A. (1985). The effect of repeated readings on reading rate, speech pauses, and word recognition accuracy. *Reading. Research Quarterly, 20*(5), 553-565.

Hoffman, J. V. (2009). In search of the "simple view" of reading comprehension. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 54-65). London: Routledge.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 2*,127-160.

However, far less is known as to whether early English-word reading is an essential prerequisite to LM learners' long-term development of English-reading comprehension, and whether early English word-reading ability contributes to the persistence of reading comprehension success or difficulties across upper elementary and middle grades.

Hu, L. T., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), Structural equation modeling: *Concepts, issues, and applications* (pp. 76-99). London: Sage.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1-55.

Hurford, D. P., Potter, T. S., & Hart, G. S. (2002). Examination of three techniques for identifying first-grade children at risk for difficulty in word identification with an emphasis on reducing the false negative error rate. *Reading Psychology, 23*(3), 159-180.

Hus, Y. (2001). Early reading for low-SES minority language children: An attempt to "catch them before they fall." *Folia Phoniatrica et Logopaedica, 53*, 173-182.

Hutchinson, J. M., Whiteley, H. E., Smith, C. D., & Connors, L. (2003). The developmental progression of comprehension-related skills in children learning EAL. *Journal of Research in Reading, 26*, 19-32.

Huttenlocher, J., & Levine, S. C. (1990). The Primary Test of Cognitive Skills (PTCS). New York: CTB/McGraw Hill.

Jared, D., Cormier, P., Levy, B. A., & Wade-Woolley, L. (2011). Early predictors of biliteracy development in children in French Immersion: A 4-year longitudinal study. *Journal of Educational Psychology, 103*, 119-139.

Jencks, C., & Meredith, P. (1998). *The black-white test score gap*. Washington, DC: Brookings Institution Press.

Jenkins, J. R., & Jewell, M. (1993). Examining the validity of two measures for formative teaching: Read aloud and maze. *Exceptional Children, 59*, 421-432.

Jenkins, J. R., Fuchs, L. S., van den Broek, P., Espin, C.A., & Deno, S. L. (2003). Sources of individual differences in reading comprehension and reading fluency. *Journal of Educational Psychology, 95*, 719-729.

Johnston, T. C., & Kirby, J. R. (2006). The contribution of naming speed to the simple view of reading. *Reading and Writing, 19*, 339-361.

Joshi, R. M., & Aaron, P. G. (2000). The component model of reading: Simple view of reading made a little more complex. *Reading Psychology*, *21*(2), 85-97.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children fromfirst through fourth grades. *Journal of Educational Psychology, 80*(4), 437-447.

Juel, C. (1991). Beginning reading. In R. Barr, M. L. Kamil, P. Mosenthal & P. D. Pearson (Eds.), *Handbook of reading research* (Vol. II, pp. 759-788). New York: Longman.

Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78*, 243-255.

Just, M. A., & Carpenter, P. A. (1987). *The psychology of reading and language comprehension*. Boston, MA: Allyn & Bacon.

Kainz, K., & Vernon-Feagans, L. (2007). The ecology of early reading development for children in poverty. *The Elementary School Journal, 107*, 407-427.

Kaplan, D., & Walpole, S. (2005). A stage-sequential model of reading transitions: Evidence from the Early Childhood Longitudinal Study. *Journal of Educational Psychology, 97*, 551-563.

Katzir, T., Kim, Y., Wolf, M., Kennedy, B., Lovett, M., & Morris, R. (2006). The relationship of spelling recognition, RAN, and phonological awareness to reading skills in older poor readers and younger reading-matched controls. *Reading and Writing, 19*, 845–872. doi:10.1007/s11145-006-9013-2

Kaufman, A. S. & Kaufman, N. L. (1998). *Kaufman test of educational achievemen*t. Circle Pines, MN: American Guidance Service, Incorporated.

Kaufman, P., Alt, M. N., & Chapman, C. D. (2001). *Dropout Rates in the United States: 2000* (No. 2002-114). Washington, DC: U.S. Department of Education; National Center for Educational Statistics.

Keenan, J. M., Betjemann, R. S., & Olson, R. K. (2008). Reading comprehension tests vary in the skills they assess: Differential dependence on decoding and oral comprehension. *Scientific Studies of Reading, 12*(3), 281-300.

