A Longitudinal analysis investigating the role of immigrant generation status on intra-linguistic and cross-linguistic models of reading comprehension among Latino bilinguals in elementary school

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A LONGITUDINAL ANALYSIS INVESTIGATING THE ROLE OF IMMIGRANT GENERATION STATUS ON INTRA-LINGUISTIC AND CROSS-LINGUISTIC MODELS OF READING COMPREHENSION AMONG LATINO BILINGUALS IN ELEMENTARY SCHOOL

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Abstract

For young Latinos, the role of immigrant generation status on Spanish and English language development has not received much attention. Empirical studies (Bean & Stevens, 2003; Veltman, 1983) and descriptive data from the US Census Bureau (Fry & Passal, 2009; US Census Bureau, 1993), however, suggest an intergenerational shift from Spanish to English, such that the first generation primarily speaks Spanish, the second generation speaks both Spanish and English (to varying degrees), and the third generation primarily speaks English. Indeed, this intergenerational shift suggests the important role of immigrant generation status in the language and reading comprehension development of bilingual Latinos. If first generation students are more likely to be Spanish dominant, arguably their English language and reading development are likely distinctive to their second and third generation peers. Logically, this would suggest a lockstep intergenerational improvement such that second and third generation peers would significantly outperform their first generation peers in English language and reading. Further, second and third generation peers who may be more English dominant may not rely as much on the hypothesized bilingual specific characteristics of cross-linguistic transfer.

To address this role of immigrant status in the English oral language and reading development among Latino bilinguals, this dissertation is divided into two studies. Both studies utilized data from the Comprehension, Language Acquisition, and Vocabulary in English and Spanish Project (CLAVES; Silverman, Proctor, & Harring, 2009-2013). The first study was guided by a component view of reading within the context of the immigrant paradox. Study 1 used multi-level growth modeling to address the following research questions: (1) For bilingual Latino students, do second through fifth grade

growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status? (2) For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension? (2a) Are these relationships moderated by immigrant generation status? The second study was concerned with the role of immigrant generation status on the linguistic interdependence (Cummins, 1979) between Spanish language, English language, and English reading comprehension. Study 2 used multi-level growth modeling to address the following research questions: (1) What are the main and moderating effects of immigrant generation status and Spanish oral language (i.e., vocabulary, syntax) on the initial status and growth of English language components (i.e., vocabulary, morphology, syntax, and semantics) and English reading comprehension over two academic years? (2) In a dual-language model for English reading comprehension, are components of Spanish language, English language, and generation status predictive of the intercept or slope?

Results indicated that Latino children's English language and reading comprehension performance increased over time. For Study 1, significant effects for generation status suggested a Generation 2 and Generation 3 advantage. For the intra-language growth models of reading, some components of language were predictive of intercept and growth of reading comprehension. For Study 2, significant effects for generation status and Spanish language on the English language growth trajectories provide evidence for paradoxical immigrant generation status trends and cross-language transfer. For the cross-language growth models of reading the intercept and slope of some language components were predictive of reading comprehension intercept and slope, however there were no effects for Spanish or generation status. Both studies emphasize the need for educators to be cognizant of linguistic differences within the bilingual population – particularly for newcomers and students who are less likely to speak English.

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Table of Contents

List of Tables

List of Figures

List of Equations

Chapter 1: Introduction

The cultural and linguistic diversity in the United States has been on the rise with an increasing number of non-native English speakers residing in the United States. According to the Pew Research Center (2013), 34.8 million individuals have a home language of Spanish. Thus, of particular interest, for this dissertation, is the Latino population residing in the United States. According to the US Census Bureau (2010) 50,477,594 Latinos live in the US and Puerto Rico resulting in 10.7 million Latino family households, the majority of whom speak Spanish.   Nearly a quarter of all school age children (Fry & Passal, 2009) come from these Latino households; 10.9 million of whom are designated as English Language Learners (Kohler & Lazarín, 2007). According to the federal definition (Public Law 107-110, Title IX, Part A, Sec. 9101), English Language Learners (ELLs) are students between the age of 3 and 21, enrolled in elementary or secondary school, whose native language is not English, and whose limited English proficiency results in difficulties with speaking, reading, writing, and understanding, thus interfering with the student's ability to meet State proficiency levels, participate in the mainstream English-speaking classroom, or fully participate in society.

Large efforts have been made to support this English learner population. In 2007-2008, for instance, Title III funding, which has the goal of ensuring that ELLs achieve English proficiency while also meeting state academic content and standards, totaled $617,176,83 (National Clearinghouse for English Language Acquisition and Language Instruction Educational Program; NCELA, 2012). Despite these efforts, however, previous research demonstrates that ELLs continue to perform below average when compared to their non-ELL peers (Lesaux, Koda, Siegel, & Shanahan, 2006; National

Center for Education Statistics; NCES, 2011). While not all bilingual Latinos are necessarily labeled as ELLs the Latino population as a whole performs below average (NCES, 2011), has higher high school drop out rates (Fry, 2003), and by the age of 17 Latinos read at an age level 4 years beyond the average, white, non-Latino student (NCES, 1998). Further, 10.9 million Latinos are, in fact, designated as ELLs (Kohler & Lazarín, 2007). Indeed, the need to better understand how to support this bilingual population is clearly present.

At the same time, however, the constant emphasis on Latino student academic performance continues to employ a deficit model that tends to focuses on what Latino children *can't* do compared to their more proficient English peers. Further, since the educational efforts are centered on supporting English oral language and English reading comprehension, much research with the young Latino population is based on previous work with English monolingual speakers and/or focuses solely on the English language. While findings from previous research on English monolingual language and reading development can certainly help inform research and instruction on the language and reading development of bilingual Latino children, research efforts must also consider the rich diversity within the developmental context of bilingual children.

There is no question that linguistic variation and developmental contexts vary among all children, monolingual and bilingual alike. Unlike their English monolingual peers, however, Latino children often have *dual* language proficiencies. Thus, where characteristics such as SES, parent education, and home literacy practices can be informative in understanding the English language for all children, there may be additional characteristics that may inform the English *and Spanish* language development of bilingual Latino children. For example, empirical research (Bean & Stevens, 2003; Veltman, 1983) and descriptive data from the US Census Bureau (Fry & Passal, 2009; US Census Bureau, 1993) provide evidence that when dividing bilingual Latinos into groups according to immigrant generation status an interesting trend emerges such that first generation Latinos are more likely to speak Spanish, second generation Latinos tend to speak a combination of Spanish and English, and third generation Latinos are more likely to be either English dominant or monolingual. Perhaps, in better understanding the linguistic development among Latinos in different immigrant generation groups we can develop more appropriate ways to support this bilingual population.

Perspectives for Latino Oral Language and Reading Development

The purpose of this dissertation is to examine English language and reading development among a sample of bilingual Latinos residing in the US. I propose that in better understanding the relationship between immigrant generation status, English oral language, Spanish oral language, and English reading comprehension we can better support the English language and reading development for Latinos and, in turn, create better educational, social, and economic experiences for this ever present population. An underlying premise of this dissertation is that oral language and reading comprehension are related, however when considering the nature of this relationship among Spanish-English bilinguals, important perspectives of language and reading must inform the way this relationship is understood. First, one must consider the unique contexts in which bilingual Latinos develop language and literacy; specifically, for this dissertation I am concerned with the context of immigration. Immigrant generation status is an important context to consider in the oral language and reading development of Latinos. In the developmental health literature, the relationship between immigrant generation and health outcomes have been referred to as the epidemiological paradox (e.g., Antecol & Bedard, 2006; Ceballos & Palloni, 2010) which suggest that components of health vary between immigrant generation groups; specifically the epidemiological paradox documents an intergenerational decline such that first generation immigrants have better health outcomes than their second and third generation peers. Recent literature focused on academic performance and generation status has yielded similar findings (e.g., Hao & Woo, 2012). Interestingly, however, when focusing specifically on language, recent trends in census data suggest an intergenerational shift from Spanish to English such that third generation Latinos are less likely to speak Spanish when compared to their first and second generation peers. This is curious, as research with monolinguals and bilinguals has suggested the important role of English oral language in English reading comprehension and general academic performance. Thus, it would seem logical that if English oral language proficiency, and arguably acculturation, increases intergenerationally, then academic performance (e.g., reading comprehension) should also increase. It is these paradoxical intergenerational trends that frame the context for this dissertation.

Within this paradoxical context of immigration, there are two important perspectives of reading and language that inform this dissertation. The first is a component view of reading; this perspective of reading is informed by the field of linguistics. Many linguists, for example, discuss language in the following structural components of language: phonology, morphology, semantics, and syntax (Akmajian, 2001). This view of reading is informed by this idea of multiple components, however my perspective on reading includes the components of vocabulary, morphology, syntax, semantics, and word reading. The component view of reading can be useful in better understanding the oral language development of bilingual Latinos. Further, in using a component view of reading to examine the relationship between oral language and reading, this perspective could help target more precise ways to support Latinos in their English reading comprehension. On a related matter, bilingual Latinos' oral language includes both English and Spanish and many linguistics and education theorists alike would agree that the two languages do not work independent of one another (e.g., Cummins, 1978). Thus, my second perspective is a second language development perspective that is informed by the linguistic interdependence hypothesis; this hypothesis is built on the underlying framework that a bilingual's two languages are related. Indeed, in order to fully understand English oral language and English reading comprehension development among bilingual Latinos, we must also account for their Spanish language proficiency. It is within the context of immigration and these two perspectives of language and reading (i.e., component view of reading and linguistic interdependence) that this dissertation is framed.

Statement of the Problem

Bilingual Latinos need more support in English oral language and English reading comprehension. Previous research in this area has not given enough attention to perspectives of language that consider unique contexts for development and the entire range of linguistic ability for Spanish-English bilinguals. Indeed, research which accounts for a more holistic understanding of English oral language and English reading comprehension development is warranted.

Research Questions

To address the need to more holistically examine English oral language and reading comprehension among Latinos, I conducted two studies. Both studies examined the relationship between immigrant status, English language, and English reading; Study 1 developed intra-linguistic growth models and Study 2 developed cross-linguistic growth models. The specific research questions guiding each study are listed below:

Study 1: Intra-linguistic Models of English Oral Language and Reading Comprehension

1. For bilingual Latino students, do second through fifth grade growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status?
2. For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension?
    a. Are these relationships moderated by immigrant generation status?

Study 2: Cross-linguistic Models of English Oral Language and Reading Comprehension

1. What are the main and moderating effects of immigrant generation status and Spanish oral language (i.e., vocabulary, syntax) on the initial status and growth of English language components (i.e., vocabulary, morphology, syntax, and semantics) and English reading comprehension over two academic years?
2. In a dual-language model for English reading comprehension, are components of Spanish language, English language, and generation status predictive of the intercept or slope?

Outline of Dissertation

In the remainder of the chapter I describe the organization of this dissertation. The first (present) chapter provides a brief introduction of the context of bilingual Latinos in the US, a brief description of the perspectives framing this study, a concise statement of the problem, the research questions, and an outline of the subsequent chapters. Chapter 2 is divided into two sections. First, I present the context for the study (i.e., immigration) and then the two perspectives for language and reading that guided this study. I discuss the importance of the immigrant generation status by unpacking intergenerational trends. I then present the conceptual framework guiding this study: a component view of reading. In this discussion, I first describe a component of reading and identify specific components of interest. Indeed, the component view of reading illustrates the multidimensionality of oral language in reading comprehension. The second perspective discussed is the linguistic interdependence hypothesis. Specifically, I discuss how linguistic interdependence can help researchers understand the relationships between Spanish and English language and literacy.

The second part of Chapter 2 consists of three extensive literature reviews. The first literature review includes the recent research that has investigated the relationships between immigrant generation status and educational outcomes. The second literature review is organized by a component view of reading and reviews the literature that has examined the relationships between English oral language and English reading comprehension among elementary-school aged Spanish-English bilingual Latinos in the US. This particular section is divided two main sections. The first section focuses on components of early language that are predictive of later reading comprehension.

Although the focus of the current study was on elementary-school aged students, understanding relationships between early oral language and later reading comprehension help inform our understanding of later oral language and reading comprehension. The second section focuses on the literature in middle-elementary school. Both sections are divided into respective sub-sections on how specific components of reading play a role in reading comprehension.

The final literature review in Chapter 2 reviews the literature that has focused on cross-language relationships between Spanish and English among elementary school aged Spanish-English Latinos in the US. This review is also divided into two sections: the first section reviews cross-language relationships and the second section reviews dual-language models of reading comprehension. The final section in Chapter 2 synthesizes the main findings from the three bodies of literature. Specifically, I emphasize the need to examine the development of English oral language and reading among Latinos within the context of immigrant generation status. Further, I suggest that research should focus not only on multiple components of reading (i.e., vocabulary, morphology, syntax, semantics), but also account for a Latino's Spanish oral language ability. Finally, as also discussed in the literature reviews, few of the existing studies discussed are longitudinal in design and in order to truly capture this dynamic process, the research literature would benefit from work that examines these relationships longitudinally.

Chapter 3 describes the methodology guiding the two studies in this dissertation. Chapter 3 first describes the methodological perspectives, specifically describing how the current literature and perspectives guided the two studies and respective research questions. As mentioned above, the dissertation is divided into two studies: one study developed an intra-linguistic model of reading and the second study developed a cross-linguistic model of reading. Both studies, however, draw form the same data sources: a larger three-year longitudinal study that used a cohort-sequential design. The next section in Chapter 3 describes the data sources in detail, including participants and the language and literacy batteries. I then describe Study 1, which used hierarchical linear modeling to model English oral language and English reading comprehension from Grade 2 to Grade 5. I then describe Study 2, which used hierarchical linear modeling to model English oral language and English reading comprehension over two academic years.

Chapter 4 presents the results from the two studies. This chapter is also divided into two sections, one for each respective study. In each section, descriptive analyses are presented first and then results for each research question are presented separately; each research question contains subsections for each component of reading. Respective tables and figures for each component are also included within each sub-section. Chapter 5 is the final chapter. A discussion of each study is discussed separately in detail, including a discussion of findings as they relate to current research in reading comprehension (Study 1 and Study 2) and second language acquisition theory (Study 2 only), implications for research and practice, limitations, future research, and conclusion.

Chapter 2: Background

In order to best address the concern of how to support bilingual Latinos in their English language and reading development, it is imperative to examine this population through the context of their bilingual language and literacy development process. One specific context for bilingual children is that of immigration. To set the context for this dissertation, I first present the immigrant paradox, that is a documented intergenerational decline among immigrants and children of immigrants (Gibson, 1997; Portes & Rumbaut, 1996; Suarez-Orozco & Suarez-Orozco, 1995; Vigil, 1997), as an enigmatic context in which to examine the English language and reading development of bilingual Latinos. I then propose two perspectives: a perspective of reading and a perspective of second language development.

The first perspective is a conceptual framework for reading comprehension based on a component view of reading. This framework establishes the need to assess language and reading development comprehensively through several different components. The next perspective takes a second language perspective and is informed by Cummins' (1979) linguistic interdependence hypothesis, which posits that it is imperative to examine the relationship between languages, as another perspective in which to examine reading comprehension. I suggest applying these by applying these two perspectives within the context of immigrant generation status we can better understand the nuances in the English language and reading development of bilingual Latinos.

The Context: The Immigrant Paradox

Developmental perspectives on child development, such as Bronfenbrenner's (2003) bioecological model, suggest that there are several interrelated processes that affect children’s development and it is suggested that immigrant generation status is one factor that may influence the bilingual language development of young bilinguals growing up in the US. The immigrant population can be divided into three immigrant status groups, designated by their generation: first generation, second generation, and third or higher generation. In line with contemporary immigrant literature (e.g., Alba, & Silberman, 2009; Hernandez, Denton, & McCartney, 2006; Portes & Rumbaut, 2001) first generation immigrants are those who have migrated to the US from their original country of birth; second generation immigrants are born in the US and have at least one parent who migrated to the US; and third generation or higher are the children and subsequent descendants of the second generation. Currently, the second generation makes up just over half of the US Latino population (Fry & Passal, 2009). Research that has examined generation status stems from the social work and public health literature that has documented an epidemiological paradox (e.g., Antecol & Bedard, 2006; Hamiltion, 2015; Ceballos & Pelloni, 2010) such that first generation children significantly outperform their later generation peers in the areas of health. This trend has been examined less extensively in the education literature, however in the limited research that has examined immigrant generation status and academic performance, empirical research has also suggested a paradoxical pattern, particularly among the bilingual Latino population (e.g., Alba et al., 2002; Buriel & Cardoza, 1988; Portez & Hao, 1998).

This intergenerational trend is particularly interesting when considering language shift (Hurtado & Vega, 2004), that is, a change in preference and dominance from one language to another. Among Latinos, language shift often refers to the process of moving from the dominant use of Spanish language to English language dominance. For example, a child growing up in the US from a Spanish speaking home may primarily speak Spanish in her childhood, however as the child starts to attend school and develops relationships with more English-speaking peers, this child's language preference and/or dominant proficiency may shift from Spanish to English. This intergenerational shift from Spanish to English seems plausible when considering that English is the primary language of the US. Given this intergenerational trend of language shift, the paradoxical pattern of intergenerational decline in both the health literature (Hamilton, 2015) and education literature (Gibson, 1997; Portes & Rumbaut, 1996; Suarez-Orozco & Suarez-Orozco, 1995; Nielsen & Fernanez, 1981; Schumaker & Getter, 1977; Vigil, 1997) is curious. It is particularly puzzling, as it would seem logical that higher English language proficiency would result in better academic performance. Indeed, among research with monolinguals higher levels of English oral language proficiency have been predictive of later reading comprehension (e.g., Kendeou, Broek, White, & Lynch, 2009) and this pattern has also been found among Latinos (Kieffer, 2012). If English oral language proficiency is predictive of English reading comprehension and if language shift toward English monolingualism occurs intergenerationally, then what might explain this documented decline in academic performance across generations?

One explanation for this paradox might be directly related to the level of Spanish language competence. Higher Spanish proficiency, for example, among immigrants has been found to be positively associated with academic achievement (Buriel & Cardoza, 1988; Duran, 1983; Portes & Rambaut, 2001). In other words, students with higher Spanish language comprehension perform better academically. Thus, first and second generation students, who according to evidence on language shift may be more likely to speak Spanish, may have a bilingual advantage or cross-linguistic potential. In contrast, given the relationship between English oral language and English reading comprehension, students in the second and third generations may have an intra-language advantage when compared to their more Spanish-dominant first generation peers. There are two perspectives that serve as useful frameworks for examining these intergenerational nuances in academic performance.

Conceptual Framework: A Component View of Reading

There is no question that reading comprehension is complex. A vast amount of literature has explored the role of a variety of factors that may explain the process of reading. Within the literature, many researchers have examined the role of language proficiency (e.g., vocabulary). Indeed, research has documented a relationship between oral language proficiency and reading (e.g., Hoover & Gough, 1990) and it is this perspective that informs the present view of reading. Drawing from the field of linguistics, language proficiency can be understood as “the speaker-hearer’s knowledge of his language” (Akhmanova, 1971, p.454) and linguists often conceptualize this linguistic knowledge with the following structural components of language: phonology, morphology, semantics, and syntax (Akmajian, 2001). Thus, the linguistic perspective of language proficiency combined with the documented relationship between oral language proficiency and reading comprehension are the two perspectives that frame the present conceptual framework for reading. The conceptual framework for reading that guided this dissertation includes the components of vocabulary, morphology, syntax, semantics, and word reading. The inclusion of word reading as a component is based on its empirically documented relationship to reading comprehension (e.g., Hoover & Gough, 1990). This component view of reading posits that each of these components play a role in reading comprehension and in better understanding these interrelated components a more holistic view of oral language proficiency and reading begins to emerge. Each component is described below.

Vocabulary

Vocabulary refers to a speaker-hearer's language productivity or use. Vocabulary includes, for example, the sheer breadth of words an individual has in her linguistic repertoire and her ability to use these words in different language functions (i.e., speaking, listening, reading, writing). Thus, vocabulary is an important component of reading as it is serves as the conceptual knowledge base for the language that the reader decodes.

Morphology

Morphemes refer to the smallest meaningful sound or combination of sounds (e.g., read) and morphology refers to the manipulation of these sounds and the study of word formation. Thus, morphological awareness is the ability to manipulate words through the use of morphemes such as prefixes (e.g., **re**read), suffixes (e.g., read**ing**), or grammatical inflections (e.g., read**s**). Morphology is an important component of word structure, as the more competent a speaker-hearer-reader is with word structure manipulation, the more potential for vocabulary expansion. Take, for instance, when a child familiar with the word read encounters a new word: reader. If the child is able to derive read from **read**er, then the child can begin to understand that this new word is related to read. While morphology refers to the meaningful combination and manipulation of sounds to form words, language is not constrained to single words. Similar to how there are morphological rules to sound combinations, there are also rules on how to structure combination of words.

Syntax

Syntax refers to the sentence structure, or the meaningful combination of words. In linguistics, syntax is the set of grammatical rules for a particular language. In the English language, for example, a basic sentence structure follows this basic rule: subject + verb. In other words, proficient English language speakers know to say "I read" where "I" is the subject and "read" serves as the verb. Similarly, the English language follows an adjective + noun pattern when describing something, thus one would say, "big book". In contrast, the Spanish language uses a noun + adjective rule, thus for Spanish speakers, "el libro grande (the book big)" is the syntactically correct order. Consider the infinite possibilities of morpheme combinations, this same concept applies to word combinations. Syntax provides a constrained structure to these possible combinations, thus serving as the linguistic tool that allows to speakers to effectively communicate through language.

Semantics

Where syntax provides language structure, semantics is concerned with language meaning. Semantic awareness refers to the set of rules by which we derive meanings from morphemes, words, and sentences. There are many branches of semantics including formal semantics, conceptual semantics, and lexical semantics. The latter deals specifically with word meanings and relationships, for example read is more closely semantically related to library than it is to orange. Semantics can also include knowledge of multiple meanings of words. Thus, while a child may be familiar with reading, does this same child also know book, library, fiction, and non-fiction? When considering semantic awareness together with the aforementioned components it because evident that there are many components to understanding the word read.

Word reading

The first four components of reading were related to oral language proficiency and directly informed by the field of linguistics. There is no question that oral language proficiency is important, however word reading is the component of reading that transforms a speaker-hearer into a reader. Word reading refers to the reader's ability to convert graphic information (i.e., words) into linguistic form (i.e., language) . Thus, word reading is the component of reading that connects linguistic components of language proficiency (i.e., vocabulary, morphology, syntax, and semantics) to the text.

Components of reading and Latino bilinguals

There is no question that this component view illustrates the multidimensionality of reading. Most work with Latinos, however, often constrains oral language proficiency to a single indicator (e.g., English vocabulary). Further, recent empirical work that has been informed by a more comprehensive view of reading is often intra-language (i.e., only English language components). Bilingual Latinos, however have a linguistic repertoire that is made up of two languages: English and Spanish.

Second Language Perspectives: Linguistic Interdependence Hypothesis

For bilingual children, linguistic structural knowledge is relevant to not one, but two languages and this relationship between these two languages may be developmental (Snow, 1992). For example, Cummins' (1979) linguistic interdependence hypothesis suggests that the knowledge of one language can be positively transferred into another language. This interdependence suggests that for bilinguals, while the actual vocabulary is different between languages, there exists a common underlying proficiency between the two languages. For example, a young Spanish dominant Latino bilingual may refer to "a set of printed sheets of paper that are held together inside a cover" (Merriam-Webster) as a libro. However, just because the child does not have the English word book as part of her vocabulary repertoire does not mean that the child does not know what a book is, the child merely has a different word (i.e., vocabulary) for this particular item. In other words, the idea of a book (libro) is in the child's common underlying proficiency. Further, this child, does not lack in linguistic components that may be shared between libro and book, for example the morphological ability to pluralize both words by adding the /s/ morpheme (i.e., book**s**, libro**s**). This application of Spanish linguistic proficiency into the English language can be referred to as cross-linguistic transfer. This notion of transfer begins to suggest some sort of linguistic advantage for bilinguals, however there is no question that when comparing monolinguals to bilinguals in the US public school system, there is little to no documentation of an actual "bilingual advantage".

One perspective for linguistic interdependence is the threshold hypothesis (Cummins, 1978; Toukomaa & Skutnabb-Kangas, 1977). The threshold hypothesis suggests that a bilingual must have a certain level of linguistic competence in his or her first language in order to see positive benefits in the second, with particular emphasis on how the level of linguistic competence in both languages mediate the effects of their bilingual learning experience (Cummins, 1979). In other words, for a Spanish-English bilingual with a native language of Spanish, under the threshold hypothesis the concern is that a certain threshold of linguistic competence in English must exist in order for positive benefits of transfer to manifest. Similarly, the developmental hypothesis perspective (Cummins 1978; 1979) has suggested that this interdependence between languages is developmental: the level of competence that can transfer is directly related to the type of competence the child has developed in their dominant language. In other words, for a Spanish-English bilingual with a native language of Spanish, under the developmental hypothesis the concern is that there must be a certain level of Spanish language proficiency in order for positive benefits of transfer to manifest. Thus, the threshold hypothesis is concerned with sufficient second language (L2) development, where developmental interdependence is concerned is with sufficient native language (L1) competence.

When considering the cross-linguistic relationship between components of reading, specific similarities and differences between the Spanish and English language may a play in role in the interdependence of linguistic components. For example, given the similar rules of pluralizing nouns between the languages, a child's ability to manipulate word structure in Spanish (e.g., escuela —> escuela**s**) may transfer to English (e.g., schools —> school**s**). Not all cross-linguistic associations, however, are positive. Broad vocabulary, for example, has been empirically documented to be negatively associated across languages. This is not surprising, especially for second language learners, since higher Spanish vocabulary index may mean a lower English vocabulary repertoire, especially when considering sequential bilinguals. Both perspectives of linguistic interdependence are inseparably linked as they both posit a robust relationship between first and second language: the degree of proficiency in the first (or second) language is related to the degree of proficiency in the second (or first).

Synthesis: The Immigrant Paradox and A Component View of Linguistic Interdependence

For K12 educators in the US, helping bilingual children develop sufficient English oral language and reading comprehension is often the primary goal. Two perspectives that can serve useful in examining the development of English oral language and reading comprehension are a component view of reading and the linguistic interdependence hypothesis. First, by drawing from the field of linguistics and unpacking a bilingual Latino child's reading development from a component view we can better understand how distinct components of reading might develop differently and how these different components might independently, and collectively, inform the development of English reading comprehension. Further, in recognizing the potential interdependence between a bilingual's first and second languages an even more robust understanding of the relationships between languages and reading comprehension may emerge. Thus, when merging these perspectives within the context of the immigrant paradox, the first hypothesis is that multiple components (i.e., vocabulary, morphology, syntax, semantics, word reading) play a role in reading comprehension. Second, when considering first and second language perspectives on reading, one might hypothesize that the fact that first generation Latino students are more likely to be Spanish proficient suggests that a developmental perspective of linguistic interdependence would support the idea that first generation students are more likely to depend on their first language, Spanish, in English reading comprehension and therefore Spanish language may be a positive predictor for first generation students, but not the later generations who are more likely to be English dominant. Thus, the interdependence between Spanish and English might be more robust for first generation students. Indeed, unpacking intergenerational trends of English language and reading comprehension development through the perspectives of a component view of reading and the linguistic interdependence hypothesis among bilinguals is an area ripe for discussion.

The following section presents the empirical research on Latino English oral language and reading comprehension. First, I review the work that examines oral language proficiency and academic performance and their relationship to immigrant generation status. Next, I review two bodies of literature on English language and English reading comprehension: the first examines English oral language development and its relationship to English reading comprehension and the second reviews the literature on cross-language transfer from Spanish oral language to English language and reading comprehension. Finally, I synthesize the findings from the three bodies of literature and identify areas that warrant further research.

Literature Review Overview

There is a need to more closely examine language and reading comprehension among bilingual children in the elementary grades. Of the current literature base there are two general trends when comparing bilinguals to their monolingual peers. First, in regard to word reading ability, bilingual children perform about on par with their monolingual peers (Jongejan et al., 2007; Lesaux et al., 2006; Mancilla-Martinez & Lesaux, 2011; Nakamoto, Lindsey, and Manis, 2008). However, in regard to English oral language proficiency (e.g., vocabulary), bilingual children tend to have lower levels of vocabulary (August, Carlo, Dressler, & Snow, 2005; Cummins 1991; Mancilla-Martinez & Lesaux, 2011b). This is particularly concerning given the relationship between oral language and reading comprehension (Hoover & Gough, 1990).