Kieffer, M. J. (2008). Catching up or falling behind? Initial English proficiency, concentrated poverty, and the reading growth of language minority learners in the United States. *Journal of Educational Psychology, 100*, 851-868.

Kieffer, M. J. (2011). Converging trajectories: Reading growth in language minority learners and their classmates, kindergarten to grade eight. *American Educational Research Journal, 48*(5), 1187-1225.

Kieffer, M. J. (2012). Early Spanish and English language proficiency and later reading development among Spanish-speaking English language learners: Evidence from a nine-year longitudinal study. *Journal of Applied Developmental Psychology*, *33*(3), 146-157.

Kieffer, M. J., & Vukovic, R. K. (2012). Growth in reading-related skills of language minority learners and their classmates: More evidence for early identification and intervention. *Reading & Writing: An Interdisciplinary Journal*, *26*, 1159-1194.

Kim, Y., Petscher, Y., Schatschneider, C., & Foorman, B. (2010). Does growth rate in oral reading fluency matter in predicting reading comprehension achievement? *Journal of Educational Psychology, 102*(3) 652-667.

Kim, Y.-S., Wagner, R. K., & Lopez, D. (2012). Developmental relations between reading fluency and reading comprehension: A longitudinal study from grade 1 to grade 2. *Journal of Experimental Child Psychology, 113*, 93–111. doi:10.1016/j.jecp.2012.03.002

Kindler, A. L. (2002). *Survey of the states' limited English proficient students and available educational programs and services: 2000-2001 summary report*. Washington, DC: National Clearinghouse for English Language Acquisition.

Kintsch, W. (2004). The construction-integration model of text comprehension and its implications for instruction. In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading* (5th Ed., pp. 1270-1328). Newark, DE: International Reading Association.

Kirby, J. R., & Savage, R. S. (2008). Can the simple view deal with the complexities of reading? *Literacy, 42*, 75–82.

Klingner, J. K., & Edwards, P. (2006). Cultural considerations with response-to-intervention models. *Reading Research Quarterly, 41*, 108-117.

Klingner, J. K., & Harry, B. (2006). The special education referral and decision-making process for English language learners: Child study team meetings and placement conferences. *Teachers College Record, 108*(11), 2247-2281.

Koda, K. (1988). Cognitive process in second language reading: Transfer of L1 reading skills and strategies. *Second Language Research, 4* (2), 133-156.

Koda, K. (2004). *Insights into second language reading: A cross-linguistic approach*. Cambridge: Cambridge University Press.

LaBerge, D., & Samuels, J. (1974). Towards a theory of automatic information processing in reading. *Cognitive Psychology, 6*, 293-323.

Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress toward equity? *Educational Researcher, 31*(1), 3-12.

Lee,V. E., & D. T. Burkam. 2002. *Inequality at the starting gate: Social background differences in achievement as children begin school.* Washington, DC: Economic Policy Institute.

Lesaux, N. K., & Siegel, L. S. (2003). The development of reading in children who speak English as a second language. *Developmental Psychology, 25*, 1005-1019.

Lesaux, N. K., Crosson, A., Kieffer, M. J., & Pierce, M. (2010). Uneven profiles: Language minority learners' word reading, vocabulary, and reading comprehension skills. *Journal of Applied Developmental Psychology, 31*, 475-483.

Lesaux, N. K., Koda, K., Siegel, L. S., & Shanahan, T. (2006). Development of literacy. In D. August & T. Shanahan (Eds.), *Developing literacy in second-language learners: Report of the national literacy panel on language-minority children and youth* (pp. 75-122). Mahwah, NJ: Lawrence Erlbaum.

Lesaux, N. K., Rupp, A., & Siegel, L. S. (2007). Growth in reading skills of children from diverse linguistic backgrounds: Findings from a 5-year longitudinal study. *Journal of Educational Psychology, 99*, 821-834.

Lesgold, A., Resnick, L., & Hammond, K. (1985). Learning to read: A longitudinal study of word skill development in two curricula. In G. E. Mackinnon and T. G. Waller (Eds.), *Reading research, advances in theory and practice* (Vol. 4, pp. 107-138). New York: Academic Press.

Lindsey, K. A., Manis, F. R., & Bailey, C. E. (2003). Prediction of first-grade reading in Spanish-speaking English-language learners. *Journal of Educational Psychology, 95*, 482-494.

Linklater, D. L., O'Connor, R. E., Palardy, G. J. (2009). Kindergarten literacy assessment of English Only and English language learner students: An examination of the predictive validity of three phonemic awareness measures. *Journal of School Psychology, 47*, 369-394.

Lomax, R. G. (1983). Applying structural modeling to some component processes of reading comprehension development. *Journal of Experimental Education, 52*, 33-40.

Long, J. S. (1997). *Regression models of categorical and limited dependent variables*. Sage, Thousand Oaks, CA.

Lyon, G. R. (1998). *Overview of reading and literacy initiatives.* Washington, D.C. National Institute of Child Health and Human Development.

MacMillan, P. (2000). Simultaneous measurement of reading growth, gender, and relative-age effects: Many-faceted Rasch applied to CBM reading scores. *Journal of Applied Measurement, 1*, 393-408.

Mancilla-Martinez, J., & Lesaux, N. K. (2010). Predictors of reading comprehension for struggling readers: The case of Spanish-speaking language minority learners. *Journal of Educational Psychology, 102*(3), 701-711.

Mancilla-Martinez, J., & Lesaux, N.K. (2011). The gap between Spanish-Speakers' word reading and word knowledge: A longitudinal study. *Child Development, 82*, 1544-1560.

Mancilla-Martinez, J., Kieffer, M. J., Biancarosa, G., Christodoulou, J., & Snow, C. E. (2011). Investigating English reading comprehension growth in adolescent language minority learners: Some insights from the simple view. *Reading and Writing: An Interdisciplinary Journal, 24,* 339-354.

Manis, F. R., Lindsey, K. A., & Bailey, C. E. (2004). Development of reading in grades K-2 in Spanish-speaking English-language learners. *Learning Disabilities Research & Practice, 19*, 214-224.

Markwardt, Jr., F. C. (1989). *Peabody Individual Achievement Test-Revised (PIAT-R).* Circle Pines, MN: American Guidance Services.

McArdle, J.J. (1988). Dynamic but structural equation modeling of repeated measures data. In J. R. Nesselroade & R. B. Cattell (Eds.), *The Handbook of multivariate experimental psychology*, Volume 2. New York, Plenum Press, 561‑614.

McCardle, P., Mele-McCarthy, J., Cutting, L., Leos, K., & D'Emilio, T. (2005). Learning disabilities in English language learners: Identifying the issues. *Learning Disabilities: Research & Practice, 20*(1), 1-5.

McCoach, D. B., O'Connell, A. A., Reis, S. M., & Levitt, H. (2006). Growing readers: A hierarchical linear model of children's reading growth over the first two years of school. *Journal of Educational Psychology, 98*, 14-28.

McDonald, R. P., & Ho, M. R., 2002. Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*, 64-82.

McIntyre, E., Rightmyer, E., & Petrosko, J. (2008). Scripted and non-scripted reading instructional models: Effects on the phonics and reading achievement of first-grade struggling readers. *Reading & Writing Quarterly, 24*(4), 377-407.

McKeown, M. G., Beck, I. L., Omanson, R., & Pople, M. T. (1985). Some effects of the nature and frequency of vocabulary instruction on the knowledge and use of words. *Reading Research Quarterly, 20*, 522-535.

McLoyd, V. C. (1998). Socioeconomic disadvantage and child development. *American Psychologist, 53*, 185-204.

Meece, J. L. & Kurtz-Costes, B. (2001). Schooling of ethnic minority children and youth. [Special Issue]. *Educational Psychologist*. Mahwah, NJ: Lawrence Erlbaum Associates.

Menard, S (2002). *Applied logistic regression analysis. 2nd edition.* Sage University Paper series on Quantitative Applications in the Social Sciences. (No. 07-106). Beverly Halls, CA: Sage.

Meredith, W. (1993). Measurement invariance, factor analysis, and factorial invariance. *Psychometrika, 58*, 525-543.

Meredith, W., & Horn, J. (2001). The role of factorial invariance in modeling growth and change. In A. Sayer & L. Collins (Eds.), *New methods for the analysis of change* (pp. 203-240). Washington, DC: American Psychological Association.

Meredith, W., & Tisak, J. (1990). Latent curve analysis. *Psychometrika, 55*, 107-122.