The first section describes the parameters within which literature was selected for review, including operationalizing the key terms. The next section reviews the work that has examined the intergenerational trends among Latino immigrants, focusing primarily on Spanish oral language, English oral language, English reading comprehension, and the relationships between these components. The next section is framed through a component view of language and reviews the literature that examines oral language proficiency among bilingual Latinos. The empirical research presented in this section is organized by the following four components of reading: vocabulary, morphology, syntax, and semantics. Each section unpacks the predictive relationship between the respective component of language and English reading comprehension. The next section presents the research on cross-language transfer among Spanish-English bilingual children. This section is organized into two main sections: the first unpacks the relationship of Spanish linguistic components to their respective components in English and the second reviews the statistical testing of dual-language models of reading comprehension. A final section synthesizes the main findings across the three bodies of literature, suggesting that immigrant generation status might help better unpack relationships between Spanish oral language, English oral language, and English reading comprehension.

Literature Criteria and Operationalization of Key Terms

Linguists often distinguish between language learning and language acquisition or development, in which learning refers to receiving formal second language instruction (e.g., in a language classroom) and acquisition or development refers to the informal process of language learning (e.g., through immersion and exposure). The body of literature on language learning encompasses the research on second language acquisition (SLA), which is often experimental in nature; SLA work also tends to focus on adults and/or focuses on those who demonstrate strong first language proficiency (Bigelow & Tarone, 2004; Tarone, Bigelow, & Hanson, 2009). Given that the population of interest is children, literature that has focused on adults was excluded.

Bauer and Gort (2012), among other researchers (see: Moll, Saez, & Dworin, 2001; Reyes, 2006), often discuss bilingualism and biliteracy as "the ongoing, dynamic development of concepts and expertise for thinking, listening, speaking, reading, and writing in two languages" (p.2). Consequently, research on bilingual language and literacy development focuses primarily on two environments: the home and the school. Of the more traditional SLA research among young children and their home, however, emphasis is often on type and/or age of exposure (e.g., sequential vs. simultaneous bilingualism), which is not a focus of this dissertation. Further, much of the bilingual research concentrated in education is often comparative in nature and examines effects of different bilingual models on bilingual development. The majority of young bilingual children in the US, however, are not receiving formal language instruction. Unless otherwise specified, studies that focus on age of acquisition, language education, or bilingual education were excluded from this review.

Bilingual children. For the purpose of this review, bilingual children will refer to children who possess dual-language ability to speak and/or read, to some extent. Specifically, this dissertation is concerned with Latinos, thus unless otherwise specified bilingual children will refer to children with dual-language ability in Spanish and

English. Some researchers (e.g., Lesaux and colleagues; Nakamoto and colleagues) refer to this same population of interest as language minority students (LM) or English Learners (EL), however the defining features are the same. It is also worth noting that while the Latino population makes up nearly a quarter of all school age children (Fry & Passal, 2009), not all Latinos in the US are necessarily bilingual. Thus, unless otherwise specified the literature reviewed was also constrained to research which focused on the bilingual Latino population attending school in the US.

Immigrant generation status. Drawing from previous research on immigrant generation status (Alba & Silberman, 2009; Hernandez, Denton, & McCartney, 2006; Portes & Rumbaut, 2001) I use the following definitions: first generation immigrants are those who were not born in the US and therefore immigrated to the US at some time after birth; second generation immigrants are those who are born in the US and have at least one parent who migrated to the US from their birth country. The immigration literature also recognizes third generation and beyond, which refers to children who have grand- or great-grand parents from a country outside the US, but both their parents and themselves were born in the US. Given that the vast majority of third-generation and beyond are native-English speakers (Veltman, 1983) third generation Latinos were not a primary focus of this literature review. In summary, for the purpose of these literature reviews, bilingual children are understood to be Spanish-English speaking Latinos attending the US public school system; further, each child belongs to a respective immigrant generation status, which is determined by their own and parental birthplace.

Oral language proficiency and components of reading. Components of reading consist of word reading and four components of oral language proficiency:

vocabulary, morphology, syntax, and semantics. A vast number of education researchers that have examined oral language proficiency among bilinguals and common indicators for oral language proficiency often include an index of vocabulary and/or a subtest for a respective linguistic component such as syntax. Regardless of the measures used many researchers discuss findings in terms of "oral language proficiency" as opposed to just "vocabulary". Given my focus on specific components of language, I take a more compartmentalized lens and therefore the interpretation of the literature gives particular attention to the specific manner in which oral language proficiency has been operationalized by the respective researcher. Thus, where previous work has operationalized vocabulary (or other components or composites of components) as oral language proficiency, I will discuss the findings in terms of vocabulary (or additional components).

English reading comprehension. Due to the fact that biliteracy development is not a primary focus of this dissertation, literature was constrained to studies that examine English reading comprehension. Further, given that English is the dominant language in the US and that the majority of Spanish-English bilinguals are educated in an English-only education setting, understanding how the bilingual language development relates to English reading comprehension is a critical area of concern. While the focus is reading comprehension, it is difficult to discuss reading comprehension without also recognizing word reading ability. English word reading is simply meant to refer to students' ability to decode words in isolation whereas English reading comprehension refers to students' ability to make meaningful sense from complete sentences and passages. There is a sizable body of literature on English reading comprehension and thus parameters were set to only include those studies which focus on English reading comprehension among Spanish-English bilinguals attending elementary school in the US public school system.

Literature Review: Immigrant Status and Oral Language

Bilingual researchers have argued that bilingual children are not "perfectly bilingual" (Snow, 1998) suggesting that their dual language ability varies on a number of levels (Bialystok, 1988; Bialystok, 1997; Hornberger, 2008). Arguably, this varying language and literacy proficiency is related to specific language development experiences, which are influenced by contextual factors unique to the bilingual Latino child. For instance, bilingual children vary in unique experiences such as language of instruction (Tong, Irby, Lara-Alecio, & Mathes, 2008) and home language use (Gonzalez & Uhing, 2006). Beyond these specific language experiences, however, are additional distal factors that are, arguably, related to bilingual child development. One of these distal factors is immigrant status.

Since 1970 the foreign-born population, primarily from Latin America (Gibson & Lennon, 1999), of the US has increased rapidly and according to the most recent US Census Bureau (2010) Latinos are currently the largest sub-group of immigrants residing in the US. While immigration is not a new phenomenon in the US, it was not until the 1999 volume of the *Historical Census Statistics of Foreign-born population of the United States: 1950-1990* that the volume included information regarding mother tongue and language spoken in the home. Thus, the conversation on immigrant status and language is relatively new, especially given the US' long history of immigrants. In regard to status, immigrants can be categorized by their generation status, which is related to both their own and their parents' country of birth. The literature on generation trends within the

Latino population has focused on issues related, but not limited to, English language acquisition, academic performance, aspirations, and, to a lesser degree, Spanish language maintenance.

The Immigrant Paradox

When looking across the three generations, 43 percent of first generation Latinos are not fluent in English; this number is cut in half by the second generation (21%), and by the third generation only 5% are not fluent in English (Fry & Passel, 2009; U.S. Census Bureau, 1993), in fact by the third generation many Latinos can be considered native English speakers (Veltman, 1983). Thus, in general, across generations the Spanish language becomes less and less present as English becomes the dominant language. For example, Portes and Hao (1998) surveyed second-generation students in eighth and ninth grade to investigate experiences that may be predictive of Spanish language maintenance. It was found that co-ethnic relationships, parental language use, and interactions with non-parent family members who shared the native tongue were significant predictors of Spanish language retention. It is not entirely surprising that more interaction with those who speak Spanish is more likely to result in Spanish maintenance and similar findings have been confirmed in later work. For instance, Gonzalez and Uhing (2008) also found that among 48 Latino families time spent with extended Spanish speaking-family accounted for the greatest amount of variance in Spanish language proficiency. Similarly, Alba, Logan, Lutz and Stuts (2002) examined the home language of children of contemporary Chinese, Cuban, and Mexican immigrants. For the purpose of this review, only the Latino findings will be discussed. Through the use of logistic regression modeling, Alba et al (2002) examined predictors related to preference for speaking English vs. speaking English and Spanish. It was found that the percentage of English-only preference was highest for in the third generation and language spoken by the adults in the home carried the most weight in influencing English acquisition and Spanish maintenance. Given that non-English language practices are more strongly associated with Spanish maintenance and since earlier generations are more likely to engage in these practices, it would seem logical that the by third generation (and later) English is the more dominant language.

Interestingly, though, while English language proficiency and use increases across generations, at the same time a documented decline in academic performance across generations has also been found in the literature. Research, for instance, has found that first and second generation Mexican immigrants demonstrate higher academic performance than their third-generation peers (Gibson, 1997; Kimball, 1968; Nielsen & Fernandez, 1981; Portes & Rumbaut, 1996; Schumaker & Getter, 1977; Suarez-Orozco & Suarez-Orozco, 1995; Vigil, 1997). For example, using data from the Longitudinal Immigrant Student Adaption Study (LISA), Suarez-Orozco, Rhodes, and Milburn (2009) used SEM to examine the patterns of adaption of 408 recently arrived immigrant youth. It was found that academic performance began to drop during the second and third year of the study, with a steeper decline in the fourth and fifth year of the study. Related work of Hao and Woo (2012) used growth mixture modeling to examine 10,795 children of immigrants in the National Longitudinal Study of Adolescent Health and the Adolescent Health and Academic Achievement study and found that children who immigrated to the US in middle childhood or early adolescence (*e.g., 1.5 generation*) had an advantage in academic achievement and school engagement; this pattern held for Latinos.

Previous research with younger cohorts of Latino immigrants has yielded similar results. For example, Kao (2004) used the National Education Longitudinal Study (NELS, 1988) dataset and also found that despite the fact that third generation Latino children tend to have better educated parents and live in homes with slightly better income than their first and second generation peers when it comes to academic performance there is still an immigrant and children of immigrants advantage. In an attempt to further unpack this first and second generation advantage Kao (2004) used OLS regression to examine the role of parent-child relationships on academic performance; it was found that even after accounting for educational aspirations and parent-child relationships the effects of a first and second generation advantage remained in all academic subjects with the exception of reading. In contrast, Hao and Bronstead-Burns (1998) also used the NELS (1988) dataset and found that when specifically examining a Mexican sub-sample the second-generation immigrants fared worse academically than their third generation peers. Later work of Hao and Ma (2012) found that among Latinos, non-Mexican children of immigrants (*i.e., second generation*) perform better academically than their third generation peers. When taken together these findings point to the variability within the immigrant population, suggesting that generation status may actually be a proxy for another factor, such as language. For example, in the work of Hao and Bronstead-Burns (1998) it was also found that Spanish was significantly and positively predictive to both math scores and GPA among Mexican eighth graders.

Buriel and Cardoza (1988) used data from the High School and Beyond Study (Jones, Clarke, Mooney, McWilliams, Crawford, Stephenson, Tourangeau, & Peng,

1982) to examine the role of Spanish language in academic achievement. They used four variables for Spanish language: mother tongue, home language, Spanish oral proficiency, and Spanish literacy; these variables were used as predictors for three components academic achievement, math, reading, and vocabulary. Descriptively, the data followed the intergenerational trend of diminishing Spanish and increasing English. While they found no differences across generations in regard to performance, Buriel and Cardoza (1988) ran separate regression models for each generation, using the Spanish language indicators as predictors for academic achievement. Interestingly, the Spanish environment had no effect on first or second generation academic performance, however in regards to the third generation there were mixed results. For the third generation Spanish oral language had a negative effect on all three academic indicators (i.e., math, reading, vocabulary), however there was a positive effect of Spanish literacy on English reading scores. Thus, third generation children who possessed strong Spanish literacy skills performed better in reading than their monoliterate third generation peers. These findings suggest that there may be a threshold of Spanish proficiency necessary in order for there to be an L1 advantage. Although this work was not focused on immigrant generation status, similar work of Golash-Boza (2005) with the Children of Immigrants Longitudinal Study (CILS, 1992-1993; 1995-1996) dataset found that bilingual Latinos in Miami significantly outperformed their English-dominant Latino peers in reading, math, and GPA.

Additional work that was not limited to Latinos (Palacios, Guttmannova, and Chase-Lansdale, 2008) examined 16,395 children from the ECLS-K national cohort to examine generation status and academic achievement. While analyses suggested that first and second generation children had higher achievement, when additional demographic variables (e.g, race, family, school characteristics) were included in their multi-level model the positive association between first generation status and performance was reduced. Similar work by Gick and White (2003) examined academic trajectories across generations with the same NELS (1988) and HSB (1980) datasets mentioned earlier; they found that while generation status was found to be predictive of academic performance their work suggested that the best predictors of academic trajectories were more familial related variables such as SES and family structure.

Summary

There is no question that in regard to language and academic performance, Latino immigrants and their children are not uniform. Spanish and English language proficiencies vary across generation with higher Spanish language practices occurring in the first generation (Alba et al, 2002; Buriel & Cardoza, 1988; Portes & Hao, 1998; Hurtado & Vega 2004). However, just as language practices vary across generations, there also appears to be a generational trend in regard to academic performance. When considering the unique experiences of bilingual children, immigrant status is one context that can give insight to the development of English language and reading comprehension.

Literature Review: English Language and English Reading Among Bilingual Latinos

Latino children's abilities to read in English are typically considered on two levels: word reading ability and reading comprehension. These patterns of English reading development among bilinguals have two interesting trends. First, in regard to word reading ability, research has documented that bilingual children perform about on par with their monolingual peers (Jongejan et al., 2007; Lesaux et al., 2006; Genesee, Lindholm-Lery, Saunders, & Christian, 2006; Lesaux, Geva, Koda, Siegel, & Shananhan, 2008; Lesaux & Siegel, 2003; Lindsey et al, 2003). Thus, word reading, generally, is not a major concern for bilingual Latinos. In contrast, however, among ELLs in middle-elementary school grades there is a disproportionate prevalence of English reading comprehension difficulties (Kieffer, 2010; NCES, 2009).

Given the relationship between oral language and reading comprehension (Hoover & Gough, 1990), the stark difference between monolinguals and bilinguals when it comes to reading comprehension (August & Hakuta, 1997; Farnia & Geva, 2011; Lesaux et al, 2008; Slavin & Cheung, 2003) is likely related to the fact that for bilinguals English oral language develops more slowly than word reading skills (August, Carlo, Dressler, & Snow; Cummins, 1991). Indeed, early research investigating the English reading performance of English as a Second Language (ESL) students has suggested that is there a positive relationship between oral ability in the second language (L2) and L2 reading ability (Fitzgerald, 1995). Given the established relationship between word reading and reading comprehension (e.g., Hoover & Gough, 1990) and the fact that bilingual Latinos do not have issues with word reading (e.g., Lesaux et al., 2006), there is no question that the role of the linguistic components of reading are an area ripe for investigation.

English language components

The focus of this review is constrained to specific linguistic components of language including vocabulary, morphology, syntax, and semantics and their predictive relationship to reading comprehension. This review is divided into two distinct sections. The first section reviews the literature on the predictive role of early oral language (i.e., pre-k, kindergarten, first grade) on later reading comprehension ability (e.g., from third grade forward). The majority of research reviewed in this section is focused on vocabulary and given the nature of the research all studies in this section are longitudinal by design. The subsequent section focuses on research that examines linguistic components in middle elementary school (i.e., from third grade forward) and their predictive relationship to reading comprehension; this section includes both cross-sectional and longitudinal studies; this latter section includes four sub-sections each focusing on a specific linguistic component.

Components of early oral language. Work with monolinguals has suggested the predictive power of oral language on reading comprehension (e.g., (Catts et al, 2006; Cunningham & Stanovich, 1997; Senechal & LeFevre, 2002; Snow, Porche, Tabors, & Harris, 2007; Storch & Whithurst, 2002). Research, however, has documented that levels of English oral language proficiency, particularly around vocabulary, between monolinguals and bilinguals are not uniform. Regardless of below-proficient levels, research still documents a predictive relationship between vocabulary and reading comprehension (e.g., Davison, Hammer & Lawrence, 2011; Hammer, Lawrence, & Miccio, 2008). Kieffer (2012), for example, analyzed the longitudinal relationship between vocabulary in English and later reading comprehension with 296 Spanish-Speaking ELLS from the ECLS-K dataset (Tourangeau et al., 2009). In a model that included Kindergarten listening comprehension, vocabulary, and oral story recall on reading comprehension at third grade, vocabulary was found to be a moderate predictor ($\beta=.29$). This finding, however, did not hold when predicting for reading comprehension growth from third to eighth grade. Further, Kieffer also collapsed the three variables of interest into one composite for oral language and the standardized coefficient vocabulary on reading comprehension (β =.*29*) was slightly higher than the composite variable for oral language (β =.*20*). This work has two significant findings: first, it suggests the role of early oral language on later reading comprehension and second, this work points to the power of examining individual components of language.

Similar work of Nakamoto, Lindsey, and Manis (2007) examined the development of word reading ability and reading comprehension among a sample of 261 Latino ELLs from first through sixth grade. Of particular interest was that their final model for reading comprehension demonstrated that lower oral language ability was associated with higher initial growth on reading comprehension, however this growth rate did not hold. In fact, when examining reading comprehension at the later grades, these same students showed a rapid deceleration from third to sixth grade. In contrast while students with higher initial oral language ability did not experience rapid initial growth in reading comprehension, reading comprehension development at the later grades did not decelerate as rapidly as their less orally proficient peers. In line with Kieffer (2012), this emphasized the important role of early oral language in later reading comprehension. Work with older bilingual children has yielded similar results, for instance in their study of 55 bilinguals from fifth grade into seventh grade Mancilla-Martinez, Kieffer, Biancarosa, Chortoulou, and Snow (2009) found listening and word reading ability in fifth grade to be significant predictors for students' developmental trajectories in reading comprehension; this finding, however, did not hold for growth. Related work with 251 Latino bilinguals (Manis et al., 2004) found that Kindergarten and first grade English vocabulary predicted second grade English reading. While these studies demonstrated the importance of vocabulary at the younger years, vocabulary is not time invariant. Thus, if varying levels of early vocabulary are predictive of later reading comprehension and reading comprehension growth, what about the ongoing vocabulary development that occurs as a child progresses through school?

Mancilla-Martinez and Lesaux (2010) address this question in their longitudinal study that focused on both initial status and rate of growth of vocabulary as predictors for reading comprehension. Participants began the study in a Head Start program and were followed through second grade; 173 were then re-recruited in fifth grade giving a total of six time points: fall of preschool, spring of preschool, kindergarten, first grade, second grade, fifth grade. Longitudinal structural equation modeling revealed that both initial status (r=.33) and growth rate (r=.42) of vocabulary were significant, positive predictors of fifth grade reading comprehension. These findings suggested the developmental relationship between vocabulary and reading comprehension. It is worth mentioning, however, that Mancilla-Martinez and Lesaux (2010) also found word reading initial status (r=.97) and growth rate (r=.68) were also positive predictors for fifth grade reading comprehension. Indeed, the word reading effects were stronger than those of vocabulary, emphasizing the need to more closely examine the role of vocabulary, along with additional components of language, at later periods of development. Related work of Mancilla-Martinez and Lesaux (2011) has also illustrated that over a 6.5-year period even with vocabulary growth rates that exceeded national norms, bilingual Latinos were still performing below age-appropriate norms. Given the robust relationship between oral language and reading comprehension, examining oral language development throughout elementary school is an important are of concern.

Components of oral language in middle elementary school. There are, arguably, many components related to reading comprehension and indeed research with ELLs has debated which variables to include when examining reading comprehension (e.g., Grant, Gottardo, and Geva, 2011; Kirby & Savage, 2008; Oulette & Beers, 2009). Given the documented predictive power of early vocabulary (e.g., Keiffer, 2012; Nakamoto et al., 2007) and growth of vocabulary (Mancila-Martinez and Lesaux, 2010) on later reading comprehension, it would make sense to also examine the predictive strength of vocabulary at certain periods in elementary school on reading comprehension. Vocabulary, however, is not the sole component of language and researchers have suggested that the use of multiple components of language as opposed to only vocabulary can yield more substantial information regarding the relationship between oral language proficiency and reading comprehension.

Vocabulary. Cross-sectional work with older students (Proctor et al., 2005) used SEM to examine the English reading comprehension of 135 Spanish-speaking fourth grade ELLs. This model for reading comprehension included two components of oral language: vocabulary and listening comprehension. Results revealed a stronger effect for listening comprehension ($\beta = .72, p<.001$) and vocabulary knowledge ($\beta = .30, p<.001$) than for decoding skills ($\beta = .18, p<.01$). Lesaux, Crosson, Kieffer, & Pierce (2010) yielded similar results in their examination of a group of 87 native-Spanish speaking ELLs attending a TBE program. Participants were followed from fourth into fifth grade and were assessed on their English reading comprehension. SEM was used to test both a within- and cross-language model of vocabulary, reading fluency, and word reading on reading comprehension. Results showed a good fit for the English language model

(X^2*=18.44, CFI=.965, RMSEA=.089*) with vocabulary as a strong, statistically significant predictor for reading comprehension. In contrast to the work of Proctor et al (2005), word reading was not found to be significant, the work of Proctor and colleagues, however, did find vocabulary to have a stronger standardized coefficient that word reading ability, thus when taken together both studies pointed to the power of vocabulary above and beyond that of word reading ability.

Related work of Grant, Gottardo, and Geva (2011) also examined the relationship between vocabulary and reading comprehension in a 5-year longitudinal study that followed children from kindergarten into fourth grade. Due to challenges with both recruitment and attrition, new participants were added each year of the study, thus creating sub-samples of cohorts within the larger study. Grant et al. (2011) examined two of these cohorts: one wave of 26 third graders in 2006 and another wave of 22 third graders collected in the following year. The first cohort demonstrated lower reading performance when compared to their peers in the second cohort and therefore the cohorts were analyzed separately; these two cohorts yielded different findings. The first cohort showed a moderate correlation between receptive vocabulary and reading comprehension ($r = .478, p<.05$), however the relationship was stronger for those in the second cohort ($r=.765, p<.001$). Further, for the stronger readers both decoding ($r=.733, p<.001$) and vocabulary ($r=.765, p<.001$) were related to reading comprehension, however for the first cohort this relationship only held for decoding ($r=.733, p<.001$). Related work of Nakamoto et al (2007) found first grade Spanish vocabulary to be a negative predictor of sixth grade reading comprehension among 261 Latino bilinguals such that lower vocabulary scores predicted more rapid initial growth. This trend deems logical as students who start with lower vocabulary would have more room for growth. In contrast, the work of Neufield, Amendeum, Fitzgerald, and Guthrie (2006) found that for 68 first grade Latinos (note: 19 of whom were monolingual English speakers) growth in instructional reading level was not related to English oral language. Related work (Fitzgerald, Amendum, Relyea, & Garcia, 2015) followed 41 Latino first and second graders for two academic years and found that instructional reading level growth varied as a function of English vocabulary such that instructional reading level growth was slower for those with lower English vocabulary. These studies highlight the important role of English vocabulary in English reading comprehension, particularly in the earlier grades.

This work builds on previous work of Lesaux et al. (2010) and Proctor et al. (2005), suggesting that while the role of vocabulary is important, this relationship is contingent on actual reading ability. In other words, less skilled readers may rely more heavily on word reading ability than vocabulary. When considering the previously mentioned longitudinal work of Mancilla-Martinez and Leseaux (2010), the findings of Grant et al (2011) may serve useful: the underwhelming role of vocabulary in the work of Mancilla-Martinez and Lesaux (2010) may be a function of the well-below average performance on reading comprehension. Another explanation for the strong effect of word reading in the Mancilla-Martinez and Lesaux (2010) study may be that the variance in reading comprehension could be explained by additional components of language. For example, related work that has included additional components of linguistic comprehension has suggested the predictive power of linguistic comprehension above and beyond that of word reading ability.

Morphology. The work of Kieffer and Lesaux (2008) examined the relationship between morphological awareness and reading comprehension among older bilingual Latino ELLs; they followed 87 fourth graders into fifth grade. In a final model including word reading, vocabulary, and phonological awareness, multiple regression analyses revealed that fourth grade morphological awareness was a significant predictor on two different measures of fifth grade reading comprehension (i.e., Woodcock-Munoz Passage Comprehension subtest and Gates-MacGininitie Reading Comprehension). Particularly noteworthy was that when predicting for fourth grade reading comprehension, vocabulary ($\beta = .333, p < .05$) was the single significant predictor less than a .05 significance level; however when this same model was used to predict fifth grade reading comprehension the effect of vocabulary was no longer present at the .05 significance level ($\beta = .184, p < .10$), whereas morphology was a significant, positive predictor ($\beta = .388, p < .01$) when reading comprehension was measured through a close exercise. Kieffer and Lessaux (2008) also assessed reading comprehension as a test of passages followed by corresponding multiple choice questions and in this case both vocabulary ($\beta = .407, p < .001$) and syntax ($\beta = .329, p < .01$) were significant predictors for fifth grade reading comprehension.

Related work of Proctor et al. (2012) examined the English reading comprehension of 295 Spanish-English bilingual and English monolingual students in second, third, and fourth grade. Similar to previous work, Proctor and colleagues tested a model that controlled for word reading and vocabulary breadth, since the sample included native-Spanish speaking bilinguals and native-English speaking monolinguals across three different grades they also controlled for language status (*i.e., monolingual and* *bilingual*) and grade level. In contrast to previous work (Keiffer & Lesaux, 2008), however, morphology was not found to be predictive of reading comprehension. This work, however, included monolinguals in their analyses and unlike Kieffer and Lesaux (2008), reading comprehension was a composite variable of three different measures. A related study that used a sub-sample of the Proctor et al. (2012) work, also informed by a component view of language, developed a model for English reading comprehension. With a sample of 123 Latino bilinguals, Leider et al. (2013) tested a model that included English oral language (*i.e., vocabulary breadth, semantics, morphology, and syntax*), Spanish oral language (*i.e., vocabulary breadth and syntax*), and a dichotomous indicator of Spanish reading ability *(i.e., ability to read in Spanish)*. Similar to the work of Kieffer and Lesaux (2008), this particular model was tested against different measures of English reading comprehension and yielded mixed results depending on the literacy task at hand. When English reading comprehension was assessed as the same two reading comprehension measures as the Kieffer and Lesaux (2008) study, morphology was not found to be predictive, however Leider et al. (2013) did find morphology to be a significant predictor in a silent reading sentence judgment task. Thus, while findings of morphology on reading comprehension with Spanish-English bilinguals has yielded contradictory results, empirical work has suggested its role in reading comprehension among elementary-aged Latinos.

Syntax. Empirical research has also suggested the predictive power of syntax in reading comprehension among elementary-age Latinos. For example, the work of Swanson, Rosston, Gerber, and Solari (2008) examined the relationship between oral language (i.e., vocabulary and syntax) and phonological processing in reading comprehension among 68 Spanish-English bilingual third graders. This study was focused on cross-language effects, thus their hierarchal regression analysis included measures of vocabulary, syntax, and phonological processing in both English and Spanish. This work is particularly noteworthy as results for their final model for reading comprehension revealed a significant positive effect of English syntax ($\beta = .63, p < .001$) with null effects of vocabulary. Related work of Proctor et al. (2012) also examining the predictive power of syntax in reading comprehension found syntax to be a significant predictor for reading comprehension at the start of the academic year among a sample of 295 Spanish-English bilinguals and English monolinguals in second, third, and fourth grade. Using a bilingual sub-sample from the same study, Leider and colleagues (2013) also found syntax to be a significant predictor and this finding held for two different reading measures: a cloze exercise English syntax ($\beta = .312, p < .05$) and a silent reading sentence judgment task ($\beta = .242, p < .05$). Further, for the cloze exercise, vocabulary was also a significant predictor ($\beta = .287, p < .05$), whereas on the silent reading sentence judgment task word reading was significant predictor($\beta = .275, p < .05$). This could, arguably, be a function of the higher level of syntactical and cognitive demand required of the silent reading sentence judgment task, thus performance on this task may be constraining the readers to rely more on their decoding ability. This also suggests that relationships between language and literacy may vary depending on the observed linguistic components. Given the limited work examining syntax and reading comprehension among elementary-aged bilingual Latinos it is worth mentioning that a study of 284 sixth graders in Canada with limited English proficiency (Low & Siegel, 2005) also found syntax to be a significant predictor for reading comprehension.