Meyers, L.S., Gamst, G., & Guarino, A. (2006). *Applied multivariate research: Design and interpretation*. Thousand Oaks, CA: Sage.

Mullis, I. V. S., Martin, M. O., Kennedy, A. M., & Foy, P. (2007). *PIRLS 2006 international report: IEA's progress in international reading literacy study in primary schools in 40 countries*. Chestnut Hill, MA: Boston College.

Muthén, L., & Muthén, B. (2010). *Mplus* (Version 6) [Computer software]. Los Angeles, CA: Authors.

Myers, R. (1990). *Classical and modern regression with applications*. Duxbury Press: Boston, MA.

Nagy, W. E., Anderson, R. C., & Herman, P. A. (1987). Learning word meanings from context during normal reading. *American educational Research Journal, 24*, 237-270.

Najarian, M., Pollack, J. M., Sorongon, A. G., & Hausken, E. G. (2009). *Early Childhood Longitudinal Study, Kindergarten class of 1998-99 (ECLS-K), psychometric report for the* *eighth grade* (NCES 2009-002). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Nakamoto, J., Lindsey, K. A., & Manis, F. R. (2007). A longitudinal analysis of English language learners word decoding and reading comprehension. *Reading and Writing: An Interdisciplinary Journal, 20*, 691-719.

Nakamoto, J., Lindsey, K. A., & Manis, F. R. (2008). A cross-linguistic investigation of English language learners' reading comprehension in English and Spanish. *Scientific Studies of Reading, 12*, 351-371.

National Assessment Governing Board (NAGB). (1994). *Reading Framework for The 1994 National Assessment Of Educational Progress.* Washington, DC: Government Printing Office.

National Assessment Governing Board. (2007). *Reading framework for the 2009 National Assessment of Educational Progress*: *Pre-publication edition.* Washington, DC.

National Clearinghouse for English Language Acquisition. (2007). *The growing numbers of limited English proficient students: 1995-96 - 2005-06*. Retrieved December 2, 2008, from: http://www.ncela.gwu.edu/stats/2_nation.htm.

National Early Literacy Panel (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute of Literacy.

National Reading Panel (2000). *Teaching children to read: An evidence-based assessment of the scientific literature on reading and its implications for reading instruction*. Bethesda MD: National Institute of Child Health and Human Development.

O'Connor, R. E., & Jenkins, J. R. (1999). The prediction of reading disabilities in kindergarten and first grade. *Scientific Studies of Reading, 3*, 159–197.

O'Connor, R.E., Bocian, K., Beebe-Frankenberger, M., & Linklater,D. (2010). Responsiveness of students with language difficulties to early intervention in reading. *Journal of Special Education, 43*, 220-235.

Oakhill, J. V., & Petrides, A. (2007). Sex differences in the effects of interest on boys' and girls' reading comprehension. *British Journal of Psychology, 98*(2), 223-235.

Oakhill, J. V., Yuill, N. M., & Parkin, A. J. (1986). On the nature of the difference between skilled and less-skilled comprehenders. *Journal of Research in Reading, 9*, 80-91.

Ouellette, G., & Beers, A. (2010). A not-so-simple view of reading: How oral vocabulary and visual-word recognition complicate the story. *Reading and Writing Quarterly, 23*, 189-208.

Paris, S.G., & Hamilton, E.E (2009). The development of children's reading comprehension. In S.E. Israel & G.G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 32-53). New York: Routledge Taylor & Francis Group.

Perfetti, C. A. (1985). *Reading Ability.* New York: Oxford University Press.

Perfetti, C. A. (2007). Reading ability: Lexical quality to comprehension. *Scientific Studies of Reading, 11*, 357-383.

Perfetti, C. A., & Hart, L. (2001). The lexical bases of comprehension skill. In D. Gorfien (Ed.), *On the consequences of meaning selection* (pp. 67-86). Washington, DC: American Psychological Association.

Perfetti, C. A., & Hogaboam, T. (1975). Relationship between single word decoding and reading comprehension skill. *Journal of Educational Psychology, 67*(4), 461-469.

Perfetti, C. A., Marron, M. A., & Foltz, P. W. (1996). Sources of comprehension failure: Theoretical perspectives and case studies. In C. Cornoldi & J. Oakhill (Eds.), *Reading comprehension difficulties: Processes and intervention* (pp. 137-165). Mahwah, NJ: Erlbaum.

Perie, M., Grigg, W., & Donahue, P. (2005). *The nation's report card: Reading 2005*. (NCES 2006-451). Washington, DC: U.S. Department of Education.

Pfost, M., Hattie, J., Dörfler, T., & Artelt, C. (2014). Individual differences in reading development: A review of 25 years of empirical research on Matthew effects in reading. *Review of Educational Research, 84*, 203-244.

Pollack, J., Atkins-Burnett, S., Najarian, M., & Rock, D. (2005). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), Psychometric Report for the Fifth Grade*. (NCES 2006-036rev). Washington, DC: National Center for Education Statistics.

Proctor, C. P., August, D., Carlo, M., Barr, C. (2010). Language maintenance versus language of instruction: Spanish reading development among Latino and Latina bilingual learners. *Journal of Social Issues, 66*(1), 79-94.

Proctor, C. P., Carlo, M., August, D., & Snow, C. E. (2005). Native Spanish-speaking children reading in English: Toward a model of comprehension. *Journal of Educational Psychology, 97*, 246-256.

Qian, D. D. (1999). Assessing the roles of depth and breadth of vocabulary knowledge in reading comprehension. *Canadian Modern Language Review, 56*, 282-307.

Raftery, A. (1993). Bayesian model selection in structural equation models. In K. Bollen & J. Long (Eds.), *Testing structural equation models* (pp. 163-180): Newbury Park, California.

RAND Reading Study Group. (2002). *Reading for understanding: Toward a research and development program in reading comprehension.* Santa Monica, CA: Office of Education Research and Improvement.

Raudenbush, S.W., & Bryk, A .S. (2002). *Hierarchical linear models*. London: Sage.

Reardon, S. F. (2003). *Sources of educational inequality: The growth of racial/ethnic and socioeconomic test score gaps in kindergarten and first grade (Working Paper No. 03-05R)*: Population Research Institute, Pennsylvania State University.

Reardon, S. F., & Galindo, C. (2009). The Hispanic-white achievement gap in math and reading in the elementary grades. *American Educational Association Journal 46*(3), 853-891.

Reese, L., Garnier, H., Gallimore, R., & Goldenberg, C. (2000). A longitudinal analysis of the ecocultural antecedents of emergent Spanish literacy and subsequent English reading achievement of Spanish-speaking students. *American Educational Research Journal*, *37*, 3, 633-662.

Reid, D. K., Hresko, W .P., & Hammill, D. D. (1981). *Test of Early Reading Ability (TERA-2).* Austin, TX: PRO-ED.

Roberts, G., Mohammed, S. S., & Vaughn, S. (2010). Reading achievement across three language groups: Growth estimates for overall reading and reading subskills obtained with the Early Childhood Longitudinal Survey. *Journal of Educational Psychology, 102*(3), 668-686.

Rock, D. A. (2012). Modeling change in large-scale longitudinal studies of educational growth: Four decades of contributions to the assessment of educational growth. *ETS Research Report No. RR-12-04.* Retrieved from http://www.ets.org/Media/Research/pdf/RR-12-04.pdf

Rock, D., & Pollack, J. (2002). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) Psychometric Report for Kindergarten through First Grade.* (NCES 2002-05). Washington, DC: National Center for Education Statistics.

Roth, F. P., Speece, D. L., & Cooper, D. H. (1996). Unsolved mysteries: How do metalinguistics and narrative skills connect with early reading? *Journal of Special Education, 30*, 257-277.

Royston, P. (2004). Multiple imputation of missing values. *Stata Journal, 4*, 227 - 241.

Royston, P. (2005). Multiple imputation of missing values: Update of ice. *Stata Journal, 5*, 527 - 536.

Rubin, D. B. (1987) *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys.* (1st Ed.) New York: Wiley Interscience.

Rubin, D. B. (2004). *Multiple imputation for nonresponse in surveys*. (2nd Ed.) New York: Wiley Interscience.

Rueda, R., & Goldenberg, C. (2007). What's new in the research world? A focus on English Learners. *The California Reader, 40*(3), 23-28.