Semantics. Another noteworthy component of language is that of semantics. The related works of Proctor et al (2012) and Leider et al (2013) were concerned with the role of semantic awareness in predicting reading comprehension and both researchers found semantics to be predictive of reading comprehension. In fact when Proctor et al (2012) included both the bilingual and monolingual sample both semantics and syntax were found to be positively predictive of initial status of reading comprehension, however when they replicated the model using only the bilingual sample semantics was the only significant predictor (β =.31). Leider and colleagues (2013) yielded similar results, finding semantics ($\beta = .263, p<.05$) to be the only language component that was predictive of their multiple choice assessment for reading. Although this work included monolinguals, the work of Proctor et al (2009) examined the role of English semantic awareness in predicting English reading comprehension among 35 monolingual and bilingual fifth graders. Their sample was small, but English semantics was also found to be a significant predictor to English reading comprehension and when included in the full model it increased the overall variation an additional 3%. Thus, the final model, which also included decoding and vocabulary, explained a total of 80% of the variation in reading comprehension. Albeit limited, these studies suggest that semantic awareness may be an especially important component in reading comprehension for Latino bilinguals. Given that this body of work is limited it is worth mentioning that similar studies with monolinguals have yielded similar results for both semantics (Nation & Snowling, 2004; Tannenbaum, Torgeson, & Wagner, 2006) and morphology (Deacon & Kirby, 2004; Nagy, Berninger, & Abbot, 2006; Kuo & Anderson, 2006).

Summary

Research has suggested that for bilingual Latinos, various components of language have a relationship to reading comprehension. While the nature of these relationships is complex, there are, however, two major implications within this complexity. First, research continues to document the predictive power of oral language proficiency on reading comprehension. Indeed, multiple components of oral language, individually and collectively, have been documented to predict reading comprehension ability and this relationship, has been shown to vary as a function of English oral language proficiency. The work of Grant et al (2011), for example, demonstrated that the effect of vocabulary over decoding is stronger for more advanced readers, suggesting that the relationship between oral language and reading comprehension is constrained by a certain degree of English linguistic proficiency (e.g., Grant et al.. 2011; Leider et al., 2013). Thus, the first implication is to further investigate this relationship as a function of variation in language proficiency.

The second implication from this body of research is related to the first: while there is no question of variation in oral language proficiency, this variation among bilingual students, occurs in both English as well as Spanish. For example, the work of Grant et al (2011) suggested that for the cohort of more proficient readers vocabulary held more predictive power than word reading. One way to interpret this finding is that the two cohorts differed in their English proficiency: the significant differences between the two cohorts demonstrate that one cohort has higher English language proficiency. However, another, yet similar, interpretation is to say they differed in *Spanish* language comprehension: perhaps lower proficiency on English language components is a proxy for Spanish language dominance. While Grant et al. (2011) did not examine Spanish language comprehension the work of Proctor et al (2012) did examine variation in the linguistic components between two bilingual Latino groups: ELL and non-ELL. In this comparison, the non-ELL bilingual group significantly outperformed their ELL peers on all measures of linguistic competence (i.e., expressive vocabulary, morphology, syntax, semantics). This is not too surprising as ELL status is determined by English language proficiency. However, when comparing these two groups on levels of *Spanish* linguistic competence (i.e., vocabulary, syntax) a different pattern emerged: there was no significant difference of syntax, but ELL students significantly outperformed their non-ELL peers on expressive vocabulary. Similar work of Leider et al. (2013) compared a group of Latino monoliterate and biliterate (i.e., demonstrated ability to read in English *and* Spanish) students and while the monoliterate group demonstrated stronger English vocabulary skills, the biliterate sample demonstrated better English word reading skills in addition to higher Spanish vocabulary, Spanish syntactical awareness, and Spanish word reading ability. These two comparisons point to the rich *dual-language* diversity of linguistic comprehension among bilingual Latinos.

Literature Review: Cross Language Transfer and Spanish-English Models of English Reading Comprehension

Research which has examined English oral language and reading comprehension among bilingual Latinos often compares Latinos to their English-speaking monolingual peers with trends of monolinguals significantly outperforming their bilingual peers. However, if more attention is given to variation within the bilingual population different patterns emerge. For example, the work of Proctor et al. (2012) compared a group of monolingual English speakers to non-ELL bilingual Latinos. The distinction of non-ELL bilinguals identifies this particular group of bilinguals as possessing sufficient enough English language proficiency to participate in the mainstream classroom. In comparing these two groups on vocabulary, morphology, syntax, and semantics there were no significant differences between the two populations, save for expressive vocabulary, one of the most common measures for oral language.

Related work of Leider et al (2013) compared biliterate and monoliterate Latino bilinguals and while the monoliterate group demonstrated stronger English vocabulary skills, the biliterate sample demonstrated better English word reading skills in addition to higher Spanish vocabulary, Spanish syntactical awareness, and Spanish word reading ability. These examples demonstrate that for bilingual Latinos, components of language should be considered in both Spanish and English. In fact, not only should researchers be cognizant of both languages, but researchers should also consider the interdependent relationship between components of both languages. Thus, this final literature review unpacks linguistic interdependence among bilingual Latinos. Specifically, the first section unpacks the relationship between linguistic components across languages; the primary focus of this section is to examine how components in Spanish are related to their respective component in English. The next section unpacks the predictive power of cross-linguistic transfer, specifically focusing on how components of Spanish language (i.e., vocabulary, syntax) and Spanish word reading may play a role in English reading comprehension. As in the previous literature review, unless otherwise specified, this review is constrained to work with focuses on Latino bilinguals in the United States.

Cross-language Transfer

Cross-linguistic transfer refers to the idea that a bilingual's two languages are connected and therefore linguistic competence in one language should influence linguistic competence in the other. Thus, when considering native-Spanish speaking Latino bilinguals, cross-linguistic transfer assumes that the development of English is not like developing an entire language again, but rather a process of adapting and extending existing skills and knowledge in Spanish (Corder, 1973). In other words, knowledge and concepts of linguistic competence may be shared across languages.

Some research has documented this predictive power that Spanish linguistic components might have on English. For example, in addition to cross-linguistic correlations in phonological awareness, Quirogoa et al (2002) also found this linguistic component in Spanish was predictive of English word reading suggesting a cross language effect from early Spanish development to later English word reading. Durgunoglu and colleagues (1993) also examined the relationship of Spanish phonological awareness and later English word recognition with a sample of 27 Spanish-dominant Latino first graders. These particular students were in a TBE program and results revealed Spanish phonological awareness significantly predicted English word recognition. Similar work of Riccio, Amado, Jimenez, Hasbrouck, Imhoff, and Denton (2001) found Spanish phonological awareness to be predictive of English reading fluency among 149 Latino students in different bilingual programs in Texas; this particular study included students ranging from 5 to 11, suggesting transfer of phonological awareness to word reading might be developmental.

In a related study, although focused on orthographical skills, Sun-Alperin and Wang (2011) examined how Spanish phonological and orthographical skills influenced English word reading and spelling acquisition among 89 Spanish-English bilinguals in second and third grade. Participants were administered a bilingual battery of phonological and orthographical processing tasks. After controlling for English phonological and orthographic processing, Spanish phonological processing skills significantly predicted a significant amount of variance in English real word and psuedoword reading ($R^2=.06$, *$p<.01$ and $R^2=.07$, $p<.001$, respectively*) and English real and psuedoword spelling ($R^2=.02$ $p<.05$ *and* $R^2=.04$ $p<.01$). Further, Spanish orthographic skills, significantly predicted English real and pseudoword word reading *($R^2=.09$, $p<.001$ and $R^2=.06$, $p<.001$, respectively*) above and beyond the same skills in English and Spanish phonology; this finding did not hold for spelling. Although this study was focused on orthographic skills its findings do support potential for cross-language transfer. The work of Lindsey and colleagues (Lindsey, Manis & Bailey, 2003; Manis, Lindsey & Bailey, 2004) also provides support for cross-language transfer of Spanish phonological skills to English word reading, however, the participants in the work of Lindsey and colleagues received explicit systematic phonics instruction in Spanish and English. Thus, while limited, evidence has suggested that for bilinguals the linguistic component of Spanish phonological processing may be related to English word reading.

Research with monolinguals has suggested that phonological awareness is a linguistic component predictive of reading readiness (Bravo-Valdivieso, 1995; Juel, Griffith, & Gough, 1986; Lombardino, Riccio, Hynd, & Pinheiro, 1997; Stanovich, Cunningham, & Cramer, 1984; Wagner, 1988), thus it is interesting that research has supported a similar cross-language relationship from Spanish to English from the early linguistic component of phonological awareness to English word reading (e.g., Durgunoglu et al., 1993, Quiroga et al., 2002). However, word reading is not an area of concern among bilingual students. Indeed, bilinguals have been documented to perform about on par with their monolingual peers on word reading tasks (Jongejan et al., 2007; Lesaux et al., 2006; Genesee, Lindholm-Lery, Saunders, & Christian, 2006; Lesaux, Geva, Koda, Siegel, & Shananhan, 2008; Lesaux & Siegel, 2003; Lindsey et al, 2003). In contrast, when comparing the two populations on English reading comprehension research has documented an underwhelming performance from bilingual students. Research, however that compares bilingual students to their monolingual peers on reading comprehension does not account for the diversity of ability across linguistic components. For example, case study work of Jimenez, Garcia, and Pearson (1995) examined reading among three Spanish-English bilinguals. Although exploratory and small, qualitative analysis suggested that more proficient bilingual readers may be able to transfer reading skills across languages. Related quantitative work of Lesaux, Crosson, Kieffer, and Pierce (2010) with 87 fourth grade Latino ELLs in a TBE program used SEM to examine the role of Spanish oral language and Spanish word reading on English reading comprehension. While Lesaux et al. (2010) did find not evidence for cross-language transfer, this work emphasizes the enigmatic question of the predictive role of Spanish linguistic components on English reading comprehension.

Research which has unpacked the cross-language relationship of Spanish on English is not only limited, but given the fact that the majority of Latinos receive literacy instruction exclusively in English, researchers must also account for the role, and possible interaction, of English linguistic components on English reading comprehension. Thus, a common method in examining the Spanish-English linguistic-interdependence is through the statistical testing of theoretically informed dual-language models of reading comprehension.

Dual-language Models of Reading Comprehension in Middle Elementary School

Dual-language models of reading comprehension often include measures of vocabulary and word reading. This approach is logical as it is well established in work with monolinguals that both vocabulary and word reading are statistically significant predictors of reading comprehension, with vocabulary often having more statistical predictive power than word reading. Indeed work with Latinos has also suggested that vocabulary and word reading in English are predictive of English reading comprehension, however the exact relationship does not follow the same monolingual trend. Empirical research has supported the role of English vocabulary above and beyond that of English word reading (e.g., Lesaux et al., 2010; Proctor et al., 2005), however, additional research has also suggested the opposite: word reading having more statistical power than vocabulary.

For example, the longitudinal work of Mancilla-Martinez and Lesaux (2010) focused on both initial status and rate of growth of English vocabulary as predictors for English reading comprehension. Participants began the study in a Head Start program and were followed through second grade; 173 were then re-recruited in fifth grade giving a total of six time points: fall of preschool, spring of preschool, kindergarten, first grade, second grade, fifth grade. While longitudinal structural equation modeling revealed that both initial status ($r = .33$) and growth rate ($r = .42$) of vocabulary were significant, positive predictors of fifth grade reading comprehension, researchers also found word reading initial status (*r=.97*) and growth rate (*r=.68*) to be positive predictors for fifth grade reading comprehension. Indeed, this finding that the effects for word reading were stronger than those of vocabulary suggest that relationships between word reading, vocabulary, and reading comprehension might be different for Spanish-English bilinguals.

Related work of Grant et al. (2011), has unpacked this relationship by examining two cohorts of bilingual Latinos with different English language proficiency. Due to differences between these cohorts analyses were conducted separately, the first cohort of 26 third graders demonstrated lower reading performance when compared to their peers in the second cohort and these two cohorts yielded different findings. The first cohort showed a moderate correlation between receptive vocabulary and reading comprehension ($r = .478, p<.05$), however the relationship was stronger for those in the second cohort of 22 third graders ($r=.765, p<.001$). Further, for the stronger readers both decoding ($r=.733, p<.001$) and vocabulary ($r=.765, p<.001$) were related to reading comprehension, however for the first cohort this relationship only held for decoding ($r=.733, p<.001$).

One explanation for the discrepant finding might be the that these aforementioned models were too limited in their model and the inclusion of additional components of linguistic components in addition to vocabulary might better explain variation in Latino English reading comprehension. Indeed, research that has explored more comprehensive within-language models of reading comprehension including components such as morphology, syntax, and semantics has provided support for the predictive power of

English linguistic components on English reading comprehension. However, another explanation for discrepant findings might be explained by *Spanish* linguistic components. Where the previous section was primarily focused on how ability on specific Spanish linguistic components related to their respective components in English (e.g., Spanish phonological processing —> English phonological processing) this section focuses specifically on the transfer of Spanish linguistic components to English reading comprehension (e.g. Spanish vocabulary —> English reading comprehension). When considering native-Spanish speaking Latino bilinguals, cross-linguistic transfer assumes that the development of English is not like developing an entire language again, but rather a process of adapting and extending existing skills and knowledge (Corder, 1973).

Further, while research among English monolinguals and Spanish-English bilinguals has documented the predictive power of English linguistic components on reading comprehension, Spanish-English bilinguals are not limited to English linguistic components. Thus, the need to also examine the role of Spanish linguistic components on English reading comprehension is warranted. Given both the exclusivity of English-only literacy instruction for the majority of bilingual Latinos in the US and the theoretical view that a bilingual's languages are related, this linguistic-interdependence is most often examined by testing models of reading comprehension that account for linguistic components in both Spanish and English. The following literature examines the potential role for cross-language transfer from Spanish to English for bilingual Latinos.

Null effects. The work of Swanson, Rosston, Gerber, and Solari (2008) examined the cross-language transfer of oral language and phonological processes skills as predictors for reading performance in both Spanish and English. Sixty-eight third graders from southern California were administered a battery including measures of phonological awareness, expressive vocabulary, receptive vocabulary, syntax, word attack, word identification and reading comprehension in both Spanish and English. With the inclusion of both Spanish and English components, the final model found no effects of transfer. Similarly, Lesaux et al. (2010) examined a group of 87 native-Spanish speaking students attending a TBE program. Participants were followed from fourth into fifth grade and were assessed on their English reading comprehension. While results showed a good fit for a within-language model, the cross-language model, which used Spanish language components on English reading comprehension found no significant Spanish predictors for English reading comprehension.

A similar study with younger students (Gottardo & Mueller, 2009) tested the predictive power of first grade Spanish and English word reading, vocabulary, syntactic awareness, and phonological awareness on second grade word reading and reading comprehension among 131 native-Spanish speaking bilinguals. Similar to the work of Swanson et al (2008) and Lesaux et al (2010), there were no cross-language effects. The work of Proctor et al. (2012) also examined the potential for cross-language transfer among Spanish-English bilinguals in second, third, and fourth grade by testing a dual-language model for English reading comprehension initial status and change over an academic year. This study was focused on vocabulary and distinguished between vocabulary breadth and depth, the manner in which these two constructs were operationalized, however, followed a component view of language with vocabulary breadth indexed through a measure of receptive vocabulary and vocabulary depth operationalized as Spanish syntactical awareness. Additional predictors in their model included the following English components: word reading, vocabulary breadth (i.e., receptive vocabulary), morphology, syntax, and semantics. Their final model did not provide evidence for cross-language transfer.

Related work has also examined potential for cross-language transfer on English reading growth. For example, the longitudinal work of Mancilla-Martinez and Lesaux (2010) used SEM to examine the effects of Spanish and English language vocabulary and word reading development in early elementary on later English reading comprehension outcomes at age 11. Participants began the study in a Head Start program and were followed through middle elementary school; Spanish language did not account for any unique variance in fifth grade English reading comprehension. In a similar study (Kieffer, 2012), examined the role of kindergarten Spanish and English oral language on later English reading comprehension and the rate of reading comprehension growth from third to eighth grade. Kieffer (2012) used latent growth modeling to investigate these relationships among 296 Spanish-speaking ELLs from the Early Childhood Longitudinal Study- Kindergarten cohort (ECLS-K; Tourangeau, Le, Nord, & Sorongon, 2009). For this sample, early oral language was not predictive of later rates of growth in English reading. Kieffer (2012), however, did find that early Spanish and English oral language correlated highly with each other suggesting a relationship between the languages, however when examining specific cross-language effects of Spanish oral language on English reading comprehension, only the English component was uniquely predictive. While these aforementioned models for reading comprehension did not providence evidence for transfer, it is worth noting that for the majority of the Spanish-English bilinguals general ability across linguistic components was weak and little attention was focused on the linguistic variability of the sample.

Significant effects and interactions. A small body of work has documented a predictive relationship between Spanish language components and English reading comprehension, however the exact relationship is curious. Manis et al (2004), for example, examined 251 Spanish-speaking ELLs in a TBE program; these students were followed from kindergarten into second grade. Longitudinal regression analyses suggested that there was potential for cross-language transfer from Spanish to English, but the effect for English was stronger. For instance when predicting second grade English reading comprehension, Spanish literacy skills in kindergarten accounted for 20% of the variance. However, upon the addition of first grade English literacy skills into the model the Spanish variables were no longer significant. Follow up commonality analyses yielded similar findings: English accounted for 31% unique variance, Spanish accounted for 2%, and a total of 25% of the variance was shared between English and Spanish components. While the work of Manis et al (2004) was with younger student, similar work with older students has yielded similar findings. The work of Proctor et al. (2006), examined English reading comprehension among 135 Spanish-English in fourth grade. After controlling for language of instruction, English decoding, and English oral language they tested the effects of Spanish language decoding, fluency, and vocabulary on English reading comprehension. Their final model for English reading comprehension explained 67% of the variation with a main effect for Spanish vocabulary (β =.2) and an interaction between Spanish vocabulary and English fluency (β =.7). The significant interaction is particularly noteworthy as it suggests that for more proficient English readers Spanish vocabulary may prove beneficial. While this suggests a Spanish to English transfer, it also suggests that this transfer of Spanish vocabulary may only occur at a certain threshold of English proficiency.

A related longitudinal study (Nakamoto et al, 2008) followed a sample of 282 Spanish-speaking ELLs in a TBE program from third to sixth grade. Through the use of SEM third grade Spanish word reading and oral language skills were used to predict sixth grade English reading comprehension; the oral language skills were a composite of vocabulary and listening comprehension. Nakamoto and colleagues (2008) yield some important findings in cross-language transfer. First, in only examining zero-order correlations there is evidence for cross language-transfer from third grade word reading ($R^2=.19, p<.001$) and third grade oral language ($R^2=.06, p<.001$). However, the zero-order correlations for these respective components in English were stronger ($R^2=.47$ *and* $R^2=.42, ps<.001$, respectively), suggesting that components in English are stronger that their respective components in Spanish. Further, in the full model, which accounted for both within and cross language effects, Spanish oral language did not contribute any unique variance and Spanish word reading accounted for just 1% unique variance. Thus, while there was evidence for a small effect of Spanish components on English reading comprehension the effects of the English components were stronger than Spanish. Similar to the previous work of Proctor and colleagues (2006), Nakamoto et al. tested interactions and also found an interaction between English decoding and Spanish oral language. These findings suggest that more proficient English readers may benefit from Spanish vocabulary.

The work of Leider and colleagues (2013) compliment these findings, although the interpretation is slightly different. With a sample of 123 Latino bilinguals multiple regression was used to test the role of Spanish syntax and Spanish vocabulary above and beyond English language competence in English reading comprehension. For a reading comprehension test that consisted of silent reading and sentence judgment Leider and colleagues (2013) found Spanish syntax to be predictive of English reading comprehension, the effect, however, was negative ($\beta = -.024, p < .05$). English morphology ($\beta = .061$., $p < .05$), English syntax ($\beta = .025, p < .05$), and English word recognition ($\beta = .013, p < .05$) were also positive significant predictors. While one interpretation of this finding could be that high Spanish ability has a negative effect on English reading comprehension, another way to interpret this finding might be that the significant positive effect of English word reading together with the negative effect of Spanish syntax serve as a proxy for lower English proficiency, thus suggesting evidence that positive transfer might be contingent on a certain threshold of language proficiency.

Summary

While the research on Spanish language, English language, and English literacy has provided some evidence for cross-language transfer, it has been suggested that this potential for cross-linguistic transfer may be constrained to the degree of proficiency within the native language. In other words, the more linguistic proficiency a child possess in either language, the more the likelihood for cross-language effects. This idea is captured in the works of Proctor et al. (2006) and Nakamoto et al. (2008), both of whom demonstrated an interaction between Spanish and English components. Further, the majority of these studies not only investigated cross-language transfer, but they also examined within-language effects and, not only were within language predictions stronger than their respective cross-language components, but effects of Spanish were often little to null if English was included in the model (e.g. Mancilla-Martinez & Lesaux, 2010; Manis et al., 2004). Thus, while research with Spanish-English bilinguals has suggested potential for cross-language transfer, the exact nature of this relationship is curious.

Synthesis of the Literature

The three bodies of literature presented have reviewed the English oral language proficiency and reading comprehension of Spanish-English bilingual children from three different, but related perspectives. A common thread throughout the literature is that for Latino children in the United States, English language development and English reading comprehension performance is an important area of concern. The first body of literature addresses the enigma of an immigrant paradox. The major finding in the generation status literature suggests that the immigrant paradox may be related to language proficiency; immigrant generation status might serve as a proxy for language proficiency in either Spanish or English. The research that has examined immigrant status and language and reading development is mixed, thus this relationship warrants more attention. The second literature review was informed by a component view of language and exclusively examined the role of English language components on English reading comprehension. One major finding emerged from this literature: multiple components of linguistic comprehension play a role in reading comprehension and the exact nature of this relationship is related to English oral language proficiency (e.g., Grant et al.. 2011; Leider et al., 2013). However, among Latinos, language competence is not restricted to

English. Thus, the final body of literature was informed by a framework for linguistic interdependence and unpacked the research that has focused on the relationship English and Spanish language components on English reading comprehension. This research on cross-language transfer of Spanish and English provided two important findings. First, components of Spanish language correlated with their respective components in the English language. Second, while there was some evidence of transfer from components of Spanish language to English reading comprehension, the effect of English components was not only stronger (e.g., Nakamoto et al., 2008), but English often cancelled out the Spanish language (e.g., Kieffer, 2012).

When synthesizing the theoretical frameworks informing my view of language and reading along with the main findings from these three bodies of literature it is clear that the development of English oral language and reading comprehension is a dynamic process made up from multiple components. Informing my framework for understanding this dynamic process is recognizing the context of immigrant generation status and how the development of English oral language and reading comprehension might vary across generations. Thus, when considering multiple components of language (i.e., vocabulary, morphology, syntax, semantics) and reading comprehension it is hypothesized that the development of these components will vary depending on generation status. In addition to examining the role of immigrant generation status on the development of English oral language and reading comprehension, my framework for reading comprehension is also informed by a component view of language and the literature on English reading comprehension. Thus, this dissertation also seeks to add to the literature on English reading comprehension by examining the relationship between the development of

English oral language and the development of English reading comprehension. Further, in order to best capture this dynamic process these relationships will be examined longitudinally. Finally, this work is also informed by a theoretical framework of linguistic-interdependence and the literature that has examined effects for cross-language transfer among bilingual Latinos. Given the extant review of the literature this dissertation will add to the knowledge base of English reading comprehension among Latino bilinguals through the development of English language and reading growth trajectories. The methodological approach for developing these trajectories is discussed in the following chapter.

Chapter 3: The Present Study

For young Latinos the role of immigrant generation status on Spanish and English language development has not received much attention. Empirical studies (Bean & Stevens, 2003; Veltman, 1983) and descriptive data from the US Census Bureau (Fry & Passal, 2009; US Census Bureau, 1993), however, suggest an intergenerational shift from Spanish to English, such that the first generation primarily speaks Spanish, the second generation speaks both Spanish and English (to varying degrees), and the third generation primarily speaks English. Indeed, this intergenerational shift suggests the important role of immigrant generation status in the language and reading comprehension development of bilingual Latinos. If first generation students are more likely to be Spanish dominant, arguably their English language and reading development are likely distinctive to their second and third generation peers. Logically, this would suggest a lockstep intergenerational improvement such that second and third generation peers would significantly outperform their first generation peers in English language and reading. Indeed, when considering the intra-linguistic relationship between English oral language and English reading comprehension, the inclusion of generation status may help to further explain between-group differences within the bilingual Latino population.

Further, second and third generation peers who may be more English dominant may not rely as much on the hypothesized bilingual specific characteristics of cross-linguistic transfer. Thus, when considering the linguistic interdependence between Spanish and English, the relationships between generation status, Spanish oral language, English oral language, and English reading comprehension become ripe for investigation. To address this role of immigrant status in the English oral language and reading development among Latino bilinguals, this dissertation was divided into two studies. Both studies examined the relationship between immigrant status, English language, and English reading, however Study 1 developed intra-linguistic growth models and Study 2 developed cross-linguistic growth models.

Specifically, the first study was guided by a component view of English language and reading comprehension within the context of the immigrant paradox. Study 1 was divided into two stages. First, immigrant generation status was used to predict the growth trajectories of four components of English language (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension. Then, the intercepts and slopes from the established language trajectories were used to develop an intra-language longitudinal growth model of English reading comprehension from Grade 2 to Grade 5. The second study was concerned with the role of immigrant generation status on the linguistic interdependence between Spanish language, English language, and English reading comprehension. Study 2 was also divided into two sections. First, cross-linguistic growth models for English vocabulary, morphology, syntax, semantics, and English reading comprehension were developed; each trajectory was developed separately and included both immigrant status and Spanish oral language (vocabulary and syntax) as key variables of interest. Then, the predicted intercepts and slopes of the established cross-language English growth trajectories were used to develop a cross-language growth model for English reading comprehension. Thus, while both studies focused on the role immigrant generation status, the first study examined English language and reading from an intra-linguistic perspective and the second study assumed a cross-linguistic perspective. Studies 1 and 2 drew form the same data sources, therefore the data used is first described below; separate sections describe in greater detail the specific research question, method, and analytic approach for each study.

Data Sources

Data for this dissertation were part of a larger, four-year study examining comprehension, language acquisition, and vocabulary development among English monolinguals and Spanish-English bilinguals (CLAVES Project; Silverman, Proctor, & Harring, 2009-2013). The CLAVES Project was an exploration grant funded by the Institute of Education Sciences (IES) to the University of Maryland (No. R305A090152). Previous research with the CLAVES data has examined language and literacy from different facets such as the relationship between vocabulary depth and reading comprehension (Leider et al., 2013; Proctor et al., 2012), classroom instruction (Michener, Sengupta-Irving, Proctor, & Silverman, in press; Silverman et al., 2014), writing aptitude (Silverman, Coker, Proctor, Harring, Piantedosi, & Meyer, in press) and issues related to assessing Spanish-English bilingualism and biliteracy (Leider, Proctor, & Silverman, 2014; Proctor & Silverman, 2011). The subsequent sections describe the participants and their respective language and reading comprehension data that were collected across four time points beginning in fall 2009 and finishing in the spring of 2010.

Participants

The CLAVES participants were recruited from two regions of the US: the northeast and mid-Atlantic. Spanish and English permission forms were distributed to all second, third, and fourth graders in participating schools. A brief questionnaire that included two questions about language (i.e., *what is the child's **first** language? If* *applicable, what is the child's* ***second*** *language?*) was also included with the permission form. The English monolingual sample was limited to those whose first *and only* language was English. The Spanish-English bilingual sample consisted of those children whose parents reported their speaking a first language of Spanish and a second language of English or a first language of English and a second language of Spanish. Thus, language status (monolingual vs. bilingual) was identified by the parents in the permission form and all Spanish-English bilingual children whose parents gave consent were included in this study. The study implored a cohort-sequential design, thus participants were recruited in second, third, and fourth grade and simultaneously followed for two academic years, into the third, fourth, and fifth grades. Each cohort consisted of 40, 39, and 33 bilingual students, respectively. Table 1 displays the sample demographics disaggregated by cohort. In an effort to deal with issues of attrition, particularly among the bilingual sample, at the beginning of year two we sent a second wave of permission forms to students in third, fourth, and fifth grade. A total of 7, 11, and 6 new Spanish-English bilinguals were added to Cohort 1, Cohort 2, and Cohort 3, respectively. Thus, the full sample consisted of 134 Spanish-English bilingual children. Table 3.1 summarizes sample demographics by cohort.

Table 3.1 *Sample Demographics disaggregated by Cohort – Study 1*

	Sample (n=134)	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=39)
Female	52.4%	59.6%	39.4%	51.6%
Free and Reduced Meals	89.6%	89.1%	89.8%	89.7%
English Language Learner	62.7%	73.0%	53.1%	61.5%
Spanish as a First Language	91.8%	89.1%	91.8%	94.9%

The full sample described in Table 3.1 includes students who joined the study in either Year 1 or Year 2. While this full sample (year 1 and year 2) were included in Study

1, only students who began the study in Year 1 were included in Study 2. Spanish language data was only collected at one time point: at the inception of when a child joined the study. Thus, this smaller sample size for Study 2 was due to the fact that Spanish language is a primary predictor variable of interest and therefore only students who had the same Spanish language time point were included. More specific details describing the decision to use a more selective sample for Study 2 will be described in greater detail below. Table 3.2 displays the sample to be included for Study 2.