Ruiz-de-Velasco, J. & Fix, M. (2000). *Overlooked and underserved: Immigrant students in U.S. secondary schools.* The Urban Institute Report. Washington, DC: The Urban Institute.

Rumelhart, D. E. (1977). Toward an interactive model of reading. In S. Dornic (Ed.), *Attention and performance VI* (pp. 573-603). Hillsdale, NJ: Erlbaum. (Proceedings of the Sixth International Symposium on Attention and Performance, Stockholm, Sweden, July 28-August 1, 1975.)

Saarnio, D. A., Oka, E. R., & Paris, S. G. (1990). Developmental predictors of children's reading comprehension. In T. H. Carr & B. A. Levy (Eds.), *Reading and its development: Component skills approaches* (pp. 57-79). New York: Academic Press.

Satz, P., & Fletcher, J. M. (1988). Early identification of learning disabled children: An old problem revisited. *Journal of Consulting and Clinical Psychology, 56*, 824-829.

Savage, R. S. (2006) Reading comprehension is not always the product of decoding and listening comprehension: Evidence from teenagers who are very poor readers. *Scientific Studies of Reading, 10*(2), 143-164.

Savage, R. S., & Wolforth, J. (2007). An additive simple view of reading describes the performance of good and poor readers in higher education. *Exceptionality Education Canada, 17*(1), 243-268.

Saville-Troike, M. (1984). What really matters in second language learning for academic achievement? *TESOL Quarterly, 18*, 199-219.

Sayer, A. G., & Cumsille, P. E. (2001). Second-order latent growth models. In L. M. Collins & A. G. Sayer (Eds.), *New methods for the analysis of change* (pp. 179 - 200). Washington, DC: American Psychological Association.

Scarborough, H. S. (2001). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In S. Neuman & D. Dickinson (Eds.), *Handbook for research in early literacy* (pp. 97-110). New York, NY: Guilford.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. Chapman & Hall, London.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods, 7*, 147-177.

Schenck, B., Fitzimmons, J., Bullard., P. C., Taylor, H. G., & Satz, P. (1980). A prevention model for children at risk for reading failure. In R. M. Knights & D. J. Bakker. (Eds.), *Treatment* *of hyperactive and learning disordered children.* (pp. 31-48). Baltimore: University Park Press.

Schwarz, G. (1978). Estimating the Dimension of a Model. *Annals of Statistics 6,* 461-464.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research, 75*, 417-453.

Skrondal, A., & Rabe-Hesketh, S. (2004). *Generalized latent variable modeling: Multilevel, longitudinal and structural equation models*. Boca Raton, FL: Chapman & Hall/CRC.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Sage Publications, London.

Snow, C. E., & Sweet, A. P. (2003). Reading for comprehension. In A. P. Sweet & C. E. Snow (Eds.), *Rethinking reading comprehension* (pp. 1-11). New York, NY: Guilford.

Snow, C. E., & Uccelli, P. (2009). The challenge of academic language. In D. R. Olson & N. Torrance (Eds.), *The Cambridge handbook of literacy* (pp. 112-133). New York, NY: Cambridge University Press.

Snow, C. E., Lawrence, J. F., & White, C. (2009). Generating knowledge of academic language among urban middle school students. *Journal of Research on Educational Effectiveness, 2*, 325-344.

Snow, C. E., Porche, M. V., Tabors, P. O., & Harris, S. R. (2007). *Is literacy enough?* Baltimore, MD: Brookes Publishing Co.

Snow, C., Burns, M., & Griffin, P. (1998). *Preventing reading difficulties in young children.* Washington, DC: National Academy Press.

Snyder, T. D., Dillow, S. A., & Hoffman, C. M. (2007). Digest of Education Statistics 2006 (NCES 2007-017). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC: U.S. Government Printing Office.

Sonnenschein, S., Stapleton, L. M., & Benson, A. (2010). The relation between the type and amount of instruction and growth in children's reading competencies. *American Educational Research Journal, 47*(2), 358-389.

Speece, D. L., Ritchey, K. D., Cooper, D. H., Roth, F. P., & Schatschneider, C. (2004). Growth in early reading skills from kindergarten to third grade. *Contemporary Educational Psychology, 29*, 312-332. doi: 10.1016/j.cedpsych.2003.07.001

Stage, S. A., Abbott, R. D., Jenkins, J. R., & Berninger, V. W. (2003). Predicting response to early reading intervention from verbal IQ, reading-related language abilities, attention ratings, and verbal IQ-word reading discrepancy: Failure to validate discrepancy method. *Journal of Learning Disabilities, 36*, 24-33.