Table 3.2. *Sample Demographics disaggregated by Cohort – Study 2*

	Sample (n=112)	Cohort 1 (n=40)	Cohort 2 (n=39)	Cohort 3 (n=33)
Female	50.9%	57.5%	56.4%	42.9%
Free and Reduced Meals	89.3%	90.0%	89.7%	87.9%
English Language Learner	59.8%	77.5%	43.6%	57.6%
Spanish as a First Language	92.9%	92.5%	92.3%	93.9%

Language and Literacy Data Sources

Given that there is no good measure for assessing bilingual students' dual language abilities (Leider et al. 2014; Proctor & Silverman, 2011) the CLAVES research team compiled equivalent Spanish and English language and literacy assessment batteries comprised of subtests from two widely used standardized assessments: the Woodcock-Muñoz Language Survey – Revised (WMLS-R; Woodcock-Muñoz, Sandoval, Reuf, & Alvarado, 2005) and the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF; Semel, Wiig & Secord, 2003). A researcher-developed assessment of morphology (Extract the Base; August, Kenyon, Malabonga, Louguit, & Caglarcan, 2001) was also included in our English version of the battery. Details of subtests for each battery are described below.

Spanish language proficiency. This battery was only administered one time and therefore is limited as it only gives an initial status of Spanish language ability. Since the Spanish battery was only administered at one time point the Spanish language data were used to serve two purposes: a) describe the sample's Spanish oral language proficiency; and b) examine its relationship to development in English language and literacy outcomes. While some participants might have received prior schooling in Spanish, at the time of the study no participants were receiving formal Spanish literacy instruction from the participating schools.

Spanish vocabulary. Spanish vocabulary was indexed via the Spanish version of the WMLS-R Picture Vocabulary (PV) subtest. Students were asked to identify pictured objects of increasing difficulty; testing discontinued after 6 consecutive wrong errors. WMLS-R does not report reliability statistics for the Spanish version of this subtest. Raw scores were used for analyses.

Spanish syntax. Syntactical awareness in Spanish was assessed with the Formulated Sentences (FS) subtest from the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF, Semel, Wiig, & Secord, 2003). For this assessment students were presented with a picture and corresponding target word. Students were then asked to generate a complete sentence about the picture using the target word. The administrator would then scribe the student response and score the sentence on a scale of 0, 1, or 2. A score of 0 indicated that the student produced an incomplete sentence, complete sentence with two or more syntactical or semantic errors, a complete sentence that was not meaningful, failed to use the target word, or failed to reference the stimulus picture. A score of 1 was given if a student produced a complete sentence with no more than two semantic or syntactical errors; a score of 2 was awarded to a complete sentence that was both semantically and syntactically correct and correctly used the target word and reference picture. Target words becoming increasingly difficult as students progressed through the test and administration discontinued if a student produced five consecutive scores of 0. Test–retest reliability as reported in the CELF manual is .74–.79 for children ages 7.0–9.11 and internal consistency is .80–.82 for these same ages. Raw scores were used in all analyses.

English language and literacy battery. The English language battery was composed of four oral language subtests and two literacy subtests. The four language subtests assessed vocabulary, morphology, syntax, and semantics; the literacy subtests assessed word reading ability and reading comprehension. The English battery order of assessments was as follows: syntax, semantics, vocabulary, word reading, reading comprehension, and morphology. Specific details of each assessment are described below.

English vocabulary. English vocabulary was indexed via the English version of the WMLS-R Picture Vocabulary (PV). This measure is identical to its Spanish counterpart: students were asked to identify pictures objects of increasing difficulty and students continued with the assessment until they receive 6 consecutive wrong responses. The internal reliability for children between 7 and 21 years old is ,88-.92 (Woodcock et al., 2005). W-scores were used for analyses. The selection of W-scores allows for an interpretable growth metric. The W-scale is centered on a value of 500 for average performance of 10 year olds the distance between two points on the scale has the same interpretation regardless of age or grade level. Thus, whether a student is in Grade 2, Grade 3 or Grade 4, a score of 490 carries the same meaning: both students scored 10 points below the average performance of 10 year olds. Since students in the sample come from Grades 2-5, the use of W-scores allows for easier interpretation.

Further, W-scores were used because they are particularly useful in reporting growth, as the W-scale is an equal-interval scale. In comparison to a normative score, such as a standard score which reflects performance in comparison to same aged peers, a W-score represents the amount of progress, or growth, that a student has actually made. Thus, an increase in a W-score represents actual growth in the trait measured; this scale is structured so that increase of 10 W-units represents the individuals' ability to perform with 75% success, tasks that could previously be performed with only 50% success (Jaffe, 2009).

English morphology. Morphological awareness was assessed with the researcher designed Extract the Base test (ETB). This assessment consisted of 28 items and each item was worth 1 point. For each item students were given a word (e.g., *publicity*) and then asked to derive the base of the word to logically complete a sentence (e.g., *The _____ was happy with the show*.). The administrator read both the target word and sentence aloud and students were asked to write their response in the blank space provided. Since this was a test of morphological ability and not literacy (i.e., spelling) so long as the student response was phonologically plausible (e.g., *empti* instead of *empty*) issues related to spelling did not result in an incorrect response. This test is not normed, therefore I will report the local sample alpha, which is .843. Raw scores were used for analyses.

English syntax. The English version of CELF Formulated Sentences subtest was used to index syntactical awareness. This subtest administration is identical to its Spanish counterpart, however pictures and target words did vary between the Spanish and English versions. Stability coefficients for the English measure are .74-.62 and internal consistency is .82-.76 for children ages 7.0-12.11 (Semel et al., 2003). Raw scores were used for analyses.

English semantics. Semantic awareness was evaluated with the CELF Word Class 2 subtest (WC). For this task, students were read increasingly difficult sets of four words, two of which were semantically related (e.g., *teacher, school, street, cake*). Students tasked with identifying the two words that were related within each respective set. Testing was discontinued after five consecutive misidentifications. For children ages 7-12, re reported stability ranges from .72 to .84, and internal consistency ranges from .72-.82. Raw scores were used for analyses.

Data collection. The English version of the battery was administered in the following four waves, each spaced 6 months apart: fall 2009, spring 2010, fall 2010, and spring 2011. The WMLS-R has alternate versions (*Form A and Form B*) and therefore there were two versions of the English language and literacy battery which were administered; Form A was administered in the fall and Form B was administered in the spring. The Spanish battery was purposefully administered in between the first two English battery administrations. A team of trained research assistants individually administered the assessments in a quiet room; each administration was also recorded on an audio recorder. The English battery assessment time lasted about 30-40 minutes depending on the student's ability. A sub-team of Spanish-English bilingual research assistants administered the Spanish language battery, which lasted between 10-30 minutes depending on student's ability. The Spanish battery administration was conducted entirely in Spanish and if at any time of the administration any students protested the assessment or displayed discomfort due to lack of Spanish proficiency students were given the option to discontinue the assessment.

Data scoring. With the exception of ETB, initial scoring occurred in real time during administration. All assessments were subsequently double-scored by a second administrator whose responsibility was to verify points were correctly added, ceilings were appropriately met, and that no items or measures were inaccurately skipped.

Immigrant status. The Home Language and Literacy Questionnaire was distributed to all participating families in the CLAVES study. The 44-item survey was designed by the CLAVES research team and divided into three sections: child's background, family background, and language/literacy. This questionnaire paralleled domains that have also examined the home environment for similar purposes (e.g., Gonzalez & Uhing, 2008) and all survey data were parent report. Parents were given the choice to complete the survey in either Spanish or English, and also had the option to complete the questionnaire orally (i.e., *in person* or *on the phone*), online, or by hand. The vast majority of parents completed the survey by hand and those who did return the survey were compensated with a Barnes & Noble gift card.

Child immigrant status was determined by the Child and Family Background section of the questionnaire which contained questions specific to parental and child country of birth. Specifically, the questionnaire asked where the child was born (*In what country or U.S. Territory was the child born?*). If a parent reported that the child was born outside of the US (e.g., Mexico, Guatemala) then the child was considered to be a first generation immigrant. Separate sections for each parent asked about parental birth country (*If not born in the US, at what age did the child's MOTHER come to the U.S.? / If not born in the US, at what age did the child's FATHER come to the U.S.?)*. Thus, if a parent reported that the child was born in the US *and* at least one parent was born outside of the US then the respective child was considered to be second-generation. Parents who reported that their child was born in the US (*In what country or U.S. Territory was the child born?*) and reported that both parents where born in the US were considered third-generation, that is both themselves *and* their parents were born in the US. Table 3.3 displays the immigrant status disaggregated by cohort for Study 1 and Table 3.4 displays the immigrant status disaggregated by cohort for Study 2. Of the 23 first generation immigrant children represented in Table 3.3, countries of birth included Honduras (n=1), El Salvador (n=6), Guatemala (n=5), and Mexico (n=11).

Table 3.3 *Year 1 and Year 2 Immigrant Status disaggregated by Cohort – Study 1*

	First Generation (n=24)	Second Generation (n=93)	Third Generation (n=17)
Cohort 1 (n=46)	3	35	8
Cohort 2 (n=49)	8	36	5
Cohort 3 (n=39)	13	22	4

Table 3.4. *Year 1 Immigrant Status disaggregated by Cohort – Study 2*

	First Generation (n=17)	Second Generation (n=81)	Third Generation (n=14)
Cohort 1 (n=40)	3	30	7
Cohort 2 (n=39)	5	30	4
Cohort 3 (n=33)	9	21	3

Of the 17 first generation immigrant children represented in Table 3.4, countries of birth included El Salvador (n=4), Guatemala (n=3), and Mexico (n=9). While the overall sample size is small, the majority of the Latino bilinguals in this sample are second-generation immigrants. The next sections describe the method and analytic plan for each study.

Study 1

English oral language development and reading comprehension performance are often viewed as the educational goal for many immigrant and bilingual students. Thus, this study sought to add to the literature on English language development of bilingual Latinos by developing English language growth models and an intra-linguistic growth model of reading that accounted for the role of immigrant generation status. This study was guided by the following research questions:

1. For bilingual Latino students, do second through fifth grade growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status?
2. For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension?
    a. Are these relationships moderated by immigrant generation status?

The data used to answer these questions was from the CLAVES Project (described above). The CLAVES Project followed a cohort-sequential design (Nesselroade & Baltes, 1979) and this particular study used Hierarchical Linear Modeling (HLM) to take advantage of this longitudinal approach. These are described below.

Cohort Sequential Design and Hierarchal Linear Modeling

Cohort-sequential design is a longitudinal method that approximates a "true" longitudinal study by converging different-aged cohorts of simultaneous short-term longitudinal studies (Anderson, 1993; Bell, 1954). The present study included three cohorts that were simultaneously followed for two years; data were collected every 6 months over the course of two years. Cohort 1 consisted of 46 students who represented Grade 2 into Grade 3, Cohort 2 consisted of 49 students followed from Grade 3 into Grade 4, and Cohort 3 included 39 students followed from Grade 4 into Grade 5. Table 3.5 displays the respective mean W-Scores for English Reading Comprehension, one of the outcome variables of interest, for each Cohort across all data collection time points. Note, the first time point, Sep/Oct 2009, is considered "Time 0" to represent the inception of the study. Time was coded as such to allow for both ease and practical interpretation of the intercept; interpretation of intercept will be discussed in greater detail in Analytic Plan.

Table 3.5. *Mean W-Scores for English Reading Comprehension across all time points, disaggregated by cohort.*

	Time 0 Sep/Oct 2009	Time 1 Mar/Apr 2010	Time 2 Sep/Oct 2010	Time 3 Mar/Apr 2011
Cohort 1 (G2→G3)	468.34 (17.36)	475.74 (14.59	473.80 (17.81)	482.11 (18.48)
Cohort 2 (G3→G4)	481.76 (12.28)	488.41 (7.04)	491.57 (13.40)	495.16 (9.37)
Cohort 3(G4→G5)	482.12 (18.09)	488.52 (13.04)	489.65 (15.32)	492.48 (14.02)

As can be seen in Table 3.5, there are 3 separate cohorts, each with 4 respective time points. One way to utilize these data would be to model a developmental trajectory of English reading comprehension for each cohort, where each trajectory would represent the respective growth for each cohort over a two-year period. Figure 3.1 is a graphical representation of the three growth trajectories that could be modeled (*note: Figure 3.1 models do not represent actual data*)

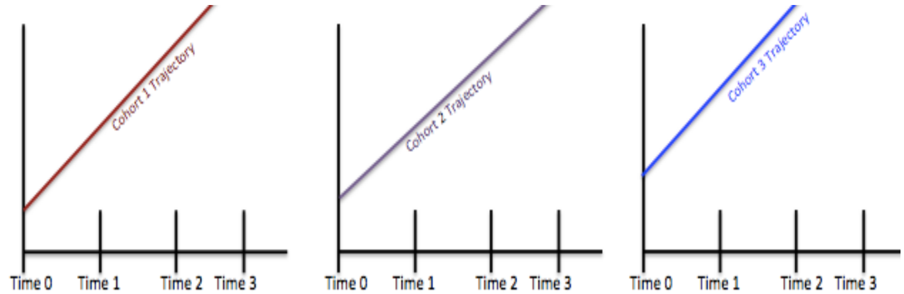

Figure 3.1. *Graphical representation of trajectories to be modeled*

Modeling data as such, however, does not allow the researcher to take full advantage of the cohort-sequential design. Thus, similar to previous cohort-sequential growth modeling (see: McArdle & Anderson, 1990; McArdle & Hamagami, 1992), Hierarchical Linear Modeling was used (HLM; Radenbush & Bryk, 2003) to estimate a common developmental trajectory from Grade 2 to Grade 5, where each cohort contributed a different section of the overall curve. The closer a cohort sequential design model is to a true longitudinal model, the better (Anderson, 1993). Specifically in regard to efficiency, it is recommended that the length of measurement within each cohort be greater that the distance between the two cohorts further apart (Bell, 1953). For the present study, each cohort contained four time points. Cohort 1 began at the first time point, Time 0, and stopped at the fourth time point, Time 3 (i.e., G3.5) and Cohort 3 began at the fifth time point, Time 4 (i.e., G4), thus meeting the proposed efficiency criterion (Bell, 1953).

The specific advantage in using HLM to model growth with cohort-situational data is that growth curves could be estimated regardless of missing and / or unbalanced data (Bickel, 2003). Thus, rather than modeling each cohort separately over 4 time points, at separate grade levels (see Figure 1), HLM allowed the three cohorts to be collapsed and therefore the data was modeled over 8 time points (i.e., grade levels), where non-overlapping time points were considered missing data. Another advantage in the 8 time point approach is that when modeling nested longitudinal data, more observations beget greater power (Hox, 2010). The next few paragraphs will demonstrate how the data in its original form of 4 time points was restructured to model 8 time points. The first step was to restructure and operationalize time. In Table 3 and Figure 1 Time was coded as Time 0, Time 1, Time 2, and Time 3 where Time 0 represented September 2009, Time 1 represented 6 months later, and so forth. The hallmark of cohort-sequential design, however is the use of multiple, overlapping cohorts, thus rather than thinking of Time in terms of the actual chronological data collection points, cohort-sequential design allows a "stacking" of these cohorts such that Time here corresponds to each of the grade levels of each respective cohort at the time. This stacking is illustrated in Table 3.6 where G2 represents the inception of Grade 2, G2.5 represents 6 months later, and so forth.

Table 3.6. *Visual Representation of Stacked-Overlapping Cohorts*

	Time 0 (n=46)	Time 1 (n=46)	Time 2 (n=95)	Time 3 (n=95)	Time 4 (n=89)	Time 5 (n=89)	Time 6 (n=40)	Time 7 (n=40)
Cohort 1	G2	G2.5	G3	G3.5				
Cohort 2			G3	G3.5	G4	G4.5		
Cohort 3					G4	G4.5	G5	G5.5

Note: Time 0 = Grade 2; Time 1 = Grade 2.5; Time 2 = Grade 3; Time 3=Grade *3.5; Time 4 = Grade 4; Time 5= Grade 4.5; Time 6 = Grade 5; Time 7 = Grade 5.5*

Table 3.6 represents this restructuring, articulating 8 time points delineated by grade.. Thus, Cohort 1 had data for Time 0-3. Cohort 2 had overlapping data with Cohort 1 and Cohort 3 at Times 2-3 and Times 4-5, respectively. Finally, Cohort 3 also had data for Time 6-7. This restructure of Time allowed for the following: collapse data from overlapping cohorts and maximize on HLM's flexibility to model growth curves in spite of missing data. For example, consider Table 3.7 below, which provides the mean scores for English Reading Comprehension disaggregated by Cohort, but across the restructured 8 time points.

Table 3.7. *Mean scores for English Reading Comprehension disaggregated by Cohort*

	Time 0 (n=46)	Time 1 (n=46)	Time 2 (n=95)	Time 3 (n=95)	Time 4 (n=89)	Time 5 (n=89)	Time 6 (n=40)	Time 7 (n=40)
Cohort 1	468.34	475.74	473.80	482.11				
Cohort 2			481.76	488.41	491.57	495.16		
Cohort 3					482.12	488.52	489.65	492.48

Note: Time 0 = Grade 2; Time 1 = Grade 2.5; Time 2 = Grade 3; Time 3=Grade 3.5; Time 4 = Grade 4; Time 5= Grade 4.5; Time 6 = Grade 5; Time 7 = Grade 5.5

In Table 3.7, Time 2 includes the mean scores for English Reading Comprehension for Cohort 1 and Cohort 2, since the cohort-sequential design model allowed me to stack the cohorts, and the new mean for English Reading Comprehension at Time 2 and Time 3 is now 477.78 and 485.26, respectively. Similarly, Time 4 and Time 5 collapse Cohort 2 and Cohort 3. Finally, as previously mentioned, an advantage with HLM is that growth can be modeled even when the data are not balanced. Thus, Cohort 1 provides data for Time 0-3 and Time 4-7 are considered "missing data". Similarly, Cohort 2 provides data for Time 2-5, with missing data at Time 0-1 and Time 6-7; Cohort 3 provides data for Time 4-7, with "missing data" at Time 0-3.

Finally, each Time point corresponds to a respective Grade Level. Table 3.8 displays the collapsed data across all Time Points, where Time 0 corresponds to Grade 2 (G2), Time 1 represents 6 months later (G2.5), Time 2 represents 6 months after than (G3), and so forth until Time 7 which represents 6 months after the start of Grade 5 (G5.5).

Table 3.8. *Mean scores for English Vocabulary across all Time Points*

	Time 0 G2 (n=46)	Time 1 G2.5 (n=46)	Time 2 G3 (n=95)	Time 3 G3.5 (n=95)	Time 4 G4 (n=89)	Time 5 G4.5 (n=89)	Time 6 G5 (n=40)	Time 7 G5.5 (n=40)
Voc.	468.34	475.74	477.78	485.26	486.85	491.84	489.65	492.48

Figure 3.2 displays a graphical representation of this cohort-sequential longitudinal design, where the dotted lines represent the respective cohort's "missing" data. The actual growth curves that were estimated in HLM will converge each of the respective lines into one linear trend. Note that Figure 3.2 assumes a linear trend.

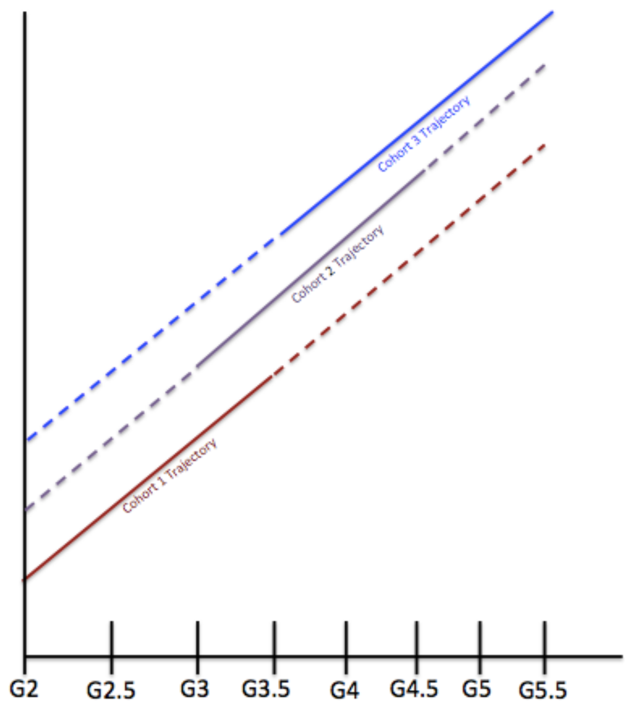

Figure 3.2. *Graphical representation of overlapping cohort data*

A common critique of the cohort-sequential approach to longitudinal analysis is that the trajectories among cohorts follow a different trend (Anderson, 1993). To address this concern models included dummy variables for Cohort 2 and Cohort 3, thus accounting for potential cohort differences. The following sections will describe in greater detail the extent to which the language and literacy data were used for analyses and the analytic approach used to develop the growth trajectories, including detailed explanation of the statistical equations.

Analytic Plan

The analytic plan for this study was divided into two stages. First five English growth trajectories were developed (i.e., vocabulary, morphology, syntax, semantics, and reading comprehension). Next, the predicted intercept and slope of the established growth trajectories were used to develop an intra-language multi-level growth model for reading. At both stages of the analytic process immigrant status was the main focus of these trajectories.

Research question 1: **For bilingual Latino students, do second through fifth grade growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status?**

This research question was concerned with developing four English language growth trajectories: vocabulary, morphology, syntax, and semantics. Each growth trajectory included immigrant generation status as predictor variable at Level 2 of the growth model. Prior to analyses it was predicted that language trajectories and reading comprehension will vary by generation status. Specifically, it was hypothesized that Generation 1 would be significantly different from their Generation 2 and 3 peers such that Generation 1 would begin behind their peers and also would grow at significantly different rates. Since all growth trajectories followed the same analytic process, the following describes the full analytic process for all language trajectories in detail, including a brief overview of the coefficients (note: due to the iterative approach to model building, the actual final models did not include all of the variables described below).

English language trajectories. The first step in developing the growth trajectory was to develop the unconditional means model. The unconditional means model is the most basic hierarchical linear model and will be used to determine the outcome variation (Singer & Willet, 2003). In other words, the unconditional means model determined whether there were inter-individual differences, that is whether performance varies among students. This model building process contains two levels: Level 1, which represents the within-student variation and Level 2, which represents the between-student variation. Equation 3.1 and Equation 3.2 represent Level 1 and Level 2 for the unconditional means model, respectively.

Equation 3.1: *Unconditional Means Model Level 1*

$$Y_{ti} = \pi_{0i} + e_{0i}$$

Where, Y_{ti} represented the language component of interest (i.e., vocabulary, morphology, syntax, or semantics) for Student i, π_{0i} represented the true mean of Student i and e_{ti} represented Student i's variation from their true mean.

Equation 3.2: *Unconditional Means Model – Level 2 Intercept*

$$\pi_{0i} = \beta_{00} + r_{0i}$$

Where, β_{00} represented the grand mean across all students (i.e., population true mean) and r_{0i} represented Student i's deviation from the population true mean. Thus, the combined Level 1 and Level 2 accounted for both within- and between- student variation is as follows:

Equation 3.3: *Unconditional Means Model – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + r_{0i} + e_{ti}$$

The estimates from the unconditional means model were then used to calculate the Intraclass Correlation Coefficient (ICC), which gave a numerical value for how much variation there is to be explained (Raudenbush & Byrk, 2002; Singer & Willet, 2003). To calculate the ICC the following equation was used:

Equation 3.4: *Intraclass Correlation Calculation*

$$\hat{\hat{\sigma}} = \frac{\sigma_0^2}{\sigma_0^2 + \sigma_e^2}$$

Where, $\hat{\hat{\sigma}}$ represented the estimated variation between-students as a function of the total proportion of variation between-students. Since it was possible that change over time may not be linear, both an unconditional linear growth and an unconditional quadratic growth model were tested. First, to test for linear growth, the first predictor variable was added to Level 1 was Time. As mentioned earlier, Time was coded as: 0, 1, 2, 3, 4, 5, 6, and 7 such that Time 0 represented G2, Time 1 represents 6 months later at G2.5 and so forth. Thus, with the addition of Time, the new Level 1 equation was as follows:

Equation 3.5: *Unconditional Linear Growth Model – Level 1*

$$Y_{ti} = \pi_{0i} + \pi_{1i}(Time)_{ti} + e_{ti}$$

Where, π_{1i} represented the predicted change at Time t for Student i. The addition of Time to the Level 1 equation altered the interpretation of the Level 1 variance, such that the Level 1 residual now represented the variation around the linear trajectory. Thus, at Time t, Student i would deviate by e from their predicted change trajectory. The addition of Time at Level 1 also added the following Level 2 equation:

Equation 3.6: *Linear Unconditional Linear Growth Model – Level 2 Slope*

$$\pi_{1i} = \beta_{10} + r_{1i}$$

Where, β_{10} represented the predicted change (i.e., slope) across all students for each Time point, and r_{1i} represented the population variance due to time. The new combined model which included Equation 3.5 Level 1 and both Equations 3.6 and 3.2 at Level 2 was as follows:

Equation 3.7: *Linear Unconditional Linear Growth Model - Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + r_{0i} + \beta_{10}(Time)_{ti} + r_{1i}(Time)_{ti} + e_{ti}$$

The current state of the model provided estimates for the predicted mean at the intercept and the predicted change for Time t. Since there was interest in the rate of change, $Time^2$ was added also to the Level 1 equation:

Equation 3.8: *Unconditional Quadratic Growth Model – Level 1*

$$Y_{ti} = \pi_{0i} + \pi_{1i}(Time)_{ti} + \pi_{2i}(Time)^2{}_{ti} + e_{ti}$$

Where, π_{2i} represented the between-student rate of change variation at *Time t f*or *Student i*. The addition of π_{2i} to the following Level 2 equation was also added:

Equation 3.9: *Unconditional Quadratic Growth Model – Level 2*

$$\pi_{2i} = \beta_{20} + r_{2i}$$

Where β_{20} represented the predicted rate of change and r_{0i} represented the between-student rate of change variance. The full unconditional growth model included Equation 2.1.1 for Level 1; Level 2 now contains 3 equations: 3.2, 3.6, and 3.9. Thus, the full combined model was as follows:

Equation 3.10: *Combined Level 1 and Level 2 Unconditional Quadratic Growth Model*

$$Y_{ti} = \beta_{00} + \beta_{10}(Time)_{ti} + r_{0i} + r_{1i}(Time)_{ti} + \beta_{20}(Time)^2_{ti} + r_{2i}(Time)^2_{ti} + e_{ti}$$

After fitting this model, the interpretation of these estimates suggested how to proceed. The fixed effects (i.e., β_{00}, β_{10}, β_{20}) gave the numerical values for the predicted average means for intercept, linear change, and quadratic change respectively. Similarly, the random effects (i.e., τ_{00} , τ_{11} , and τ_{22}), provided a numerical value for the unpredicted variation in the respective individual growth parameters (Singer & Willet, 2003), that is the unpredicted variation in the intercept (i.e., r_{0i}), linear change (i.e., r_{1i}), and quadratic change (i.e., r_{2i}). Hypotheses tests to determine the statistical significance for the fixed and random effects ($p<.05$) guided the decision making process in establishing the unconditional model. If the fixed effect for the quadratic was non-significant it was dropped from the growth model. Further, even if the random effect for the linear term was non-significant, it was kept in the model as there was still interest in any moderating effects for generation status on slope. Once the unconditional growth model was established the addition of Level 2 predictor variables were used to explain further inter-individual differences

The next step in this process was to add the control variables to the Level 2 equations. Given the dual-site cohort-sequential design, ANOVA mean comparisons was first conducted by site, cohort, and generation status to guide the decision around covariates. If an ANOVA test revealed mean differences by site, then site was included as a covariate. Regardless of the ANOVA results, cohort covariates were always included in the first model iteration; non-significant cohort or site terms (fixed effects) were dropped from subsequent model iterations. Thus, Model 1 served to add control covariates site (1 or 0) and for cohort; cohort was entered through the use of dummy variables for Cohort 1 and Cohort 2, thus Cohort 3 was the referent group. The Level 2 equations were as follows:

Equation 3.11: *English Language Trajectory Model 1 - Level 2 Intercept*

$$\pi_{0i} = \beta_{00} + \beta_{01}(site) + \beta_{02}(cohort1) + \beta_{03}(cohort2) + r_{0i}$$

Equation 3.12: *English Language Trajectory Model 1 - Level 2 Slope*

$$\pi_{1i} = \beta_{10} + \beta_{11}(site) + \beta_{12}(cohort1) + \beta_{13}(cohort2) + r_{1i}$$

Equation 3.13: *English Language Trajectory Model 1 – Level 2 Quadratic*

$$\pi_{2i} = \beta_{20} + \beta_{21}(site) + \beta_{22}(cohort1) + \beta_{23}(cohort2) + r_{2i}$$

Where the addition of β_{01}, β_{02}, and β_{03} represented the variation around the predicted intercept of the respective language component due site, Cohort 1 and Cohort 2; β_{11}, β_{12}, and β_{13} represented the variation around the predicted linear change over time in English Vocabulary due to site, Cohort 1 and Cohort 2; and β_{21}, β_{22}, and β_{23} represented the variation around the predicted quadratic change over time due to site, Cohort 1 and Cohort 2. Model 1, which included the new Level 2 equations (Equations 3.11-3.13) was as follows:

Equation 3.14: *English Language Trajectory Model 1 - Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(Cohort1) + \beta_{03}(Cohort2) + r_{0i} + \beta_{10}(Time)$$
$$+\beta_{11}(Time)(Site) + \beta_{12}(Time)(Cohort1) + \beta_{13}(Time)(Cohort2) + r_{1i}(Time) +$$
$$\beta_{20}(Time)^2 + \beta_{21}(Time)^2(site) + \beta_{22}(Time)^2(cohort1) + \beta_{23}(Time)^2(cohort2) +$$
$$r_{2i}(Time)^2 + e_{ti}$$

Where the addition of the Cohort 1 and Cohort 2 dummy variables altered the interpretation of the fixed effects: β_{00} represented the predicted grand mean at the intercept for Cohort 3, β_{01} represented the predicted difference at the intercept for students at the Mid-Atlantic site, β_{02} represented the predicted difference at the intercept between Cohort 1 and Cohort 3, β_{03} represented the predicted difference at the intercept between Cohort 2 and Cohort 3, β_{10} represented the predicted change for Time t for Cohort 3, β_{11} represented the predicted difference in change for Time t for students at the Mid-Atlantic site, β_{12}, between Cohort 1 and Cohort 3, β_{13} represented the predicted difference in change for Time t between Cohort 1 and Cohort 3. Hypotheses tests were then used to determine the statistical significance for the fixed and random effects ($p<.05$). Since the research question was interested in the role of immigrant generation status, the intercept and linear term continued to vary in the next iteration of the model; non-significant fixed effects were dropped from the model. There are 3 generation groups, thus, two dummy variables were added: Generation 1 and Generation 3*;* Generation 2 was the referent group.