Stahl, S. A., & Nagy, W. E. (2006). *Teaching word meanings*. Mahwah, NJ: Lawrence Erlbaum.

Stanovich, K. E. (1985). Explaining the variance in reading ability in terms of psychological processes: What have we learned? *Annals of Dyslexia, 35*, 67-96.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*(4), 360-407.

Stanovich, K. E. (2000). *Progress in understanding reading: Scientific foundations and new frontiers*. New York: Guilford.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38*, 175-190.

Stanovich, K. E., Nathan, R. G., & Vala-Rossi, M. (1986). Developmental changes in the cognitive correlates of reading ability and the developmental lag hypothesis. *Reading Research Quarterly, 21*, 267-283.

Stanovich, K. E., Nathan, R. G., & Zolman, J. E. (1988). The developmental lag hypothesis in reading: Longitudinal and matched reading-level comparisons. *Child Development, 59*, 71-86.

Stanovich, K.E. (1991). Word recognition: Changing perspectives. In R. Barr, M. L. Kamil, P. Mosenthal & P. D. Pearson (Eds.), *Handbook of reading research* (Vol. II, pp. 418-452). New York: Longman.

StataCorp. (2011a). *Stata statistical software: Release 12.* College Station, TX: StataCorp LP.

StataCorp. (2011b). *Stata 12 base reference manual*. College Station, TX: Stata Press.

Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38*, 934-937. doi: 10.1037//0012-1649.38.6.934

Strag, G.A. (1972). Comparative behavioral ratings of parents with severe mentally retarded, special learning disability, and normal children. *Journal of Learning Disabilities, 5*, 10.

Swanson, H.L., Rosston, K., Gerber, M., & Solari, E. (2007). Influence of oral language and phonological processing on children's bilingual reading, *Journal of School Psychology, 46*, 413-429.

Tannenbaum, K., Torgesen, J. K., & Wagner, R. K. (2006). Relationships between word knowledge and reading comprehension in third-grade children. *Scientific Studies of Reading, 10*, 381-398.

Taylor, B. M., Pearson, D. P., Clark, K., & Walpole, S. (2000). Effective schools and accomplished teachers: Lessons about primary-grade reading instruction in low-income schools. *Elementary School Journal, 101*, 121-165.

Taylor, B. M., Pearson, P. D., Peterson, D. S., & Rodriguez, M. C. (2003). Reading growth in high-poverty classrooms: The influence of teacher practices that encourage cognitive engagement in literacy learning. *Elementary School Journal, 104*, 3-28.

Tisak, J, & Meredith, W. (1990). Descriptive and associative developmental models. In A. von Eye (Ed.), *Statistical methods in developmental research, volume 2* (pp. 387-406). San Diego, CA: Academic Press.

Torgesen, J. K., & Burgess, S. R. (1998). Consistency of reading-related phonological processes throughout early childhood: Evidence from longitudinal-correlational and instructional studies. In J. Metsala & L. Ehri (Eds.). *Word recognition in beginning reading*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Burgess, S., & Hecht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second- to fifth-grade children. *Scientific Studies of Reading, 1*, 161–185. doi:10.1207/s1532799xssr0102_4

Tourangeau, K., Brick, M., Byrne, L., Lê, T., Nord, C., West, J., & Germino Hausken, E. (2005). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K) third grade methodology report.* (NCES 2005-018). Washington, DC: National Center for Education Statistics.

Tourangeau, K., Lê, T., Nord, C., & Sorongon, A. G. (2009). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K).* Eighth-grade methodology report (NCES 2009-003). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Tourangeau, K., Nord, C., Lê, T., Pollack, J.M., & Atkins-Burnett, S. (2006). *ECLS-K: Combined user's manual for the ECLS-K Fifth-grade data files and electronic codebooks.* (NCES 2006-032). Washington, DC: National Center for Education Statistics.

Tourangeau, K., Nord, C., Lê, T., Sorongon, A. G., & Najarian, M. (2009). *Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), combined user's manual for the ECLS-K eighth-grade and k-8 full sample data files and electronic codebooks* (NCES 2009-004). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*, 1-10.

Tunmer, W., & Hoover, W. (1992). Cognitive and linguistic factors in learning to read. In P. Gough, L. Ehri & R. Treiman (Eds.), *Reading acquisition*. Hillsdale, NJ: Erlbaum.

U.S. Department of Education, National Center for Education Statistics. (2001). *ECLS-K Base Year Public-Use Child File* (CD-ROM and user's manual). (NCES 2001-029). Washington, DC: Author.

Ulijin, J. M., & Strother, J. B. (1990). The effects of syntactic simplification on reading EST texts as L1 and L2. *Journal of Research in Reading, 13*, 38-54.

Vellutino, F. R., Tunmer, W. E., Jaccard, J. J., & Chen, R. (2007). Components of reading ability: Multivariate evidence for a convergent skills model of reading development. *Scientific Studies of Reading, 11*, 3-32.

Verhoeven, L. (1990). Acquisition of reading in a second language. *Reading Research Quarterly, 25*, 90-114.

Verhoeven, L. (2011). Second language reading acquisition. In M. Kamil, P. D. Pearson, E. Moje & P. Afferbach (eds.), *Handbook of reading research* (Vol. IV, pp. 661-683). New York: Routledge.

Verhoeven, L., & van Leeuwe, J. (2008). Predictors of text comprehension development. *Applied Cognitive Psychology, 22*, 407-423.

Wade-Woolley, L., & Siegel, L. S. (1997). The spelling performance of ESL and native speakers of English as a function of reading skill. *Reading and Writing: An Interdisciplinary Journal, 9*, 387-406.

Wagner, R. K., Francis, D. J., & Morris, R. D. (2005). Identifying English language learners with learning disabilities: Key challenges and possible approaches. *Learning Disabilities Research & Practice, 20*(1), 6-15.

Walberg, H. J., & Tsai, S. L. (1983). Matthew effects in education. *American Educational Research Journal, 20*, 359-373.

Weber, R.-M., & Longhi-Chirlin, T. (2001). Beginning in English: The growth of linguistic and literate abilities in Spanish-speaking first-graders. *Reading Research and Instruction, 41*(1), 19-50.

Weiss, D. J. (1982). Improving measurement quality and efficiency with adaptive testing. *Applied Psychological Measurement, 6*, 473-492.

Wharton-McDonald, R., Pressley, M., & Hampston, J. M. (1998). Literacy instruction in nine first-grade classrooms: Teacher characteristics and student achievement. *The Elementary School Journal, 99*, 101-128.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin, 91*(3), 461-481.

Wigfield, A., Eccles, J. S., Schiefele, U., Roeser, R. W., & Davis-Kean, P. (2006). The development of achievement motivation. In N. Eisenberg (Ed.), Handbook of child psychology, (pp. 933-1002). New York: Wiley.

Williamson, G. L., Appelbaum, M., & Epanchin, A. (1991). Longitudinal analyses of academic achievement. *Journal of Educational Measurement, 28*, 61-76.

Williamson, G. L., Fitzgerald, J., & Stenner, J. (2014). Student reading growth illuminates the Common Core text-complexity standard: Raising both bars. *Elementary School Journal, 115*(2).

Woodcock, R. W., & Bonner, M. (1989). Woodcock-Johnson III Tests of Achievement-Revised. Itasca, IL: Riverside.

Woodcock, R., McGrew, K., & Werder, J. (1994). *Woodcock-McGrew-Werder Mini-Battery of Achievement*. Itasca, IL: Riverside Publishing.

Wu, A. D., Liu, Y., Gadermann, A. M., & Zumbo, B.D. (2010). Multiple-indicator multilevel growth model: A solution to multiple methodological challenges in longitudinal studies. *Social indicators research: International Interdisciplinary Journal for Quality of Life Measurement, 97*, 123-142.

Yesil-Dagli, U. (2011). Predicting ELL students' beginning first grade English oral reading fluency from initial kindergarten vocabulary, letter naming, and phonological awareness skills. *Early Childhood Research Quarterly, 26*(1), 15-29.

Zinar, S. (2000). The relative contributions of word identification skill and comprehension-monitoring behavior to reading comprehension ability. *Contemporary Educational Psychology, 25*(4), 363-377.