Equation 3.15: *English Language Trajectory Model 2 – Level 2 Intercept*

$$\pi_{0i} = \beta_{01}(Site) + \beta_{02}(Cohort1) + \beta_{03}(Cohort2) + \beta_{04}(Generation1)$$
$$+\beta_{05}(Generation3) + r_{0i}$$

Equation 3.16: *English Language Trajectory Model 2 – Level 2 Slope*

$$\pi_{1i} = \beta_{10}(Time) + \beta_{11}(Time)(Site) + \beta_{12}(Time)(Cohort1)$$
$$+\beta_{13}(Time)(Cohort2) + r_{1i}(Time) + \beta_{14}(Time)(Generation1)$$
$$+\beta_{15}(Time)(Generation3)$$

Equation 3.17: *English Language Trajectory Model 2 - Level 2 Quadratic*

$$\pi_{2i} = \beta_{20} + \beta_{21}(Site) + \beta_{22}(Cohort1) + \beta_{23}(Cohort2)$$
$$+\beta_{24}(Time)^2(Genearion\ 1) + \beta_{25}(Time)^2(Generation\ 3) + r_{2i}(Time)$$

Where, the addition of the Generation 1 and Generation 3 altered the interpretation of the fixed effects. Interpretation of the fixed effects were now as follows: β_{00} represented the predicted grand mean at the intercept for Generation 2 immigrants,

β_{01} represented the predicted difference at the intercept between Generation 2 and Generation 1, β_{02} represented the predicted difference at the intercept between Generation 2 and Generation 3, β_{10} represented the predicted change for Time t for Generation 2, β_{11} represented the predicted difference in change for Time t for students at the Mid-Atlantic site, β_{12} represented the predicted difference in change Time t between Generation 1 and Generation 2, β_{13} represented the predicted difference in change Time t between Generation 2 and Generation 3. This final model is represented below:

Equation 3.18: *English Language Trajectory Model 2 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(Cohort1) + \beta_{03}(Cohort2) + \beta_{04}(Generation1)$$
$$+\beta_{05}(Generation3) + r_{0i} + \beta_{10}(Time) + \beta_{11}(Time)(Site) + \beta_{12}(Time)(Cohort1)$$
$$+\beta_{13}(Time)(Cohort2) + r_{1i}(Time) + \beta_{14}(Time)(Generation1)$$
$$+ \beta_{15}(Time)(Generation3) + \beta_{20}(Time)^2 + \beta_{21}(Time)^2(Site)$$
$$+\beta_{22}(Time)^2(Cohort1) + \beta_{23}(Time)^2(Cohort2) + \beta_{24}(Time)^2(Generation\ 1)$$
$$+\beta_{25}(Time)^2(Generation\ 3) + r_{2i}(Time)^2 + e_{ti}$$

The interpretation of the new fixed effects are as follows: β_{04} and β_{05} represented the predicted differences in the intercept as a function of Generation 1 and Generation 3, respectively; β_{14} and β_{15} represented the predicted differences in change for Time t as a function of Generation 1 and Generation 3, respectively. Hypotheses tests were used to determine the statistical significance for the fixed and random effects ($p<.05$). Model 2 was the final model for the language component of interest. At this stage of the analyses, chi-square testing was used to compare model fit. After establishing the final model, predicted values were saved for the trajectory. The development of this trajectory was done in SPSS and since the model building process was the same for all language components (i.e., vocabulary, morphology, syntax, semantics).

English reading comprehension trajectory. For English reading comprehension the Unconditional Models takes the similar approach as the English language trajectories, thus the model description below begins with the model that first adds control variables. The full models are listed below, where Y_{ti} represented English Reading Comprehension and all coefficients carried the same meaning as described in the previous section.

Given the empirically documented relationship between word reading and reading comprehension (e.g., Hoover & Gough, 1997), word reading was included an additional predictor variable (LWID). Similar to all outcome variables, the LWID data was collected at four different time points. Bivariate correlations revealed that the LWID raw scores across all time points were strongly correlated (*r* range .842-.894). Thus, for the LWID predictor variable, the average LWID performance for each student across the four time points was calculated and then grand mean centered the variable. Further, ANOVA results revealed no mean differences by Cohort, Cohort covariates were omitted from the model. The equations for Model 1 and Model 2 are represented below.

Equation 3.19: *English Reading Trajectory Model 1 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(LWR - LWR..) + \beta_{10}(Time) + \beta_{11}(Time)(Site)$$

$$+\beta_{12}(Time)(LWR - LWR..) + r_{0i} + r_{1i}(Time) + e_{ti}$$

Equation 3.20: *English Reading Trajectory Model 2 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(LWR - LWR..) + \beta_{03}(Generation1)$$

$$+\beta_{04}(Generation3) + \ \beta_{10}(Time) + \beta_{11}(Time)(Generation1)$$

$$+\beta_{12}(Time)(Generation\ 3) + r_{0i} + r_{1i}(Time) + e_{ti}$$

Research Question 2 and 2a: For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension? Are these relationships moderated by immigrant generation status?

The predicted values for each language component were used to address research question 2. The final model for each predicted value was run and the respective predicted values were saved. Each participant's predicted value for Time 0 was then translated into a new variable. For example, the predicted value for Time 0 of English Vocabulary was translated into a non-time varying variable of English Vocabulary Initial Status. Bivariate correlations revealed that the predicted initial status for all language components were moderately to strongly correlated with each other (*r* range .669-.820, all ps<.01). Bivariate correlations also revealed a range of significantly weak positive correlations between predicted slopes (Vocabulary and Morphology, r=.082, p<.001; Vocabulary and Semantics, r=.062, p<.05) and significantly weak to moderate negative correlations (Vocabulary and Syntax, r=-.168, p<.01; Syntax and Morphology, r=-.484, p<.01; Semantics and Syntax, r=.438, p<.01). These calculated predicted were all grand mean centered and used as Level 2 predictor variables. It was hypothesized that generation status, particularly Generation 1 would have a significantly different initial status and growth rate than their Generation 2 and Generation 3 peers. It was also hypothesized that initial status and slopes of the predicted growth trajectories will have a positive relationship with initial status and growth in reading comprehension.

To address the predictive effects for language components on the intercept for English reading comprehension, I first referred to Model 2 from the English reading comprehension trajectory from Research Question 1 and then a new model was fitted which added the intercepts of the predicted values as L2 predictors for the intercept. This equation for intercept is represented below:

Equation 3.21: *English Reading Trajectory Model 3 (Intercept Only) – Level 2*

$$\pi_{0i} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(LWR - LWR..) + \beta_{03}(Generation\ 1)$$
$$+ \beta_{04}(Generation\ 3) \ + \beta_{05}(VOCIntercept - VOCIntercept..)$$
$$+\beta_{06}(MORIntercept - MORIntercept..) + \beta_{07}(SYNIntercept - SYNIntercept..)$$
$$+\beta_{08}(SEMIntercept - SEMIntercept..) \ + r_{1i}$$

The final equation for the full model is now as follows:

Equation 3.22: *English Reading Trajectory Model 3 (Intercept Only) –*

Combined Level 1 and Level 2

$$Y_{ti} = \beta_{00} + \beta_{01}(Site) + \beta_{02}(LWR - LWR..) + \beta_{03}(Generation\ 1) +$$
$$\beta_{04}(Generation\ 3) \ + \beta_{05}(VOCIntercept - VOCIntercept..)$$
$$+\beta_{06}(MORIntercept - MORIntercept..) + \ \beta_{07}(SYNIntercept - SYNIntercept..)$$
$$+ \beta_{08}(SEMIntercept - SEMIntercept..) + \ \beta_{10}(Time)$$
$$+\beta_{11}(Time)(Generation\ 1) + \beta_{12}(Time)(Generation\ 3) + r_{1i} + r_{1i}(Time\ )_{ti}$$

Where, Y_{ti} still represented English Reading Comprehension and all previous coefficients maintain their same meaning. The interpretation of the new fixed effects were as follows: $\beta_{05}, \beta_{06}, \beta_{07}, \beta_{08}$ represented the predicted differences in the initial status of English Reading Comprehension as a function VOCInterecpt, MORIntercept, SYNIntercept, and SEMIntercept, respectively. To address the predictive effects for language components on the slope for English reading comprehension, I first referred to Model 2 from the English reading comprehension trajectory from Research Question 1 and then a new model was fitted which added the intercepts of the predicted values as L2 predictors for the Time. This equation for Time is represented below.

Equation 3.23: *English Reading Trajectory Model 3 (Slope Only)– Level 2 Slope*

$$\pi_{1i} = \beta_{10} + \beta_{11}(Generation\ 1) + \beta_{12}(Generation 3)$$
$$+ \beta_{13}(VOCSlope - VOCSlope..) + \ \beta_{14}(MORSlope - MORSlope..)$$
$$+ \beta_{15}(SYNSlope - SYNSlope..) + \ \beta_{16}(SEMSlope - SEMSlope..)$$
$$+ \beta_{17}(VOCIntercept - VOCIntercept..) + \beta_{18}(MORIntercept - MORIntercept..)$$
$$+ \beta_{19}(SYNIntercept - SYNIntercept..) + \beta_{110}(SEMIntercept - SEMIntercept..)$$
$$+r_{1i}(Time\ )_{ti}$$

The final equation for the full model is now as follows:

Equation 3.24: *English Reading Trajectory Model 3 (Slope Only)– Combined Level 1 and Level 2*

$$Y_{ti} \ = \beta_{00} + \beta_{01}(Site) + \beta_{02}(LWR - LWR..) + \beta_{03}(Generation\ 1)$$
$$+ \beta_{04}(Generation\ 3) + \ \beta_{10}(Time) + \beta_{11}(Time)(Generation\ 1)$$
$$+\beta_{12}(Time)(Generation\ 3) + \beta_{13}(VOCSlope - VOCSlope..)$$
$$+ \beta_{14}(MORSlope - MORSlope..) + \beta_{15}(SYNSlope - SYNSlope..)$$
$$+ \beta_{16}(SEMSlope - SEMSlope..) +\beta_{17}(VOCIntercept - VOCIntercept..)$$
$$+\beta_{18}(MORIntercept - MORIntercept..) + \beta_{19}(SYNIntercept - SYNIntercept..)$$
$$+ \beta_{110}(SEMIntercept - SEMIntercept..) +r_{0i}+r_{1i}(Time\ )_{ti} + e_{ti}$$

Where, Y_{ti} still represented English Reading Comprehension and all previous coefficients maintain their same meaning. The interpretation of the new fixed effects was as follows: $\beta_{13}, \beta_{14}, \beta_{15}, \beta_{16}$ represent the predicted differences in the slope of English Reading Comprehension as a function of VOCSlope, MORSlope, SYNSlope, and SEMSlope respectively; $\beta_{17}, \beta_{18}, \beta_{19}, \beta_{110}$ represented the predicted differences in English Reading Comprehension change for slope as a function VOCInterecpt, MORIntercept, SYNIntercept, and SEMIntercept, respectively.

Study 2

The goal of Study 2 was to examine the role of immigrant status on the linguistic interdependence between Spanish and English. Existing research (e.g., Mancilla-Martinez et al, 2009) has proposed that there is a need to examine reading growth models with consideration to the *entire range* of variation in skills by bilingual students. Study 2 contributes to the literature in that it will model English language development and English reading comprehension performance by accounting for two important variables related to the developmental context of bilingual Latinos: immigrant generation status and Spanish language. The research questions guiding Study 2 are as follows:

1. For bilingual Latino students, do second through fifth grade growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status?
2. For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension?

a. Are these relationships moderated by immigrant generation status?

Study 2 was concerned with developing cross-linguistic growth trajectories four different English language components: vocabulary, morphology, syntax, and semantics and English reading comprehension. For this study, a separate growth trajectory was developed for each English language component and English reading comprehension. This current study however, was limited to a sub-sample of the greater sample from Study 1 (see Table 2 and Table 4) and participants who joined the CLAVES Project in Year 2 will be excluded from Study 2. While Study 1 was able to maximize on the flexibility of using HLM with a cohort-sequential design for Study 1 to model Grade 2 to Grade 5 trajectories, given the interest in testing linguistic interdependence this study was concerned with the initial status of Spanish (first language) on the growth trajectories of English (second language). Thus, the analytic plan was different from Study 1. First, Spanish language was considered time invariant, thus constricting the sample to those who shared the same Spanish language data collection time point. The sample was, therefore, limited to students who joined in Year 1 and participants who joined in Year 2 were not included in the study. Thus, the sample for Study 2 was 112 students. The other major difference between Study 1 and Study 2 was that for this study the Grade 2 through Grade 5 trajectory could not be modeled as the "initial status" of Spanish was not the at the same grade level for the different cohorts. Thus, while Study 2 still implored a growth trajectory, rather than modeling over 8 time points, Study 2 modeled growth over 4 time points, spread out evenly over 2 years.

Analytic Plan

Study 2 followed a similar analytic plan as Study 1 and was divided into two stages. First, four English language growth trajectories: vocabulary, morphology, syntax, and semantics were developed; a growth trajectory for English reading comprehension was also developed. Next, main and moderating effects of Spanish oral language and immigration status were tested to answer RQ1. To answer RQ2, the established growth trajectories were used to develop an intra-language multi-level growth model and to determine if, net English language proficiency, Spanish language and immigrant status predicted initial status and / or growth in English reading comprehension.

Research question 1: What are the main and moderating effects of immigrant generation status and Spanish oral language (i.e., vocabulary, syntax) on the initial status and growth of English language components (i.e., vocabulary, morphology, syntax, and semantics) and English reading comprehension over two academic years? The following sub-sections will describe the process of the developing the growth trajectory for English vocabulary, English morphology, English, syntax, and English semantics. These growth trajectories implore the same model building process. First, the unconditional model is established, followed by a model which added covariates as controls (Model 1). Given the collapsing of three cohorts, in order to adjust estimates for cohort differences cohort covariates were included in all model iterations, even if their fixed effects were null. At Model 2, two Spanish language variables (i.e., Spanish vocabulary, Spanish syntax) and then Model 3 added immigrant generation status (i.e., Generation 1, Generation 2)

It was hypothesized that Spanish syntax and vocabulary would have a significant main effect for the language and reading trajectories for Generation 1 and, if present, these same variables would have a positive effect for Generation 2 and Generation 3. It was also predicted that initial status and growth of the trajectories to vary by immigrant generation status. Since all growth trajectories follow the same analytic process, the following describes the full analytic process for all language trajectories in detail, including a brief overview of the coefficients (note: due to the iterative approach to model building, the actual final models do not include all of the variables described below).

Cross-language trajectories. The first step in developing the growth trajectory was to develop the unconditional means model. The unconditional means model take the similar approach as the English language trajectories from Study 1, thus the model description below begins with Model 2, where Spanish language variables are added. For Model 2, the Spanish language predictor variables of interest Spanish vocabulary (SPNVOC) and Spanish syntax (SPNSYN) were first grand mean centered and then entered in at Level 2. The combined full model is listed below.

Equation 3.25: *Cross-Language Trajectory Model 2 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(Site)$$

$$+\beta_{04}(SPNVOC - SPNVOC..) + \beta_{05}(SPNSYN - SPNSYN..)$$

$$+ \beta_{10}(Time) + \beta_{11}(Time)(Cohort1) + \beta_{12}(Time)(Cohort2) + \beta_{13}(Time)(Site)$$

$$+\beta_{14}(SPNVOC - SPNYVOC..)(Time) + \beta_{15}(SPNSYN - SPNSN..)(Time)$$

$$+ r_{0i} + r_{1i}(Time) + e_{ti}$$

Where, Y_{ti} represented the language component of interest and all previous coefficients maintained their same meaning. The interpretation of the new fixed effects were as follows: β_{04}, β_{05} represented the predicted differences in the intercept as a function of SPNVOC and SPNSYN respectively; β_{14}, β_{15} represented the predicted differences in English change for Time t as a function SPNVOC and SPNSYN respectively. Model 3 then tested, whether Immigrant Generation Status (i.e., Generation 1, Generation 3) predicted intercept or time. The equation for Model 3 is below.

Equation 3.26: *Cross-Language Trajectory Model 3 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(Site)$$
$$+\beta_{04}(SPNVOC - SPNVOC..) + \beta_{05}(SPNSYN - SPNSYN..) + \beta_{06}(Generation1)$$
$$+ \beta_{07}(Generation3) + r_{0i} + \beta_{10}(Time) + \beta_{11}(Time)(Cohort1)$$
$$+\beta_{12}(Time)(Cohort2) + \beta_{13}(Time)(Site) + \beta_{14}(SPNVOC - SPNVOC..)(Time) +$$
$$\beta_{15}(SPNSYN - SPNSYN..)(Time) + \beta_{16}(Generation1)(Time) +$$
$$\beta_{17}(Generation3)(Time) + r_{1i}(Time) + e_{ti}$$

The interpretation of the new fixed effects were as follows: β_{06} and β_{07} represents the predicted differences in the intercept as a function of Generation 1 and Generation 3, respectively; β_{16} and β_{17} represented the predicted differences in Time t as a function of Generation 1 and Generation 3, respectively. This same process was repeated for all the language trajectories.

English reading comprehension trajectory. For English reading comprehension the Unconditional Models took the similar approach as the English language trajectories, thus the model description below begins with the model that first added control variables. The full models are listed below, where Y_{ti} represented English

Reading Comprehensio*n* and all coefficients carried the same meaning as described in the previous section. Given the empirically documented relationship between word reading and reading comprehension, word reading (LWID) was included as an additional control variable. Similar to all outcome variables, the LWID data was collected at four different time points. Bivariate correlations revealed that the LWID raw scores across all time points were strongly correlated (*r* range .842-.894). Thus, for the LWID predictor variable, the average LWID performance for each student across the four time points was calculated and then grand mean centered the variable. Models 1 – 3 are below.

Equation 3.27: *Cross-Language Reading Trajectory Model 1 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..) + r_{0i}$$
$$+\beta_{10}(Time) + \beta_{11}(Time)(Cohort1) + \beta_{12}(Time)(Cohort2)$$
$$+\beta_{13}(Time)(LWID - LWID..) + r_{1i}(Time) + e_{ti}$$

Equation 3.28: *Cross-Language Reading Trajectory Model 2 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..) + \beta_{04}(SPNVOC -$$
$$SPNVOC..) + \beta_{05}(SPNSYN - SPNSYN..) + r_{0i} + \beta_{10}(Time)$$
$$+\beta_{11}(Time)(Cohort1) + \beta_{12}(Time)(Cohort2) + \beta_{13}(Time)(LWID - LWID..)$$
$$+\beta_{14}(SPNVOC - SPNVOC..) + \beta_{15}(SPNSYN - SPNSYN..) + r_{1i}(Time) + e_{ti}$$

Equation 3.29: *Cross-Language Reading Trajectory Model 3 – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..)$$
$$\beta_{04}(SPNVOCB - SPNVOC..) + \beta_{05}(SPNSYN - SPNSYN..) + \beta_{06}(Generation1)$$

$$+ \beta_{07}(Generation3)\ + r_{0i} +\ \beta_{10}(Time) + \beta_{11}(Time)(Cohort1)$$

$$+\beta_{12}(Time)(Cohort2) + \beta_{13}(Time)(LWID - LWID..)$$

$$+\beta_{14}(SPNVOCB - SPNVOC..) + \beta_{15}(SPNSYN - SPNSYN..)$$

$$+\beta_{16}(Generation1)(Time) + \beta_{17}(Generation3)(Time) + r_{1i}(Time) + e_{ti}$$

Research Question 2: In a dual-language model for English reading comprehension, are components of Spanish language, English language, and generation status predictive of the intercept or slope? The predicted values for each language component were used to answer RQ2. Each participant's predicted value for Time 0 was translated into a new variable: initial status. For example, the predicted value for Time 0 of English Vocabulary was translated into a non-time varying variable of English Vocabulary Initial Status. Bivariate correlations revealed that the predicted initial status for all language components were moderately to strongly correlated with each other (*r* range .714-.804, all ps<.01). Predicted values were also used to calculate slopes. To calculate the slopes predicted value for Time 0 was subtracted from the predicted value of Time 1. This calculated value was then translated into a new variable. For example, the difference between the predicted value of Time 1 and Time 0 for English Vocabulary was translated into a non-time varying variable of English Vocabulary Slope. Bivariate correlations revealed a range of significantly weak positive correlations (Vocabulary and Morphology, r=.151, p<.01) and significantly weak negative correlations (Vocabulary and Syntax, r=-.233, p<.01; Morphology and Syntax, r=-.278, p<.01; Semantics and Syntax, r=-.416, p<.01). Semantics was not significantly correlated to either Vocabulary or Morphology. These calculated predicted were all grand mean centered and used as Level 2 predictor variables. Given the inclusion of English language components within this model it was hypothesized that any significant effects for Spanish would no longer be significant. It was also hypothesized that the slopes and intercepts of the English language trajectories would have a positive relationship with the slope and intercept of English reading comprehension. Finally, it was hypothesized that these relationships would be moderated by Spanish oral language.

To address the predictive effects for language components on the intercept for English reading comprehension, I first referred to Model 2 from the English reading comprehension trajectory from Research Question 1 and then a new model was fitted which added the intercepts of the predicted values as L2 predictors for the Intercept. These new equations for the intercept are represented below.

Equation 3.30: *Dual-Language Reading Trajectory Model 3 (Intercept Only) – Level 2*

$$\pi_{0i} = \beta_{10} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..)$$
$$+\beta_{04}(SPNSYN - SPNSYN..) + \beta_{05}(Generation\ 1) + \beta_{06}(Generation3)$$
$$+ \beta_{07}(VOCSlope - VOCSlope..) + \beta_{08}(MORSlope - MORSlope..)$$
$$+ \beta_{09}(SYNSlope - SYNSlope..) + \beta_{010}(SEMSlope - SEMSlope..)$$
$$+\beta_{011}(VOCIntercept - VOCIntercept..)$$
$$+\beta_{012}(MORIntercept - MORIntercept..)$$
$$+ \beta_{013}(SYNIntercept - SYNIntercept..)$$
$$+ \beta_{014}(SEMIntercept - SEMIntercept..) + r_{1i}$$

Equation 3.31: *Dual-Language Reading Trajectory Model 3 (Intercept Only) – Combined Level 1 and Level 2*

$$Y_{ti} = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..)$$
$$+\beta_{04}(SPNSYN - SPNSYN..) + \beta_{05}(Generation\ 1) + \beta_{06}(Generation\ 3)$$
$$+\beta_{07}(VOCIntercept - VOCIntercept..) + \beta_{08}(MORIntercept - MORIntercept..)$$
$$+ \beta_{09}(SYNIntercept - SYNIntercept..) + \beta_{010}(SEMIntercept - SEMIntercept..)$$
$$+r_{0i} + \beta_{10}(Time) + \beta_{11}(Time)(Cohort1) + \beta_{12}(Time)(Cohort2)$$
$$+\beta_{13}(Time)(LWID - LWID..) + \beta_{14}(Time)(Generation\ 1)$$
$$+\beta_{15}(TIme)(Generation3) +r_{1i}(Time\ )_{ti} + e$$

Where, Y_{ti} still represented English Reading Comprehension and all previous coefficients maintain their same meaning. The interpretation of the new fixed effects are as follows: $\beta_{07}, \beta_{08}, \beta_{09}, \beta_{110}$ represent the predicted differences in the slope of *English Reading Comprehension* as a function of *VOCIntercept, MORIntercept, SYNIntercept,* and *SEMIntercept,* respectively.

To address the predictive effects for language components on the slope for English reading comprehension, I first referred to Model 2 from the English reading comprehension trajectory from Research Question 1 and then a new model was fitted which added the intercepts of the predicted values as L2 predictors for the slope. These equations for slope are represented below.

Equation 3.32: *Dual-Language Reading Trajectory Model 3 (Slope Only) – Level 2*

$$\pi_{1i} = \beta_{10} + \beta_{11}(Cohort1) + \beta_{12}(Cohort2) + \beta_{13}(LWID - LWID..)$$

$$+\beta_{14}(Generation\ 1) + \beta_{15}(Generation3) + \ \beta_{16}(VOCSlope - VOCSlope..)$$

$$+ \beta_{17}(MORSlope - MORSlope..) + \ \beta_{18}(SYNSlope - SYNSlope..)$$

$$+ \beta_{19}(SEMSlope - SEMSlope..) + \beta_{110}(VOCIntercept - VOCIntercept..)$$

$$+\beta_{111}(MORIntercept - MORIntercept..) +$$

$$\beta_{112}(SYNIntercept - SYNIntercept..) +$$

$$\beta_{113}(SEMIntercept - SEMIntercept..)+ r_{1i}(Time\ )_{ti}$$

Equation 3.33: *Dual-Language Reading Trajectory Model 3 (Slope Only) – Combined Level 1 and Level 2*

$$Y_{ti} \ = \beta_{00} + \beta_{01}(Cohort1) + \beta_{02}(Cohort2) + \beta_{03}(LWID - LWID..)$$

$$+\beta_{04}(SPNSYN - SPNSYN..) + \beta_{05}(Generation\ 1) + \ \beta_{06}(Generation\ 3)$$

$$+r_{0i} + \ \beta_{10}(Time) + \beta_{11}(Time)(Cohort1) + \beta_{12}(Time)(Cohort2)$$

$$+\beta_{13}(Time)(LWID - LWID..) + \beta_{14}(Time)(Generation\ 1)$$

$$+\beta_{15}(Time)(Generation3) + \ \beta_{16}(Time)(VOCSlope - VOCSlope..)$$

$$+ \beta_{17}(Time)(MORSlope - MORSlope..) + \ \beta_{18}(Time)(SYNSlope - SYNSlope..)$$

$$+ \beta_{19}(Time)(SEMSlope - SEMSlope..) + \beta_{110}(VOCIntercept - VOCIntercept..)$$

$$+\beta_{111}(MORIntercept - MORIntercept..)$$

$$+ \beta_{112}(SYNIntercept - SYNIntercept..)$$

$$+ \beta_{113}(SEMIntercept - SEMIntercept..) + r_{1i}(Time\ )_{ti} + e$$

Where, Y_{ti} still represented *English Reading Comprehension* and all previous coefficients maintain their same meaning. The interpretation of the new fixed effects are as follows: $\beta_{16}, \beta_{17}, \beta_{18}, \beta_{19}$ represent the predicted differences in the slope of *English*

Reading Comprehension as a function of *VOCSlope, MORSlope, SYNSlope,* and *SEMSlope* respectively*;* $\beta_{110}, \beta_{111}, \beta_{112}, \beta_{113}$ represent the predicted differences in *English Reading Comprehension* change for slope as a function *VOCInterecpt, MORIntercept, SYNIntercept,* and *SEMIntercept*, respectively.

Chapter 4: Results

This chapter is divided into two sections. The first section presents the results for Study 1 and the second section presents the results for Study 2. Each Study begins discussion on descriptive analyses and then presents the analyses and findings for each research question separately.

Study 1 Results

Descriptive Analyses

Table 4.1 displays the distribution of generation status across each time point (i.e., grade level) and Table 4.2 displays the student mean and standard deviation scores on all language components across all time points (i.e., grade level). Vocabulary and reading comprehension are presented with the WMLS-R W-scores; the morphology, syntax, and semantics scores presented are the raw scores. As can be seen in Table 4.1, the trend is generally linear with a small dip at G5; this slight dip at G5 may be due to a cohort effect. Also, notice that given the nature of cohort-sequential design Grades 3 - 4.5 have the largest cells (n=95 for G3 and G3.5; n=89 for G4 and G4.5) with fewer students in the cells at the tails (n=46 for G2 and G2.5; n=40 for G5 and G5.5).

Table 4.1. Student *Generation Status (n) disaggregated by Time Point*

	G2	G2.5	G3	G3.5	G4	G4.5	G5	G5.5
Generation 1	3	3	11	11	21	21	13	13
Generation 2	35	35	70	70	58	58	23	23
Generation 3	8	8	14	14	10	10	4	4
Total	46	46	95	95	89	89	40	40

Bivariate correlations revealed a general trend of significant and negative weak to moderate relationships between Generation 1 and respective language components of interest. In contrast, bivariate correlations suggested significant and positive weak to moderate relationships for Generation 2 and few significant relationships for Generation 3. Table 4.3 summarizes these results.

Generation 1 was significantly, moderately, and negatively correlated to vocabulary in G3-5.5 (r range = .452--.594, all ps<.01). In contrast, Generation 2 was significantly, moderately, and positively correlated at the same time points (r range =.373-.566, all ps <.01); Generation 3 was not significantly correlated to any vocabulary time points. Save for G4, a similar trend, albeit weaker, held for Generation 1 (r range = -.232--.482, all ps <.01) and Generation 2 (r range = .302-.480, all ps<.01). Generation 3 had a significantly negative and weak correlation with Morphology at G2.5 and G3 (r=-.356 and r=-.255, ps <.05, respectively). Generation 1 had a significantly weak and negative relationship with syntax at G3.5 (r=-.307, p<.01), G4 (r=-*.317,* p<.01), G4.5 (r=-..257*,* p<.05), and G5.5 (r=-.359, p<.05). Save for G2.5 and G5, Generation 2 held significant positive weak to moderate correlations across all time points for syntax (r range =.224-.434, all ps<.05). For semantics, Generation 1 had a negative, weak correlation at G4 (r=-.247, p<.05) and G5 (r=-.454, p<.01). Generation 2 was weakly and significantly correlated with semantics at the two points for G3 (r=3.10, p<.01 and r=.260, p<.05) and moderately correlated at the two time points for G5 (r=3.69, p<.05 and r=.493, p<.01). Generation 3 was negatively and significantly correlated with syntax (r=-.437, p<.01) and semantics (r=-.337, p<.05) at G2. For reading, Generation 1 had significant, negative weak to moderate correlations across most time points (r range =-.224--.506, all ps<.05) and Generation 2 had a similar trend, albeit positive (r range = .272-.466). Generation did not have any significant relationships to reading comprehension.

Table 4.2. *Mean scores for each Language Component*

	G2 (n=46)	G2.5 (n=46)	G3 (n=95)	G3.5 (n=95)	G4 (n=89)	G4.5 (n=89)	G5 (n=40)	G5.5 (n=40)
Vocabulary W Score	475.33 (12.29)	478.33 (12.14)	484.32 (14.11)	486.96 (14.01)	488.73 (17.74)	492.70 (17.59)	488.60 (21.44)	491.59 (19.11)
Morphology Raw Score	20.98 (12.41)	29.92 (7.63)	32.10 (7.95)	35.88 (8.49)	36.70 (8.67)	38.90 (8.67)	36.11 (11.08	38.08 (10.36)
Syntax Raw Score	27.35 (8.25)	29.86 (10.08)	30.90 (9.84)	33.68 (9.34)	34.08 (9.51)	37.40 (9.45)	34.54 (11.32)	36.16 (10.25)
Semantics Raw Score	4.76 (1.72)	6.43 (2.56)	7.06 (2.31)	8.38 (2.40)	8.42 (2.93)	9.44 (3.13)	9.31 (3.60)	10.32 (3.73)
Reading W Score	496.46 (16.15)	477.03 (12.40)	478.77 (14.95)	485.94 (13.26)	485.84 (17.77)	490.41 (14.06)	485.89 (18.89)	489.32 (16.46)

Table 4.3 *Correlation Matrix for Language Components and Reading by Generation Status*[1]

	Generation 1	Generation 2	Generation 3
Vocabulary G2	n/a	.259	-.259
Vocabulary G2.5	n/a	.031	-.031
Vocabulary G3	-.452***	.373**	-.080
Vocabulary G3.5	-.489**	.456**	-.151
Vocabulary G4	-.488**	.359**	.112
Vocabulary G4.5	-.527**	.440**	.039
Vocabulary 5	-.579**	.566**	-.018
Vocabulary 5.5	-.594**	.501**	.109
Morphology G2	-.211	.303	-.202
Morphology G2.5	-.087	.371*	-.356*
Morphology G3	-.150	.311**	-.255*
Morphology G3.5	-.232*	.302**	-.171
Morphology G4	-.417	.343**	.052
Morphology G4.5	-.339**	.355**	-.087
Morphology 5.	-.471**	.480**	-.050
Morphology 5.5	-.482**	.421**	.065
Syntax G2	-.048	.434**	-.437**
Syntax G2.5	-.048	.271	-.267
Syntax G3	-.130	.224*	-.164
Syntax G3.5	-.307**	.243*	-.033
Syntax G4	-.317**	.256*	.037
Syntax G4.5	-.257*	.219*	.013
Syntax G5	-.300	.291	-.066
Syntax 5.5	-.359*	.395*	-.083
Semantics G2	.024	.311	-.337*
SemanticsG2.5	-.359	.192	-.046
Semantics G3	-.209	.310**	-.201
Semantics G3.5	-.157	.260*	-.185
Semantics G4	-.247*	.116	.170
Semantics G4.5	-.210	.190	-.007
Semantics 5	-.454**	.369*	.117
Semantics 5.5	-.510	.493**	-.007
Reading Comprehension G2	-.235	.279	-.196
Reading Comprehension G2.5	-.259	.311	-.217
Reading Comprehension G3	-.224*	.272*	-.141
Reading Comprehension G3.5	-.293**	.350**	-.177
Reading Comprehension G4	-.426**	.379**	-.004
Reading Comprehension G4.5	-.284*	.282*	-.048
Reading Comprehension 5	-.403	.361*	.046
Reading Comprehension 5.5	-.506**	.466**	.031

*Note: *p<.05, **p<.01, ***p<.001; [1]=Generation Status is a binary code*

Research question 1: **For bilingual Latino students, do second through fifth grade growth trajectories (i.e., intercept and slope) of English language components (i.e., vocabulary, morphology, syntax, semantics) and English reading comprehension differ by immigrant generation status?**

Results for each growth trajectory are presented separately, including the preliminary descriptive analyses that guided the model building process.

Vocabulary. To test for group differences separate ANOVAs were run by site, cohort, and generation status; these analyses can be found in Tables 4.4-4.6. As can be seen in Table 4.4, statistically significant differences between the sites for Grade 2.5, Grade 3, and Grade 3.5 (all *p*s<.05) suggested that site should be included as a covariate. Similarly, a statistically significant difference between Cohort 1 and Cohort 2 (*p*<.05) warranted the inclusion of Cohort. Finally, as can be seen in Table 4.6, Generation 2 and Generation 3 significantly outperformed Generation 1 in Grade 4 and Grade 4.5; Generation 2 also significantly outperformed Generation 1 in Grade 5 and Grade 5.5.

Table 4.4 *Mean W Scores for Vocabulary disaggregated by Site*

	Site 1 (n=96)	Site 2 (n=39)
Grade 2	474.22 (14.09)	478.67 (10.52)
Grade 2.5	475.96 (11.71)	485.44 (11.08)[a]
Grade 3	481.83 (14.36)	491.55 (8.39)[a]
Grade 3.5	484.07 (14.58)	494.45 (8.99)[a]
Grade 4	490.16 (17.49)	484.05 (18.25)
Grade 4.5	493.07 (17.49)	491.78)18.57)
Grade 5	491.38 (15.39)	484.43 (28.40)
Grade 5.5	489.51 (18.05)	494.86 (21.01)

Note: [a]=Site 2 significantly outperforms Site 1

Table 4.5 *Mean W Scores for Vocabulary disaggregated by Cohort*

	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Grade 2	475.33 (12.29)		
Grade 2.5	478.33 (12.14)		
Grade 3	483.05 (16.39)	485.66 (11.29)	
Grade 3.5	483.64 (15.88)	490.73 (10.52)[a]	
Grade 4		490.16 (20.46)	486.85 (13.37)
Grade 4.5		494.23 (19.59)	490.59 (14.39)
Grade 5			488.60 (21.44)
Grade 5.5			491.59 (19.11)

Note: [a]=Cohort 2 significantly outperforms Cohort 1

Table 4.6 *Mean W Scores for Vocabulary disaggregated by Generation Status*

	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Grade 2	492.00[1]	477.00 (13.56)	468.43 (10.15)
Grade 2.5	476.00	478.50 (12.70)	477.50 (9.73)
Grade 3	464.14 (23.26)	487.18 (10.57)	481.73 (8.96)
Grade 3.5	465.14 (16.79)	490.41 (11.87)	481.723 (8.96)
Grade 4	472.29 (27.37)	493.04 (9.97)[a]	494.63 914.20)[b]
Grade 4.5	474.83 (27.07)	497.84 (9.81)[a]	494.75 (10.57)[b]
Grade 5	471.67 (26.10)	498.95 (10.65)[a]	487.33 (14.01)
Grade 5.5	476.38 (21.69)	500.30 (11.64)[a]	497.50 (9.43)

Note: [1]=Generation 1 in Grade 2 and Grade 2.5 have 1 student; [a]=Generation 2 significantly outperforms Generation 1; [b]=Generation 3 significantly outperforms Generation 1

Table 4.7 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the intraclass correlation coefficient (ICC). The ICC calculation suggested that without accounting for any other variables, 12.1% of the variance in English Vocabulary performance can be accounted for over time and the 87.9% of the variation in English vocabulary could be explained by individual differences. Addition of the linear effect of time significantly improved model fit [χ^2(2, N=1080) =3.02, p<.05] and while the fixed effect for time was significant (β_{10}=3.02; p<.001), the random effect was non-significant (r_{1i}=.278). Non-significance of the random effect for the linear term suggested that while time had a significant effect on vocabulary growth, the variance in growth did not vary across between individuals and therefore the linear term should be fixed. Further, while deviance hypothesis testing suggested that inclusion of the random effect did not improve model fit [$\chi^2(1,$ N=1080) =3.02, p>.05], since there was still substantive interest in effects for generation status on time, I decided to proceed with the random effect for time. Inclusion of the quadratic term was neither significant nor did it improve model fit [$\chi^2(2,$ N=1080) =19.4, p>.05],

Table 4.7 *Unconditional Means and Growth Models for Vocabulary*

	Unconditional Means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	485.91 (1.50)***	475.28 (1.56)***	475.47 (1.65)***
Linear		3.02 (.27)***	3.18 (.730)***
Quadratic			-.033 (.106)
Random Effects			
Intercept	282.89 (37.75)***	195.10 (45.92)***	156.92 (46.05)**
Linear		.278 (.000)	7.81 (9.20)**
Quadratic			.239 (.000)
Residual Variance	58.83 (4.63)***	42.53 (3.46)***	45.49 (4.57)***
Deviance Statistic (AIC)	3565.42	3461.81	3481.21

Note: **p<.05, **p<.01, ***p<.001*

Table 4.8 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 adds Site and Cohort as control variables; Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=469.97, p<.001) and time (β_{10}=3.85, p<.001) were statistically significant. Further, Site (β_{11}=1.36, p<.05) had a statistically significant effect on time such that students at the Northeastern Site were predicted to gain 1.36 W-points more per time point when compared to their Mid-Atlantic peers. Parameter estimates for the random effects suggested that there was still significant variation to be explained it initial status (r_{0i}=220.74, p<.001); non-significant fixed effect parameters were dropped. Model 2 added immigrant generation status, with Generation 2 as the referent group. Fixed effects results revealed that that the parameter estimates for intercept (β_{00}=479.27, p<.001) and time (β_{10}=4.03, p<.001) remained significant with Generation 1 (β_{01}=-25.93, p<.001) having a significant effect for intercept and Site (β_{11}=-.982, p<.05) having a significant effect for Time.

Table 4.8 *Model Building Process for Vocabulary*

		Fixed Effects	Model 1	Model 2
Level 1 Predictor		**Intercept**	469.97 (4.34)***	479.27 (1.73)***
Level 2 Predictors	Control Variables	Site	.199 (3.62)	_
		Cohort 1	5.07 (4.44)	_
		Cohort 2	8.21 (4.66)	_
	Immigrant Status	Generation 1		-25.93 (4.78)***
		Generation 3		-3.60 (4.32)
Level 1 Predictor		**Time**	3.85 (.633)***	4.03 (.447)***
Level 2 Predictors	Control Variables	Site	-1.36 (.604)*	-.982 (.447)*
		Cohort 1	.248 (.715)	_
		Cohort 2	.528 (.702)	_
	Immigrant Status	Generation 1		-.476 (.781)
		Generation 3		.122 (.822)
		Random Effects		
		Intercept	220.74 (53.41)***	168.37 (41.99)***
		Time	.116 (.000)	.038 (.000)
		Residual Variance	41.73 (3.40)***	41.69 (3.35)***
		Deviance Statistic	3432.59	3387.80

*Note: *p<.05, **p<.01, ***p<.001*

Thus, the final model (Model 2) suggests that at initial status, on average, students are predicted to perform 479.27 W-points on English Vocabulary, however Generation 1 students are predicted to begin 25.93 W-points below their Generation 2 and Generation 3 peers. Further, students are predicted to grow, on average, 4.03 W-points every 6 months, however, students at the Mid-Atlantic Site will grow at a slightly rate. These findings are consistent with the previous ANOVA that revealed statistically significant differences between Generations 1-3, but no statistically significant differences between Generation 2 and Generation 3 (see Table 4.6). Findings are also consistent with the negative correlations found in the descriptive analyses between Generation 1 and vocabulary (see Table 4.3).

Figure 4.1 displays the growth trajectory with a separate line representing each Generation Status; the unconditional model is also included as a reference for the predicted growth prior to including any other variables. The slight gap between Generation 2 and Generation 3 is not significant. Further, the slight variation in the trajectories (i.e., slope) is not significantly different, which is consistent with the non-significant random effect for time at each iteration of the model.

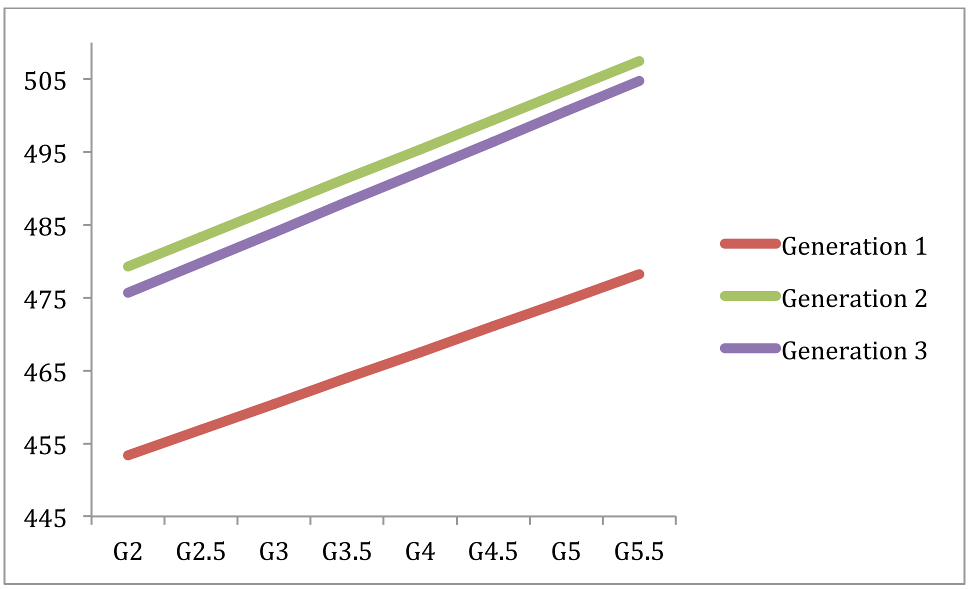

Figure 4.1 *Vocabulary Growth Trajectories disaggregated by Generation Status*

Morphology. Tables 4.9-4.11 display the ANOVA results for group differences by site, cohort, and generation status, respectively. As can be see statistic differences by site and cohort warrant their inclusion as covariates. ANOVA results for Generation Status suggest that Generation 2 significantly outperforms Generation 1 from Grade 3.5

onward; interestingly, Generation 2 also significantly outperformed Generation 3 at Grade 3.

Table 4.9. *Mean Raw Scores for Morphology Disaggregated by Site*

	Sample (n=135)	Site 1 (n=96)	Site 2 (n=39)
Grade 2	20.98 (12.41)	19.79 (13.66)	25.33 (4.09)
Grade 2.5	29.92 (7.63)	29.21 (8.17)	32.11 (5.42)
Grade 3	32.10 (7.95)	32.48 (8.20)	30.85 (7.13)
Grade 3.5	35.88 (8.49)	35.82 (9.01)	36.00 (7.13)
Grade 4	36.70 (8.67)	37.98 (8.79)[a]	33.32 (9.70)
Grade 4.5	38.90 (8.67)	39.97 (8.51)	36.22 (8.67)
Grade 5	36.11 (11.08	37.67 (9.92)	33.79 (12.64)
Grade 5.5	38.08 (10.36)	40.09 (8.06)	34.79 (12.99)

Note: [a]=Site 1 significantly outperforms Site 2

Table 4.10 *Mean Raw Scores for Morphology Disaggregated by Cohort*

	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Grade 2	20.98 (12.41)		
Grade 2.5	29.92 (7.63)		
Grade 3	30.56 (9.01)	33.56 (6.57)	
Grade 3.5	34.02 (9.26)	38.03 (7.01)[a]	
Grade 4		39.27 (7.54)[a]	33.40(10.22)
Grade 4.5		41.04 (8.61)[a]	35.94 (7.95)
Grade 5			36.11 (11.08)
Grade 5.5			38.08 (10.36)

Note: [a]=Cohort 2 significantly outperforms Cohort 1

Table 4.11 *Mean Raw Scores for Morphology Disaggregated by Generation Status*

	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Grade 2	11.67 (3.79)	23.19 (11.93)	15.88 (14.13)
Grade 2.5	26.00	31.27 (6.92)	23.83 (9.12)
Grade 3	28.67 (12.20)	33.47 (6.91)[b]	26.91 (7.25)
Grade 3.5	29.84 (12.35)	37.30 (7.43)[a]	32.27 (8,76)
Grade 4	29.84 (12.86)	38.94 (6.95)[a]	38.13 (2.30)
Grade 4.5	33.24 (11.93)	40.95 (6.97)[a]	36.63 (5.78)
Grade 5	29.00 (11.10)	40.65 (9.50)[a]	34.33 (6.11)
Grade 5.5	31.38 (10.91)	42.05 (8.50)[a]	40.00 (7.16)

Note: [a]=Generation 2 significantly outperforms Generation 1; [b]=Generation 2 significantly outperforms Generation 1 and Generation3

Table 4.12 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the ICC and the calculation suggested that without accounting for any other variables, 66.3% of the variation lies between individuals. Addition of the linear effect improved the model fit [$\chi^2(2,$ N=1080) =199.26, p<.001] and both the fixed effect (β_{00}=24.89 and β_{01}=2.85, ps <.001) and the random effects (r_{00}=88.86 and r_{01}=3.37, ps <.001 for the parameter estimates were statistically significant warranting the inclusion of predictors to explain the variance at both the initial status and in growth of morphology. The addition of the fixed quadratic term further improved model fit [$\chi^2(1,$ N=1080)] =23.57, p>.001); the quadratic term was negative (β_{20}=-.355, p<.001), suggesting that growth slowed over time. Further, a significant negative covariance between the intercept and slope (r =-6.96; p<.05) suggested a negative relationship between intercept and slope such that students who start higher grow slower.

Table 4.12**.** *Unconditional Means and Growth Models for Morphology*

	Unconditional Means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	33.86 (.798)***	24.89 (1.03)***	21.27 (1.21)***
Linear		2.85 (.231)***	5.28 (.486)***
Quadratic			-.355 (.064)***
Random Effects			
Intercept	74.38 (10.59)***	88.86 (16.50)***	92.76 (17.70)***
Linear		3.37 (.953)***	2.15 (.783)**
Quadratic			_
Residual Variance	37.84 (2.90)***	17.16 (1.60)***	16.88 (1.58)***
Deviance Statistic (AIC)	3358.08	3158.82	3135.25

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.13 displays the model building process for morphology. Model 1 added the control variables of site and cohort, with Cohort 3 as the referent group; only the significant Level 2 predictors (i.e., Cohort 1 on intercept, β_{02}=12.68, *p*<.01 and Cohort 2 on intercept, β_{03}=13.02, *p*<.01) remained in the next iteration of the model. Model 2 added Generation Status which Generation 2 as the referent group. The fixed effects for intercept (β_{00}=19.90, *p*<.001), time (β_{10}=5.33, *p*<.001), and rate of change (β_{20}=-.338, *p*<.001) were all significant with Cohort 2 and Generation 1 being significant predictors for intercept (β_{02}=5.68 and β_{03}=-9.16, respectively, both *p*s<.01). There were no significant effects for Level 2 predictors on Time. The final model suggests that there are no significant difference across generation status groups in regard to growth, thus each student is predicted to grow 5.33 of a raw score point every 6 months; this growth rate, however, was predicted to slow down over time. There were, however predicted difference around the intercept suggested that Generation 1 students were, on average, predicted to begin Grade 2 with 10.74 raw score points on the morphology assessment, whereas their Generation 2 were predicted to begin Grade 2 with 19.90 points and Generation 3 peers were predicted to begin Grade 2 with 15.31 points.

Table 4.13. *Model building process for Morphology*

		Fixed Effects	Model 1	Model 2
Level 1 Predictor		**Intercept**	7.65 (6.19)	19.90 (1.88)***
Level 2 Predictors	Control Variables	Site	1.70 (2.31)	_
		Cohort 1	12.68 (6.01)*	3.25 (1.84)
		Cohort 2	13.02 (4.50)**	5.68 (1.70)**
	Immigrant Status	Generation 1		-9.16 (2.95)**
		Generation 3		-4.59 (2.92)
Level 1 Predictor		**Time**	7.95 (2.16)***	5.33 (.505)***
Level 2 Predictors	Control Variables	Site	.022 (.477)	_
		Cohort 1	-1.96 (1.62)	_
		Cohort 2	-1.30 (.933)	_
	Immigrant Status	Generation 1		-.207 (.576)
		Generation 3		.154 (.639)
Level 1 Predictor		**Rate of Change**	-.561 (.190)***	-.338 (.067)***
		Random Effects		
		Intercept	86.13 (16.26)***	78.47 (15.14)***
		Time	2.24 (.791)**	2.29 (.767)**
		Residual Variance	16.75 (1.56)***	16.65 (1.54)***
		Deviance Statistic	3103.26	3076.18

*Note: *p<.05, **p<.01, ***p<.001*

Figure 4.2 displays the growth trajectory (Model 3) for morphology, disaggregated by Generation Status. The curvilinear nature of the trajectory demonstrates that the data suggests that morphological growth slows over time (note: Generation status was not used as a predictor for the quadratic term). Also, note that there are no significant differences in the trajectory between Generation Statuses, however the gap displayed in Figure 4.2 between Generation 1 at initial status is significantly from Generation 2; there were no significant differences between Generation 2 and Generation 3.

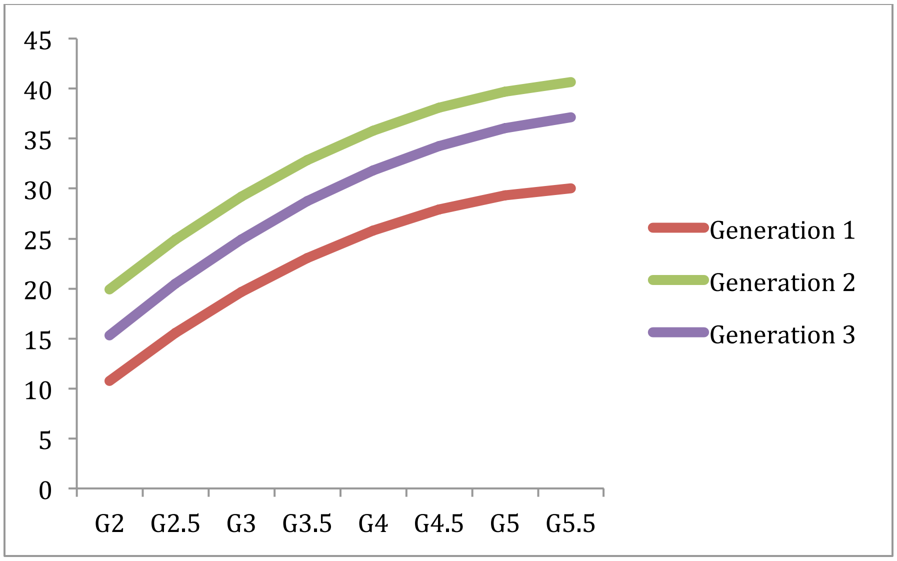

Figure 4.2. *Graphical representation for Morphology Growth Trajectory disaggregated by generation status.*

Syntax. Tables 4.14 – 4.16 display the ANOVA results disaggregated by site, cohort, and generation status, respectively. ANOVA and Tukey post-hoc results warranted the inclusion of site and cohort as covariates. Results in Table 16 suggest that there were no significant differences between Generation 2 and Generation 3, although Generation 2 did significantly outperform Generation 1 at Grade 3.5, Grade 4, Grade 4.5, and Grade 5.5. At Grade 2 and Grade 2.5, Generation 1 had fewer than two cases and therefore post-hoc tests were not conducted at those time points, however ANOVA analyses at that time point did reveal statistically significant differences at Grade 2.

Table 4.14 *Mean Raw Scores for Syntax Disaggregated by Site*

	Site 1 (n=96)	Site 2 (n=39)
Grade 2	25.86 (7.91)	32.00 (7.91)[a]
Grade 2.5	26.53 (7.99)	40.56 (8.44)[a]
Grade 3	28.32 (9.25)	38.50 (7.42)[a]
Grade 3.5	30.98 (9.03)	40.77 (5.82)[a]
Grade 4	33.96 (8.33)	34.36 (12.30)
Grade 4.5	36.98 (9.26)	38.43 (10.06)
Grade 5	34.05 (10.06)	35.29 (13.36)
Grade 5.5	35.96 (9.09)	36.50 (12.29)

Note: [a]=Site 2 significantly outperforms Site

Table 4.15 *Mean Raw Scores for Syntax Disaggregated by Cohort*

	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Grade 2	27.35 (8.25)		
Grade 2.5	29.86 (10.08)		
Grade 3	28.51 (11.06)	33.47 (7.68)[a]	
Grade 3.5	31.26 (10.24)	36.49 (7.34)[a]	
Grade 4		35.80 (9.26)[b]	31.79 (9.50)
Grade 4.5		38.60 (9.55)	35.74 (9.21)
Grade 5			34.54 (11.32)
Grade 5.5			36.16 (10.25)

Note: [a]=Cohort 2 Significantly outperforms Cohort 2; [b]= Cohort 2 significantly outperforms Cohort 3

Table 4.16 *Mean Raw Scores for Syntax Disaggregated by Generation Status*

	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Grade 2	25.00 (0.00)[1]	29.21 (8.02)	20.00 (5.23)
Grade 2.5	27.00 (0.00)	31.17 (10.36)	23.83 (7.22)
Grade 3	27.13 (16.79)	32.13 (8.44)	26.91 (10.01)
Grade 3.5	25.13 (11.96)	34.93 (8.47)[a]	32.91 (9.45)
Grade 4	28.36 (12.09)	35.722 (7.93)[a]	35.13 (9.82)
Grade 4.5	32.71 (12.40)	38.77 (8.46)[a]	37.75 (6.32)
Grade 5	29.92 (13.10)	37.35 (9.05)	34.33 (15.82)
Grade 5.5	31.23 (12.36)	39.85 (7.68)[a]	33.75 (8.54)

Note:[1]=Generation 1 in Grade 2 and Grade 2.5 have fewer than 2 students, post-hoc tests were not conducted for these two time points; [a]=Generation 2 significantly outperforms Generation 1

Table 4.17 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the ICC and the calculation suggested that without accounting for any other variables, 75.1% of the variation in syntax lies between individuals. Inclusion of the linear term improved model fit [χ^2(2, N=1080) =70.51, *p*<.001], however the quadratic [χ^2(2, N=1080) =3.3, *p*=.192], did not improve the model. Even though the random effect for the linear term was not significant (r_{10}=.041, *p*>.05), interest in potential effects for generation status on time retained the random effect for the linear term and the model building process proceeded with a random slopes and intercepts model.

Table 4.17 *Unconditional Means and Growth Models for Syntax*

	Unconditional Means	Unconditional Linear Growth	Unconditional Linear Growth
Fixed Effects			
Intercepts	32.79 (.317)***	26.81 (.989)***	26.69 (1.06)***
Linear		1.70 (.188)***	1.72 (.188)***
Quadratic			
Random Effects			
Intercept	81.57 (11.20)***	68.44 (16.15)***	84.57 (11.43)***
Linear		.041 (.000)	
Quadratic			
Residual Variance	27.04 (2.12)***	21.47 (1.69)***	21.50 (1.69)***
Deviance Statistic(AIC)	3177.85	3107.34	3104.04

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.18 summarizes the model building process for the syntax growth trajectory. Model 1 adds the control variables of interests. The fixed effects for the intercept (β_{00}=25.43, p<.001) and time (β_{10}=2.13, p<.001) were significant. Further, site (β_{01}=-4.98, p<.05) and Cohort 2 (β_{03}=7.41, p<.05) had a significant effect for intercept where time had no significant predictors; all non-significant terms were dropped for the next iteration. The random effects suggested that the intercept (r_{00}=58.35, p<.001) had remaining significant variance to be explained, where the Time did not. However, given the differences between generation status (see Table 16) and the initial descriptive statics (See Table 14-16), time was allowed to vary in the next model. Model 2 included the significant fixed effects from Model 1 and also added generation status, with Generation 2 as the referent group. Similar to Model 1 the fixed effects for the Intercept (β_{00} =30.85, p<.001) and Time (β_{10}=1.61, p<.001) were significant. The same trend from

Model 1 held for Model 2 with Site and Cohort 2 (β_{01}=-4.93 and β_{02}=4.90, respectively, all *p*s<.01) significant predictors for the Intercept. With the addition of generation status, Generation 1 (β_{03}**=-**11.90, *p*<.001) was significantly predictive of the Intercept. Thus, for the final model, while there was no significant variation across generation for growth (i.e., all students were predicted to gain 1.61 points every 6 months), Generation 1 was predicted to start Grade 2 11.90 behind Generation 2; Generation 3 peers were predicted to begin 3.81 points behind their Generation 2 peers, but this difference was not significant.

Table 4.18. *Model Building for Syntax*

		Fixed Effects	Model 1	Model 2
Level 1 Predictor		**Intercept**	25.43 (2.73)***	30.85 (1.55)***
Level 2 Predictors	Control Variables	Site	-4.98 (2.13)*	-4.93 (1.58)**
		Cohort 1	4.87 (2.73)	_
		Cohort 2	7.41 (2.93)*	4.90 (1.48)*
	Immigrant Status	Generation 1		-11.90 (2.92)***
		Generation 3		-3.81 (2.64)
Level 1 Predictor		**Time**	2.13 (.446)***	1.61 (.219)***
Level 2 Predictors	Control Variables	Site	-4.98 (2.13)	_
		Cohort 1	.479 (.507)	_
		Cohort 2	.071 (.501)	_
	Immigrant Status	Generation 1		.606 (.530)
		Generation 3		.354 (.564)
		Random Effects		
		Intercept	58.35 (15.29)***	49.78 (12.97)***
		Time	.034 (.000)	1.039 (.000)
		Residual Variance	21.52 (1.72)***	21.59 (1.73)***
		Deviance Statistic	3073.43	3051.03

*Note: *p<.05, **p<.01, ***p<.001*

Figure 4.3 displays a graphical representation of the final syntax trajectory (Model 2), disaggregated by Generation Status. The slight gap between Generation 2 and Generation is not significant, further Figure 4.3 does not account for the significant differences of site on the intercept.

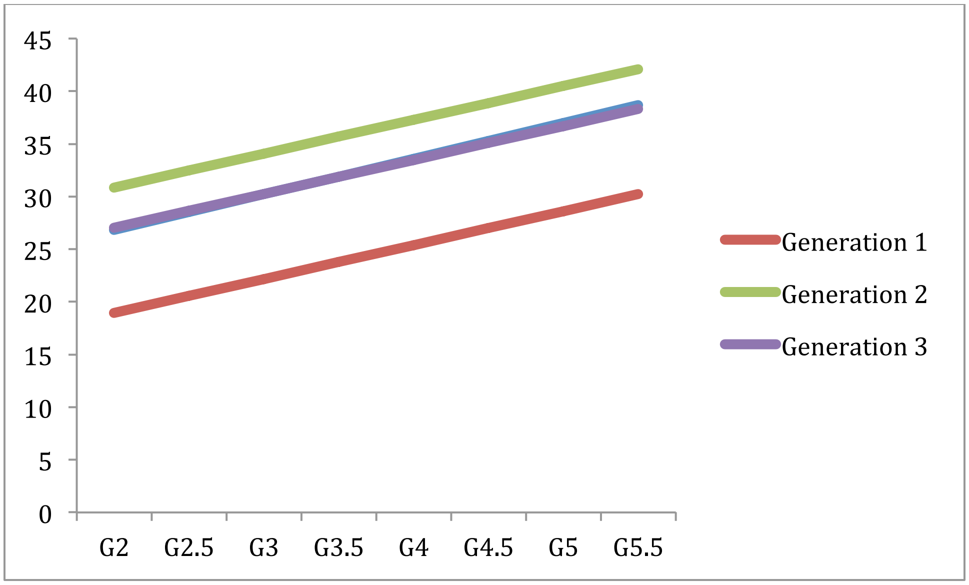

Figure 4.3 *Syntax Growth Trajectory disaggregated by Generation Status*

Semantics. Tables 4.19-4.21 display the ANOVA results for group differences by Site, Cohort, and Generation Status, respectively. As can be seen in Tables 19 and 20, statistically significant differences by site and cohort warrant their inclusion as covariates. ANOVA results for Generation Status suggest that Generation 2 significantly outperforms Generation 1 at Grade 5 and Grade 5.5 (see Table 4. 21). At Grade 2 and Grade 2.5, Generation 1 had fewer than two cases and therefore post-hoc tests were not conducted at those time points, however ANOVA analyses at that time point did reveal statistically significant differences at Grade 2.

Table 4.19 *Mean Raw Scores for Semantics Disaggregated by Site*

	Site 1 (n=96)	Site 2 (n=39)
Grade 2	4.50 (1.58)	5.56 (2.01)
Grade 2.5	6.36 (2.56)	6.67 (2.69)
Grade 3	6.71 (2.31)	8.05 (2.04)[a]
Grade 3.5	8.14 (2.51)	9.00 (2.00)
Grade 4	8.50 (2.98)	8.23 (2.84)
Grade 4.5	9.52 (3.34)	9.26 (2.56)
Grade 5	9.38 (3.35)	9.21 (4.08)
Grade 5.5	10.43 (3.92)	10.14 (3.55)

Note: [a]=Site 2 significantly outperforms Site 1

Table 4.20 *Mean Raw Scores for Semantics Disaggregated by Cohort*

	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Grade 2	4.76 (1.72)		
Grade 2.5	6.43 (2.56)		
Grade 3	7.00 (2.48)	7.13 (2.13)	
Grade 3.5	8.00 (2.38)	8.81 (2.38)	
Grade 4		9.02 (2.90)[a]	7.61 (2.82)
Grade 4.5		9.83 (3.28	8.91 (2.87)
Grade 5			9.31 (3.60)
Grade 5.5			10.32 (3.73)

Note: [a]*=Cohort 2 significantly outperforms Cohort 3*

Table 4.21 *Mean Raw Scores for Semantics Disaggregated by Generation Status*

	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Grade 2	5.00	5.03 (1.61)	3.57 (1.90)
Grade 2.5	1.00	6.67 (2.50)	6.17 (2.14)
Grade 3	5.63 (2.20)	7.46 (2.31)	5.91 (1.58)
Grade 3.5	7.25 (2.31)	8.72 (2.32)	7.27 (2.49)
Grade 4	7.06 (3.63)	8.65 (2.58)	10.00 (1.73)
Grade 4.5	8.18 (3.86)	9.84 (2.92)	9.38 (2.33)
Grade 5	7.08 (2.97)	10.45 (3.52)[a]	10.67 (3.06)
Grade 5.5	7.77 (3.85)	12.00 (2.99)[a]	10.25 (2.06)

Note: [a]*=Generation 2 significantly outperforms Generation 1*

Table 4.22 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the ICC and the calculation suggested that without accounting for any other variables, 49.8% of the variation in semantics lies between individuals. Inclusion of the linear term improved model fit [$\chi^2(2, \text{N=1080}) = 158.83$, $p<.001$], however the quadratic did not improve the model. The random effect for the linear term was not significant (r_{10}=.138, $p>.05$), however omission of the random effect did not significantly improve the model fit.

Table 4.22 *Unconditional Means and Growth Models for Semantics*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	8.05 (.221)***	4.99 (.241)***	4.91 (.237)***
Linear		.895 (.072)***	.934 (.177)
Quadratic			-.002 (.079)
Random Effects			
Intercept	5.03 (.827)***	31.08 (.858)***	.657 (.404)
Linear		.138 (.093)	.466 (.000)
Quadratic			.668 (.000)
Residual Variance	5.08 (.397)***	3.25 (.284)***	1.70 (.106)***
Deviance Statistic(AIC)	2276.46	2117.63	2513.15

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.23 summarizes the model building process for the semantics growth trajectory. Model 1 adds the control variables of interests. The fixed effects for the intercept (β_{00}=3.18, p<.001) and time (β_{10}=1.08, p<.001) were significant. Further, Cohort 1 (β_{02}=2.29 p<.01) and Cohort 2 (β_{03}=3.01, p<.01) had a significant effect for intercept where Time had no significant predictors; all non-significant terms were dropped for the next iteration. The random effects suggested that the intercept (r_{00}=1.09, p<.001) had remaining significant variance to be explained, where the Time did not. However, given the differences between generation status for the final two time points (see Table 4.21) and the initial descriptive statics (See Table 4.1), Time continued to vary in the next model. Model 2 included the significant fixed effects from Model 1 and also added generation status, with Generation 2 as the referent group. Similar to Model 1 the fixed effects for the Intercept (β_{00} =3.89, p<.001) and Time (β_{10}=1.06, p<.001) were significant. The same trend from Model 1 held for Model 2 with Cohort 1 and Cohort 2 (β_{01}=1.27 and β_{02}=1.47, respectively, all ps<.05) significant predictors for the Intercept.

With the addition of Generation Status, Generation 1 (β_{11}=-.349, p<.001) was significantly predictive of time, suggesting that Generation 1 students gain .349 less of a point on the semantics assessment per time point when compared to their Generation 2 and Generation 3 peers. Thus, the final model suggested that there were no significant difference at the beginning of Grade 2 across generation status, however while students were predicted to grow, on average, 1.06 points every 6 months, Generation 1 students were only predicted to grow .711 of a point per time point. The difference in growth rates between Generation 2 and Generation 3 were not significant.

Table 4.23. *Model Building process for Semantics*

		Fixed Effects	Model 1	Model 2
Level 1 Predictor		**Intercept**	3.18 (.874)***	3.89 (.589)***
Level 2 Predictors	Control Variables	Site	-.709 (.542)	_
		Cohort 1	2.29 (.864)**	1.27 (.572)*
		Cohort 2	3.01 (.956)**	1.47 (.540)*
	Immigrant Status	Generation 1		-.995 (.656)
		Generation 3		-.933 (.656)
Level 1 Predictor		**Time**	1.08 (.184)***	1.06 (.093)***
Level 2 Predictors	Control Variables	Site	.035 (.163)	_
		Cohort 1	-.072 (.212)	_
		Cohort 2	-.252 (.210)	_
	Immigrant Status	Generation 1		-.349 (.201)***
		Generation 3		.046 (.210)
		Random Effects		
		Intercept	1.09 (.833)	.868 (.786)
		Time	.165 (.096)	.104 (.088)
		Residual Variance	3.17 (.277)***	3.23 (.280)***
		Deviance Statistic	2103.94	2085.54

*Note: *p<.05, **p<.01, ***p<.001*

Figure 4.4 displays a graphical representation of the final semantics trajectory (Model 2), disaggregated by generation status. The slight gap and between Generation 2 and Generation 3 is not significant; further while the pitch (i.e., slope) for the trajectory is significantly different for Generation 1, there were no significant differences between generations at the intercept.

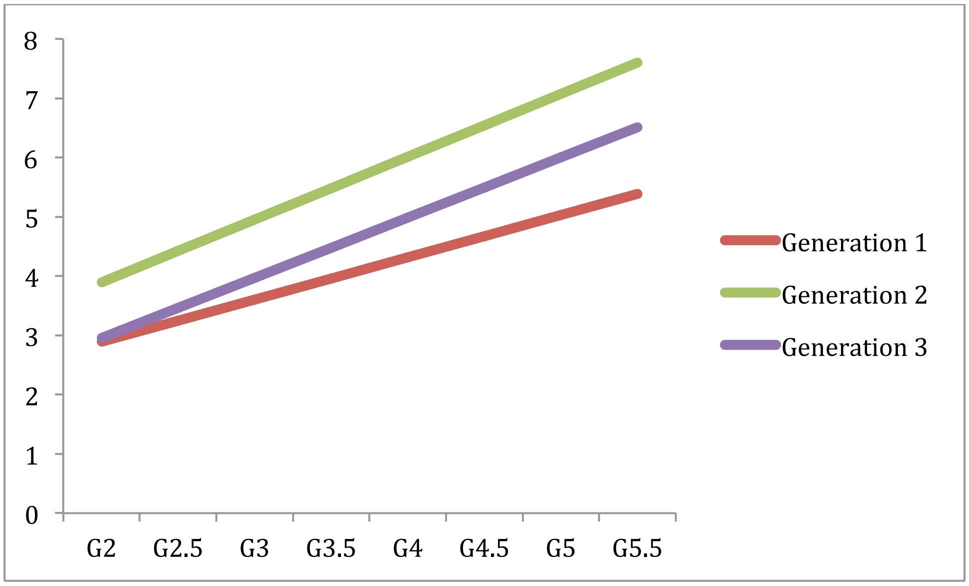

Figure 4.4 *Semantics Growth Trajectory disaggregated by generation status*

Reading Comprehension. Tables 4.24 – 4.26 display the ANOVA results disaggregated by site, cohort, and generation status, respectively. ANOVA and Tukey post-hoc revealed no differences by cohort, therefore these variables were not included as covariates in the growth model. Results in Table 4.26 suggest that there were no significant differences between Generation 2 and Generation 3, although Generation 2 did significantly outperform Generation 1 from Grade 3.5 through Grade 5.5. It is also worth mentioning that at Grade 2 and Grade 2.5, Generation 1 had fewer than two cases and therefore post-hoc tests were not conducted at those time points, however ANOVA analyses at that time point did reveal statistically significant differences at Grade 2.

Table 4.24 *Mean W Scores for Reading Comprehension Disaggregated by Site*

	Site 1(n=96)	Site 2(n=39)
Grade 2	466.21 (17.02)	479.56 (6.69)[a]
Grade 2.5	474.95 (12.67)	483.44 (9.42)
Grade 3	477.03 (15.69)	483.90 (11.34)
Grade 3.5	484.72 (13.83)	489.14 (11.26)
Grade 4	487.14 (13.78)	482.45 (25.49)
Grade 4.5	491.22 (13.85)	488.35 (14.66)
Grade 5	490.05 (14.64)	479.64 (23.09)
Grade 5.5	490.35 (13.37)	487.64 (21.05)

Table 4.25 *Mean W Scores for Reading Comprehension Disaggregated by Cohort*

	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Grade 2	469.46 (16.15)		
Grade 2.5	477.03 (12.40)		
Grade 3	476.00 (16.74)	481.76 (12.28)	
Grade 3.5	483.81 (16.68)	481.76 (12.28)	
Grade 4		488.48 (17.33)	481.94 (17.84)
Grade 4.5		491.94 (14.78)	488.29 (12.90)
Grade 5			485.89 (18.89)
Grade 5.5			489.32 (16.46)

Table 4.26 *Mean W Scores for Reading Comprehension Disaggregated by Generation Status*

	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Grade 2	447.00	471.79 15.06)	463.00 (18.65)
Grade 2.5	458.00	478.87 (12.52)	471.00 (7.90)
Grade 3	468.88 (21.56)	481.05 (12.64)	473.55 (18.33)
Grade 3.5	474.38 (22.48)	488.51 (10.45)[a]	480.09 (13.95)
Grade 4	471.47 (22.48)	488.51 (10.45)[a]	480.09 (13.95)
Grade 4.5	482.71 (23.88)	493.04 (9.64)[a]	488.38 (4.41)
Grade 5	475.50 (23.76)	491.70 (14.19)[a]	488.67 (7.09)
Grade 5.5	478.15 (19.15)	496.30 (11.95)[a]	490.75 (3.69)

Note: [a]=Generation 2 significantly outperforms Generation 1

Table 4.27 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the ICC and the calculation suggested that without accounting for any other variables, 64.2% of the variation in reading comprehension lies between individuals. Inclusion of the linear term improved model fit [$\chi^2(2, \text{N=1080})$

=91.01, p<.001], however the quadratic did not improve the model [χ^2(2, N=1080) =4.15, p=.125] and was dropped from subsequent analyses. The random effect for the linear term was not significant (r_{10}=2.47, p>.05), however omission of the random effect did not significantly improve model fit and given interest in potential effects for generation status on time, the random effect for time was retained in subsequent model iterations.

Table 4.27 *Unconditional Means and Growth Models for Reading Comprehension*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	482.94 (1.27)***	470.50 (1.79)***	468.57 (2.06)***
Linear		3.57 (.366)***	5.20 (.938)***
Quadratic			-.244 (.119)*
Random Effects			
Intercept	184.72 (27.26)***	210.22 (54.27)***	183.93 (52.89)***
Linear		2.47 (2.37)	9.77 (7.01)
Quadratic			.063 (.000)
Residual Variance	102.79 (8.07)***	73.28 (6.66)***	74.33 (7.26)***
Deviance Statistic(AIC)	3736.39	3645.38	3649.53

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.28 summarizes the model building process. Model 1 adds the covariate controls of Site and Letter-Word Identification (LWID) on initial status and growth. Both Site and LWID (β_{01}=-7.62 and β_{02}=1.31, respectively, ps<.05) were significantly predictive of initial status, but not growth. Model 4 added effects for Generation Status. Model 2 included the significant fixed effects from Model 1 and also added Generation Status, with Generation 2 as the referent group. Similar to Model 1 the fixed effects for the Intercept (β_{00} =-.740, p<.05) and Time (β_{10}=1.16**,** p<.001) were significant. With the addition of Generation Status, Generation 1 (β_{03}**=-**13.76, p<.01) was significantly predictive of Intercept, suggesting that Generation 1 students start 13.76 of a W-point lower on the Reading Comprehension assessment when compared to their Generation 2 and Generation 3 peers. Thus, the final suggests that second generation bilingual Latinos are predicted to start Grade 2 at 477.29 W-points on Reading comprehension and every 6 months they are predicted, on average, to grow 3.06 W-points; further as LWID increases its effect for average reading scores also increases. Given no predicted effect for Generation 3, this reading comprehension trajectory is also similar for students in Generation 3. However, for students in Generation 1, while they are predicted to grow at the same rate as their Generation 2 and 3 peers, they are predicted to begin 14.21 W-points behind. Finally students at the Mid-Atlantic site were predicted to begin even 3.82 points more behind their Northeast peers.

Table 4.28 *Model Building process for Reading Comprehension*

		Fixed Effects	Model 1	Model 2
Level 1 Predictor		**Intercept**	478.93 (2.50)***	477.29 (1.96)***
Level 2 Predictors	Control Variables	Site	-7.21 (2.91)**	-3.82 (1.89)*
		LWID	1.15 (.144)	1.06 (.103)***
	Immigrant Status	Generation 1		-14.21 (4.81)***
		Generation 3		1.87 (3.66)
Level 1 Predictor		**Time**	2.13 (.599)**	3.06 (.381)***
Level 2 Predictors	Control Variables	Site	.762 (.715)	_
		LWID	.007(.039)	_
	Immigrant Status	Generation 1		.454 (.969)
		Generation 3		-1.01 (.945)
		Random Effects		
		Intercept	47.87 (26.74)^{t}	46.64 (23.38)*
		Time	.417(1.99)	.512 (1.80)
		Residual Variance	78.52 (7.08)***	77.15 (6.84)***
		Deviance Statistic	3525.86	3487.43

*Note: *p<.05, **p<.01, ***p<.001*

The significant fixed effect for Generation 1 on Initial Status is represented in Figure 4.5; the slight gap and between Generation 2 and Generation 3 at the intercept is not significant, further the slightly flatter slope for Generation 3 is also not significantly different from Generation 1 or Generation 2.

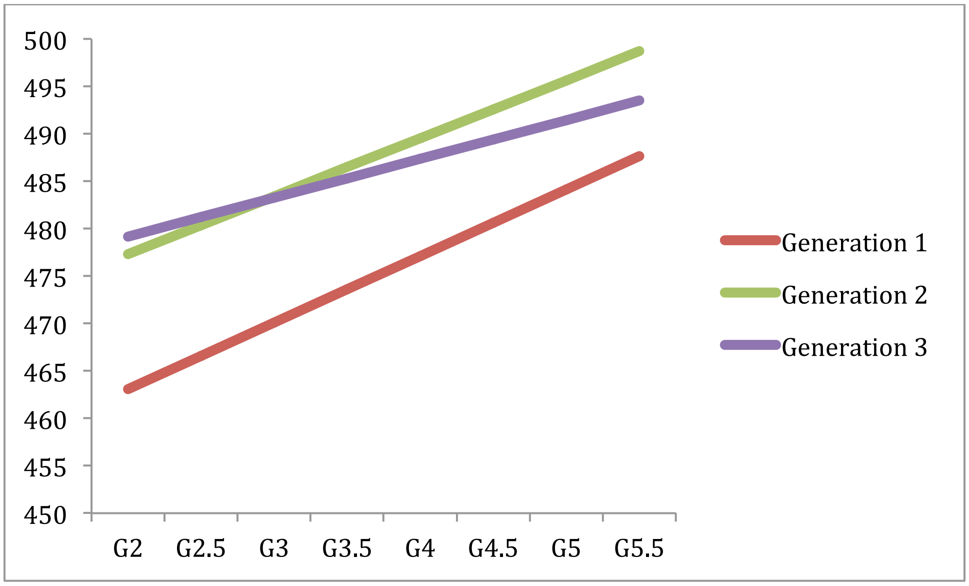

Figure 4.5 *Reading Comprehension Growth Trajectory*

Research Question 2 and 2a: For bilingual Latino students in second through fifth grade, what are the predictive relationships between initial status and growth in English language components and initial status and growth in English reading comprehension? Are these relationships moderated by immigrant generation status? Table 4.29 displays the predicted mean intercepts for each o the four language components, disaggregated by generation status. The predicted average initial status at Grade 2 for vocabulary was 474.38 W-points, with a range of 389.68 - 479.64. Average predicted initial status at Grade 2 for morphology was 21.08 raw score points, with a range of -11.21-39.17; it was 26.29 raw score points for syntax (range -6.44-42.33) and 4.58 raw score points for semantics (range 1.73-7.13). A negative score was not possible, however, the negative minimum scores for morphology and syntax reflect the predicted negative effects at initial status. ANOVA comparison revealed that there were no significant differences in predicted slopes between generation status groups.

Table 4.29 *Mean Predicted Intercepts for English Language Growth Trajectories*

	Sample (n=1072)	Generation 1 (n=192)	Generation 2 (n=744)	Generation 3 (n=144)
Vocabulary	474.38 (14.84)	453.35 (23.26)	479.33 (8.76)	475.68 (9.48)
Morphology	21.07 (3.70)	12.59 (9.83)	23.60 (7.06)	19.34 (7.08)
Syntax	26.29 (9.53)	15.96 (11.85)	29.32 (6.89)	24.41 (7.46)
Semantics	4.58 (1.12)	3.51 (1.17)	4.95 (.916)	4.04 (.825)

Table 4.30 displays the predicted mean slopes for each of the four language components, disaggregated by generation status. The predicted average growth for vocabulary from beginning of Grade 2 to the end of Grade 5 was 3.22 W-points per time point, with a range of 1.72 – 3.77. Average predicted growth for morphology from beginning of Grade 2 to Grade 5 was 4.90 raw score points per time point, with a range of .09-7.71; it was 1.80 raw score points for syntax (range 1.17-2.35) and 1.01 raw score points for semantics (range .09 -2.36). ANOVA comparison revealed that there were no significant differences in predicted slopes between generation status groups.

Table 4.30 *Mean Predicted Slopes for English Language Growth Trajectories*

	Sample (n=1072)	Generation 1 (n=192)	Generation 2 (n=744)	Generation 3 (n=144)
Vocabulary	3.22 (.647)	2.84 (.467)	3.12 (.691)	3.28 (.360)
Morphology	4.90 (1.01)	4.87 (.985)	4.88 (.998)	4.97 (1.07)
Syntax	1.80 (.279)	2.35 (.000)	1.63 (.048)	1.93 (.000)
Semantics	1.01 (.318)	3.51 (1.17)	4.95 (.916)	1.10 (.189)

Bivariate correlations revealed that the predicted initial status for all language components were moderately to strongly correlated with each other (*r* range .669-.820, all *p*s<.01). I also used the predicted values to calculate slopes. To calculate the slopes I subtracted the predicted value for Time 0 from the predicted value of Time 1. This calculated value was then translated into a new variable. For example, the difference between the predicted value of Time 1 and Time 0 for English Vocabulary was translated into a non-time varying variable of English Vocabulary Slope.

Bivariate correlations revealed that the predicted initial status for all language components were moderately to strongly correlated with each other (r range .669-.820, all ps<.01). Bivariate correlations also revealed a range of significantly weak positive correlations between predicted slopes (Vocabulary and Morphology, r=.082, p<.001; Vocabulary and Semantics, r=.062, p<.05) and significantly weak to moderate negative correlations (Vocabulary and Syntax, r=-.168, p<.01; Syntax and Morphology, r=-.484, p<.01; Semantics and Syntax, r=.438, p<.01). Negative correlations between respective slopes and intercepts of morphology (r=-.385, p<.01) and syntax (r=-.541, p<.01) suggested an inverse relationship such that students who were predicted to have lower scores at Grade 2 might grow a faster rate; alternatively, this could be interpreted such that students who were predicted to begin higher at Grade 2 were predicted to grow a slower rate. In contrast a positive significant relationship between the respective slopes and intercepts of vocabulary (r=.310, p<.01) and semantics (r=.716, p<.01) suggested that for these two constructs students who were predicted to start Grade 2 with a higher score were also predicted to grow at a faster rate. Bivariate correlations are summarized in Table 4.31. These predicted slopes and intercepts were grand mean centered and used as Level 2 predictors for the following sub-questions.

Table 4.31 *Correlation Matrix for Mean Predicted Slopes and Intercepts*

	1.	2.	3.	4.	5.	6.	7.
1. Vocabulary Sl.	1						
2. Vocabulary Int.	.310**	1					
3. Morphology Sl.	.082**	.045	1				
4. Morphology Int.	.118**	.691**	-.385**	1			
5. Syntax Sl.	-.168**	-.493**	-.008	-.484**	1		
6. Syntax Int.	.379**	.820**	.049	.667**	-.541**	1	
7. Semantics Sl.	.062*	.711**	-.011	.590**	-.438**	.663**	1

*Note: *p<.05, **p<.01, ***p<.001*

To examine the role of language components on reading comprehension intercept a new model which added the intercepts of the predicted values as L2 predictors for time. This new model is displayed in Table 4.32 The predicted mean intercept for reading comprehension was 469.90 W-points with LWID (β_{02}=.230, p<.05) as a significant main predictors for intercept. Time was also significant ($\beta_{10} = 4.87$, p<.01). The predicted intercepts for vocabulary (β_{15}=.382, p<.001), morphology (β_{16}=.443, p<.05) and syntax (β_{17}=.354, p<.1) were significant predictors for growth in reading comprehension. Thus, for this intra-linguistic growth model of reading students were predicted to begin Grade 2, on average, with 469.90 W-points and as average performance on LWID, vocabulary, morphology, and semantics increased, reading comprehension performance at Grade 2 was also predicted to increase. There were no differences between Generations on initial status at Grade 2.

Table 4.32 *Intra-Language Model for English Reading Comprehension - Predicting Intercept*

		Fixed Effects	Model 1
Level 1 Predictor		**Intercept**	469.90 (1.69)***
Level 2 Predictors	Control Variables	Site	-.242 (1.38)
		LWID	.230 (.010)*
	Immigrant Status	Generation 1	-1.25 (4.09)
		Generation 3	3.32 (2.90)
	English Language	Vocabulary	.382 (.073)***
		Morphology	.443 (.113)***
		Syntax	.354**
		Semantics	1.27 (.842)
Level 1 Predictor		**Time**	3.56 (.342)***
Level 2 Predictors	Control Variables	SITE	_
		LWID	_
	Immigrant Status	Generation 1	.868 (.812)
		Generation 3	-.702 (.739)
		Random Effects	
		Intercept	13.33(16.45)
		Time	.097 (1.08)
		Residual Variance	75.43 (6.23)***
		Deviance Statistic	3361.40

*Note: *p<.05, **p<.01, ***p<.001*

To examine the role of language components on reading comprehension slope a new model which added the slopes and intercepts of the predicted values as L2 predictors for time. This new model is displayed in Table 4.33. The predicted mean intercept for reading comprehension was 477.88 with LWID (β_{02}=.569, p<.001) and Generation 1 (β_{03}=-16.53, p<.001) as significant main predictors for intercept. Time was also significant ($\beta_{10} = 4.87, p$<.001) and the predicted intercept for vocabulary (β_{14}=.081), syntax (β_{18}=.073, p<.05) and semantics (β_{110}=.362, p<.10) were significant predictors for growth in reading comprehension. Thus, for this model, students in Generation 2 and Generation 3 were predicted to begin Grade 2 with 477.88 W-points on Reading Comprehension with an additional half point for each raw score point on LWID. However, students in Generation 1 were predicted to begin Grade 2 16 points behind their Generation 2 and Generation 3 peers. In regard to growth, average reading scores were predicted to increase for students who also started Grade 2 with higher vocabulary, syntax, and semantics scores.

Table 4.33 *Intra-Language Model for English Reading Comprehension - Predicting Slope*

		Fixed Effects	Model 1
Level 1 Predictor		**Intercept**	477.88 (2.55)***
Level 2 Predictors	Control Variables	Site	-4.26 (1.95)
		LWID	.569 (.010)***
	Immigrant Status	Generation 1	-16.53 (4.62)***
		Generation 3	-3.09 (3.80)
Level 1 Predictor		**Time**	4.87 (1.95)***
Level 2 Predictors	Control Variables	SITE	_
		LWID	_
	Immigrant Status	Generation 1	-6.48 (8.43)
		Generation 3	-3.25 (3.63)
	English Language	Vocabulary Sl.	-.570 (.693)
		Vocabulary Int.	.081 (.020)***
		Morphology Sl.	-.021 (.234)
		Morphology Int.	.049 (.038)
		Syntax Sl.	14.46 (11.48)
		Syntax Int.	.073 (.033)*
		Semantics Sl.	-.859 (.775)
		Semantics Int.	.362 (.693)^t
		Random Effects	
		Intercept	72.73 (29.66)*
		Time	2.56 (1.64)
		Residual Variance	78.61 (6.71)
		Deviance Statistic	3414.70

Note: $^t p<.10$ $*p<.05$, $**p<.01$, $***p<.001$

Study 2 Results

Descriptive Analyses

Table 4.34 displays the student mean and standard deviation scores on all language components across all time points (i.e., academic semester). As can be seen in the Table 34, the trend for all four language components is linear. Table 4.35 displays the distribution of generation status across each time point (i.e., academic semester). There were a total of 16, 82, and 14 students across Generation 1, Generation 2, and Generation 3, respectively.

Table 4.34. *Mean scores[1] for English Language Component*

	Time 0	Time 1	Time 2	Time 3
Vocabulary	482.68 (13.52)	486.42 (13.57)	488.71 (15.69)	491.99 (14.45)
Morphology	28.96 (11.64)	34.32 (8.86)	36.57 (9.18)	38.72 (8.74)
Syntax	30.87 (8.80)	33.98 (9.35)	34.34 (10.19)	36.29 (9.54)
Semantics	6.46 (2.56)	8.03 (2.83)	8.69 (3.13)	9.63 (3.03)

Note: [1]Vocabularly scores are W-score; all other scores are raw scores

Table 4.35 displays the correlations between generation status, Spanish oral language, and English oral language and English reading comprehension. Spanish vocabulary and syntax were significantly and strongly correlated (r=.701, p<.01) and Spanish syntax was also weakly correlated to Generation 1 (r=.222, p<.05). Spanish vocabulary was only significantly correlated to one English language variable, English semantics at Time 1, and the relationship was weak (r=.221, p<.05). Spanish syntax was significantly correlated with the following English language variables: morphology time 0 and time 3 (r=.267 and r=.296, respectively, ps<.05), all for time points for syntax (r range .281-.370, ps<.05), semantics time 2 (r=.228, p<.05), and time 0, 1, and 3 for reading comprehension (r=.292, r=.259, and r=.662, respectively, all ps<.05). When looking at relationships between generation status and English language components, Generation 1 had a significant weak relationship with vocabulary from time 1-3 (r range = -.276 - -.342). Generation 2 had significant positive relationships with the following variables: all time points for vocabulary (r range = .235-.398); time 1-3 for morphology (r range .248-.320); the final time point for syntax (r=.199, p<.05) and semantics (r=.250, p<.05); and the final two time points for reading (r=.264 and r=.287, respectively, ps<.05).

Table 4.35 *Correlation Matrix for Spanish Oral Language, English Language Components, and English Reading Comprehension*

	Spanish Vocab	Spanish Syntax	Generation 1	Generation 2	Generation 3
Spanish Vocabulary Time 0	1	.701**	.197	-.089	-.107
Spanish Syntax Time 0	.701**	1	.222*	-.061	-.150
English Vocabulary Time 0	-.023	.079	-.167	.235*	-.140
English Vocabulary Time 1	-.025	.110	-.276**	.283**	.087
English Vocabulary Time 2	-.106	.064	-.342**	.398**	-.168
English Vocabulary Time 3	-.042	.164	-.289**	.317**	-.118
English Morphology Time 0	.171	.267*	.001	.142	-.191*
English Morphology Time 1	.061	.200	.141	.248**	-.184
English Morphology Time 2	.073	.185	-.147	.309**	-.262**
English Morphology Time 3	.177	.296**	-.170	.320**	-.252*
English Syntax Time 0	.079	.281*	-.104	.190*	-.145
English Syntax Time 1	-.025	.307**	-.062	.115	-.088
English Syntax Time 2	.028	.300**	-.004	.131	-.176
English Syntax Time 3	.201	.370**	-.108	.199*	-.154
English Semantics Time 0	.062	.154	.001	.133	-.179
English Semantics Time 1	.221*	.078	.042	.088	-.074
English Semantics Time 2	.123	.228*	-.140	.173	-.082
English Semantics Time 3	.135	.204	-.125	.250*	-.205*
English Reading Time 0	.180	.292**	-.130	.183	-.109
English Reading Time 1	.119	.156	-.115	.171	-.108
English Reading Time 2	.112	.259*	-.143	.264**	-.205*
English Reading Time 3	.016	.662**	-.161	.287**	-.217*

*Note: *p<.05, **p<.01, ***p<.001*

Research Question 1: What are the main and moderating effects of immigrant generation status and Spanish oral language on the initial status and growth of English language components over two academic years?

Results for each growth model are presented separately, including the preliminary descriptive analyses that guided the model building process.

Vocabulary. ANOVAs by site, cohort, and generation status were first run to test for mean differences; these analyses can be found in Tables 4.36-4.38. As can be seen in Table 4.36, statistically significant differences between the sites at Time 3 suggested that site should be included as a covariate. Similarly, a statistically significant difference between Cohorts (*p*<.05) warranted the inclusion of Cohort. While both Cohort 2 and Cohort 3 significantly outperformed Cohort 1, there were no significant differences between Cohort 2 and Cohort 3. Finally, as can be seen in Table 4.38, Generation 2 significantly outperformed Generation 1 at Time 1 and Time 3; Generation 2 also significantly outperformed Generation 1 and Generation 3 at Time 2.

Table 4.36 *Mean W Scores for Vocabulary disaggregated by Site*

	Sample (n=112)	Site 1 (n=81)	Site 2 (n=31)
Time 0	482.68 (13.52)	482.50 (13.66)	483.13 (13.40)
Time 1	486.42 (13.57)	485.58 6)	488.48 (14.56)
Time 2	488.71 (15.69)	487.88 (15.24)	491.04 (15.99)
Time 3	491.99 (14.45)	489.91 (14.60)	496.31 (12.79)[a]

Note: [a]=Site 2 significantly outperforms Site 1

Table 4.37 *Mean W Scores for Vocabulary disaggregated by Cohort*

	Sample (n=112)	Cohort 1 (n=39)	Cohort 2 (n=39)	Cohort 3 (n=34)
Time 0	482.68 (13.52)	475.78 (13.38)	485.66 (11.29)[a]	486.85 (13.37)[b]
Time 1	486.42 (13.57)	478.27 (11.97)	490.73 (10.51)[a]	490.59 (14.39)[b]
Time 2	488.71 (15.69)	480.94 (16.38)	492.69 (11.28)[a]	492.48 (16.54)[b]
Time 3	491.99 (14.45)	482.91 (15.30)	497.08 (10.46)[a]	496.16 (12.93)[b]

Note: [a]=Cohort 2 significantly outperforms Cohort 1, [b]=Cohort 3 significantly outperforms Cohort 1

Table 4.38 *Mean W Scores for Vocabulary Disaggregated by Generation Status*

	Sample (n=112)	Generation 1 (n=16)	Generation 2 (n=82)	Generation 3 (n=14)
Time 0	482.68 (13.52)	477.07 (15.76)	484.59 (12.71)	477.79 (13.61)
Time 1	486.42 (13.57)	477.13 (14.32)	488.68 (13.17)[a]	483.23 (10.44)
Time 2	488.71 (15.69)	476.07 (23.83)	492.51 (11.83)[b]	481.67 (14.12)
Time 3	491.99 (14.45)	481.93 (17.40)	494.71 (13.09)[a]	487.33 (13.05)

Note: [a]=Generation 2 significantly outperforms Generation 1 3; [b]=Generation 2 significantly outperforms Generation 1 and Generation 3

Table 4.39 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the intraclass correlation coefficient (ICC). The ICC calculation suggested that without accounting for any other variables, 74.6% of the variance in English Vocabulary performance can be accounted for over time. Addition of the linear effect of time improved model fit [χ^2(2, N=448) =107.14 *p*<.001] and while the fixed effect for time was significant (β_{10}=3.26; *p*<.001), the random effect was non-significant (r_{1i}=.023, *p*>.05). Non-significance of the random effect for the linear term suggested that while time had a significant effect on vocabulary growth, the variance in growth did not vary across between individuals and should therefore the linear term should be fixed. Further, deviance hypothesis testing suggested that the inclusion of time as a random slope, however, did not provide a statistically significant difference [χ^2(1, N=448) =3.02, p>.05]. Inclusion of the quadratic term was neither significant, nor did it improve model fit [χ^2(1, N=448) =.49, *p*>.05].

Table 4.39 *Unconditional Means and Growth Models for Vocabulary*

	Unconditional Means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	487.01 (1.27)***	482.31 (1.37)***	482.27 (1.40)***
Linear		3.26 (.279)***	3.37 (.970)**
Quadratic			-.035 (.310)
Random Effects			
Intercept	165.63 (24.60)***	179.72 (29.52)***	179.64 (29.54)***
Linear		.023 (.000)	.022 (.000)
Residual Variance	57.71 (4.67)***	39.79 (3.22)***	39.92 (3.23)***
Deviance Statistic(AIC)	3162.87	3055.73	3056.22

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.40 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 adds Site and Cohort as control variables; Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=486.67; p<.001) and time (β_{10}=4.44; p<.001) were statistically significant. Further, Cohort 1 (β_{01}=-11.24; p<.001) had a statistically significant effect on the intercept such that students in Cohort 1 started at 1124 W-points behind their Cohort 2 and Cohort 3 peers. Site (β_{13}=-.454, p<.05) was a significant predictor for Time such that students at the Northeastern Site gained almost half a W-poins higher per time point. Parameter estimates for the random effects suggested that there was still significant variation to be explained it initial status (r_{0i}=.=161.43, p<.001). The fixed effect for Site on initial status was non-significant and dropped, however given the cohort-sequential design collection of data, Cohort 1 and Cohort 2 were included in subsequent models (even when their effects were non-significant). Model 2 added Spanish Vocabulary and Syntax. For these variables raw scores were used: first they were grand mean centered then entered into the equation. Fixed effects results revealed that that the parameter estimates for intercept

(β_{00}=487.13, p<.001) and time (β_{01}=4.26, p<.001) remained significant, but the Spanish Language Variables were neither predictive of the intercept nor time. With the exception of Cohort, non-significant terms were dropped for the next model iteration. Model 3 added Generation Status and fixed effects results revealed Generation 1 having a significant effect for intercept (β_{03}=-20.57, p<.001). Thus, the final model (Model 3) suggested that at initial status, on average, students are predicted to perform 491.98 W-points on English Vocabulary, however Generation 1 students are predicted to begin 20.57 W-points below their Generation 2 and Generation 3 peers; further if these students are also in Cohort 1 then they are predicted to begin an additional 15.90 points lower. Students are predicted to grow, on average, 3.51 W-points every 6 months. These findings are consistent with the previous ANOVA which revealed statistically significant differences between Generations and Cohort (see Tables 4.36 -4.38). A fourth model which included Spanish and Generation status in the model was fitted, however, Spanish effects remained null and the inclusion of both variables did not improve model fit; this model was not tabled. Figure 4.6 displays the growth trajectory with a separate line representing each Generation Status; the gap between Generation 2 and Generation 3 is not significant, further the slight variation in slopes is not significant.

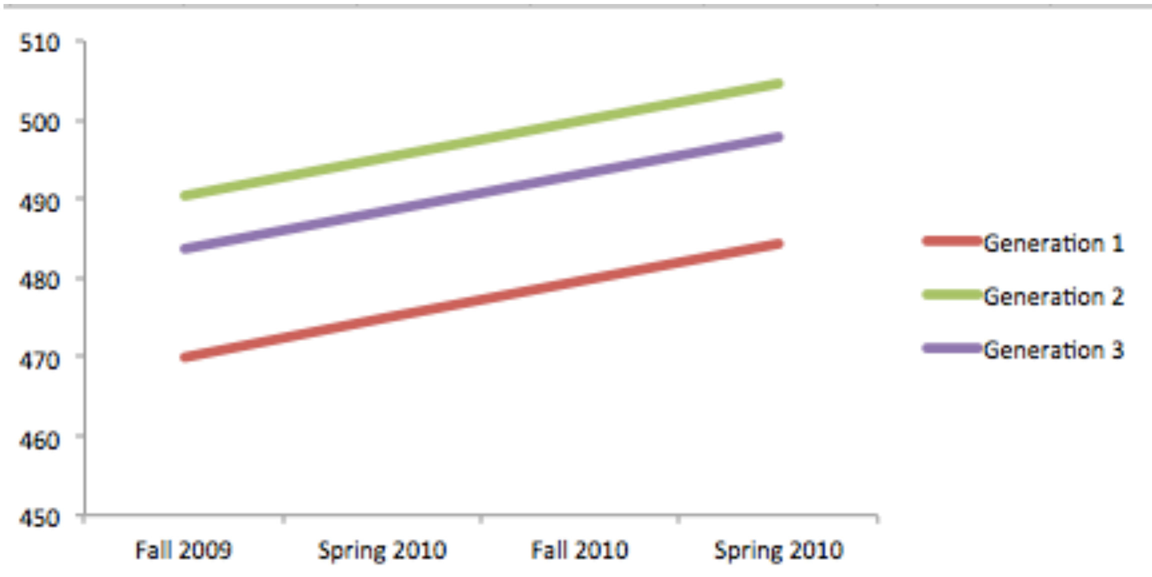

Figure 4.6 *Vocabulary Growth Trajectory disaggregated by Generation Status*

Table 4.40. *Model Building Process for Cross-Language Vocabulary Growth Trajectory*

		Fixed Effects	Model 1	Model 2	Model 3
Level 1 Predictor		**Intercept**	486.67 (3.42)***	487.13 (2.87)***	491.98 (2.69)***
Level 2 Predictors	Control Variables	Cohort 1	-11.24 (3.85)***	-12.24 (4.01)***	-15.90 (3.49)***
		Cohort 2	-1.64 (4.00)	-2.19 (4.02)	-3.59 (3.51)
		Site	-.454 (3.58)	_	_
	Spanish Language	Vocabulary		.173 (.238)	_
		Syntax		.173 (.238)	_
	Immigrant Status	Generation 1			-20.57 (4.38)***
		Generation 3			-7.15 (4.67)
Level 1 Predictor		**Time**	4.44 (.742)***	4.26 (.759)***	3.51 (.666)***
Level 2 Predictors	Control Variables	Cohort 1	.360 (.838)	.010 (.903)	-.075 (.865)
		Cohort 2	-1.64 (4.00)	.840 (.899)	.552 (.867)
		Site	-.454 (3.58)*	-1.27 (.780)	_
	Spanish Language	Vocabulary		-.096 (.075)	_
		Syntax		.067 (.056)	_
	Immigrant Status	Generation 1			-.262 (1.08)
		Generation 3			-.572 (1.16)
		Random Effects			
		Intercept	161.43 (31.58)***	159.19 (31.37)***	119.64 (24.44)***
		Time	.144 (.000)	.149 (.000)	.379 (.000)
		Residual Variance	44.56 (4.28)***	45.44 (4.47)***	44.24 (4.16)***
		Deviance Statistic	2234.76	2244.91	2206.67

*Note: *p<.05, **p<.01, ***p<.001*

Morphology. To test for group differences separate ANOVAs were run by site, cohort, and generation status; these analyses can be found in Tables 4.41-4.43. ANOVA analyses did not warrant inclusion of Site as a covariate, however statistically significant differences between Cohorts (p<.05) warranted the inclusion of Cohort. While both Cohort 2 and Cohort 3 significantly outperformed Cohort1, there were no significant differences between Cohort 2 and Cohort 3. Finally, as can be seen in Table 4.42, Generation 2 significantly outperformed Generation 3 at Time 2 and Time 3.

Table 4.41 *Mean Raw Scores for Morphology disaggregated by Site*

	Sample (n=112)	Site 1 (n=81)	Site 2 (n=31)
Time 0	28.96 (11.64)	29.04 (12.71)	28.77 (8.48)
Time 1	34.32 (8.86)	34.82 (8.42)	33.07 (9.91)
Time 2	36.57 (9.18)	36.50 (9.52)	36.77 (8.32)
Time 3	38.72 (8.74)	38.85 (9.11)	38.38 (7.83)

Table 4.42 *Mean Raw Scores for Morphology disaggregated by Cohort*

	Sample (n=112)	Cohort 1 (n=39)	Cohort 2 (n=39)	Cohort 3 (n=34)
Time 0	28.96 (11.64)	20.54 (12.30)	33.26 (6.35)[a]	33.82 (10.15)[b]
Time 1	34.32 (8.86)	29.92 (7.63)	38.03 (7.02)[a]	35.07 (9.99)[b]
Time 2	36.57 (9.18)	30.65 (9.01)	40.66 (6.24)[a]	38.45 (9.06)[b]
Time 3	38.72 (8.74)	33.64 (9.61)	42.19 (5.73)[a]	40.48 (8.11)[b]

Note: [a]=Cohort 2 significantly outperforms Cohort 1, [b]=Cohort 3 significantly outperforms Cohort 1

Table 4.43 *Mean Raw Scores for Morphology disaggregated by Generation Status*

	Sample (n=112)	Generation 1 (n=16)	Generation 2 (n=82)	Generation 3 (n=14)
Time 0	28.96 (11.64)	29.00 (10.25)	29.96 (11.30)	23.14 (14.03)
Time 1	34.32 (8.86)	31.22 (11.20)	35.61 (8.04)	29.92 (9.21)
Time 2	36.57 (9.18)	33.50 (12.33)	38.33 (7.73)[a]	30.08 (9.28)
Time 3	38.72 (8.74)	35.25 (11.57)	40.41 (7.43)[a]	32.67 (8.87)

Note: [a] =Generation 2 significantly outperforms Generation 3

Table 4.44 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means

Model was used to calculate the intraclass correlation coefficient (ICC). The ICC calculation suggested that without accounting for any other variables, 57.1 % of the variation lies between individuals. Addition of the linear effect of time improved model fit [χ^2(2, N=448) =118 .25, p<.001] and the fixed and random effects for time were significant (β_{10}=-=3.19, p<001 and r_{10} = 2.99, p<.05, respectively). Inclusion of the quadratic term further improved model fit [χ^2(2, N=448) =38.55, p<.001)] and both fixed and random effects for the quadratic term (β_{30}=-.7238, p<.05 and r_{30} =3.32, p<.05, respectively) This model building process proceeded with a random quadratic growth model.

Table 4.44 *Unconditional Means and Growth Models for Morphology*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	34.69 (.961)***	29.89 (1.20)****	29.16 (1.34)***
Linear		3.19 (.315)***	5.39 (1.14)***
Quadratic			-.728 (.309)*
Random Effects			
Intercept	60.65 (11.71)***	94.96 (18.12)***	123.26 (22.24)***
Linear		2.99 (1.35)*	60.76 (17.54)**
Quadratic			3.32 (1.40)*
Residual Variance	45.40 (4.24)***	23.38 (2.68)***	16.11 (2.61)***
Deviance Statistic(AIC)	2193.62	2075.37	2036.82

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.45 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 adds Cohort control variables; Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=33.20, p<.001) and time (β_{10}=1.96, p<.001) were statistically significant. Further, Cohort 1 (β_{01}=-11.92, p<.001) had a statistically significant effect on the intercept such that students in Cohort 1 started at 11.92 W-points behind their Cohort 2 and Cohort 3 peers. Cohort 1 was also a significant predictor for the linear (i.e., time, β_{10}=1.96, p<.001) and quadratic (i.e., rate of change, β_{20}=-1.71, p<.05) terms suggesting that students were predicted to gain 1.96 points per time point, however the negative effect for the quadratic term suggested that this rate slows over time. Model 2 retained the Cohort covariates as controls and added Spanish Vocabulary and Syntax. Fixed effects results revealed that that the parameter estimates for intercept (β_{00}=34.29, p<.001), however the parameter estimates for the linear and quadratic term were non-significant. The Cohort 1 covariate, however was significant for the intercept (β_{01}=12.36, p<.01) and for the both the linear (β_{11}=6.59, p<.01) and quadratic (β_{21}=-1.43, p<.01), suggesting that predicted initial status and growth was significantly for Cohort 1; this also suggested that there was no predicted variation in initial status or growth between Cohort 2 or Cohort 3.

Spanish Syntax was predictive for the intercept (β_{03}=.367, p<.05). All other Spanish language variables were non-significant and dropped from the model for the next iteration. The non-significant terms for both the linear and quadratic terms were intriguing and therefore another iteration fitting was done with the Spanish language variables in the model, but without the random effect, this iteration is displayed as Model 3. Chi-square deviance testing suggested that [χ^2(5, N=448) =24.37, p<.001] suggested that inclusion of the random effect for the quadratic was a slightly better fit, however I chose to proceed with the quadratic term as fixed.

Model 3 included significant main fixed effects for the intercept ($\beta_{00} = 33.58$, p<.001), time (β_{10}=4.00, p<.001) and the quadratic term (β_{30}=-.666) with Cohort 1 being significant predictor for the intercept and time (β_{01}=-10.96, p<.001 and β_{11}=2.31,

p<.01, respectively) and Spanish syntax (β_{04}=.341, p<.05) a significant predictor for the intercept. The next model added generation status and retained the fixed random term in the model; cohort coefficients were also retained, but the non-significant Spanish language predictors were dropped. Model 4 displays the results for the next iteration. The parameter estimates for the intercept ($\beta_{00} = 35.62$, p<.001), time (β_{10}=3.95, p<.001) and the quadratic term (β_{30}=-.6667, p<.01) with Cohort 1 being significant predictor for the intercept and time (β_{01}=-12.46, p<.001 and β_{11}=2.62, p<.01, respectively) and Spanish syntax and Generation 1 (β_{04}=.200, p<.05 and β_{06}=-8.41, p<.01) were significant predictors for the intercept. Generation Status was not predictive of the linear term. Given interest in potential Spanish language and Generation Status moderating effects a final model was fitted which added interaction terms.

Model 5 displays the final iteration with significant interaction terms. Parameter estimates for the fixed effects revealed that there was significant variation around the intercept (β_{00}=35.09, p<.001) and that Cohort 1 was predictive of intercept (β_{01}=-1.76, p<.001) and the linear term (β_{11}=3.95, p<.001). Spanish Syntax (β_{03}=.294 p<.01) was also significantly predictive of the intercept; upon addition of the interaction terms Generation 1 was no longer predictive of the intercept, however interaction testing suggested that Generation 1 students with higher Spanish syntax started lower than their less Spanish proficient peers (β_{06}=-.701, p<.01). Deviance testing suggested that inclusion of the interaction term was a slightly better model fit [χ^2(1, N=307) =7.58, p<.001]. Thus, the final model suggested that students were predicted to begin the school year with 35.09 points on the morphology test; further, as average performance on Spanish syntax increased, students were predicted to start .294 of a point higher.

Interestingly though, for Generation 1 students the effect for syntax was negative, suggesting that Generation 1 peers do not benefit from Spanish language proficiency in the same way as their Generation 2 and Generation 3 peers. In other words, for Generation 1 students, those with more Spanish proficiency had a lower starting point for English morphology. The final model also suggested that students were predicted, on average, to grow 3.95 points per time point, but this growth was also predicted to slow over time. Significant Cohort 1 effects suggest that while the younger students start the study significantly behind their older Cohort 2 and Cohort 3 peers, these younger students are also predicted to grow 2.62 points more than older peers per time point.

Figure 4.7 displays the growth trajectory for Model 3 with a separate line representing the 25^{th}, 50^{th}, and 75^{th} percentiles of Spanish syntax performance. As can be seen, while the slope is similar for all students, students who have higher Spanish language proficiency (75^{th} percentile) were predicted to perform significantly better on morphology than their less Spanish proficient peers. Figure 4.8 displays the growth trajectory for Model 4 with a separate line representing each Generation Status; the unconditional model is also included as a reference for the predicted growth prior to including any other variables. While the slopes of the trajectories vary slightly in the graphic representation, the only statistically significant difference by generation status was the initial status of Generation 1. Figure 4.9 displays how generation status moderates Spanish syntax, with separate lines representing the 25^{th} and 75^{th} percentiles of Spanish syntax performance. As can be seen, for the Generation 1 students, higher

Spanish proficiency was not advantageous for the initial status of morphology.

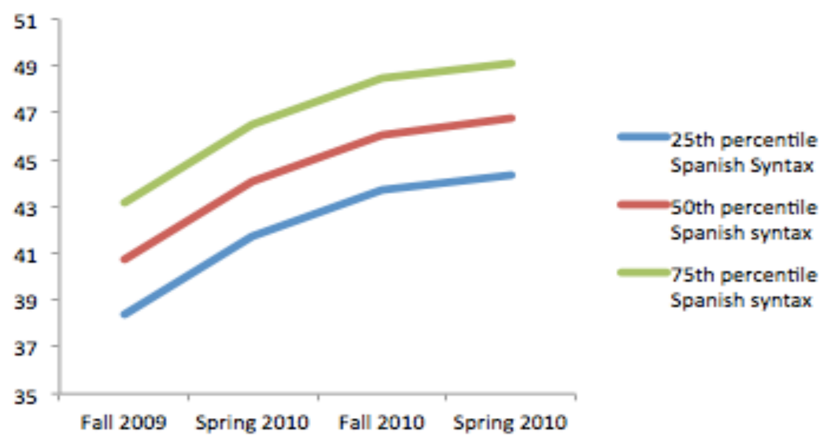

Figure 4.7 *Morphology Growth Trajectories disaggregated by Spanish syntax performance*

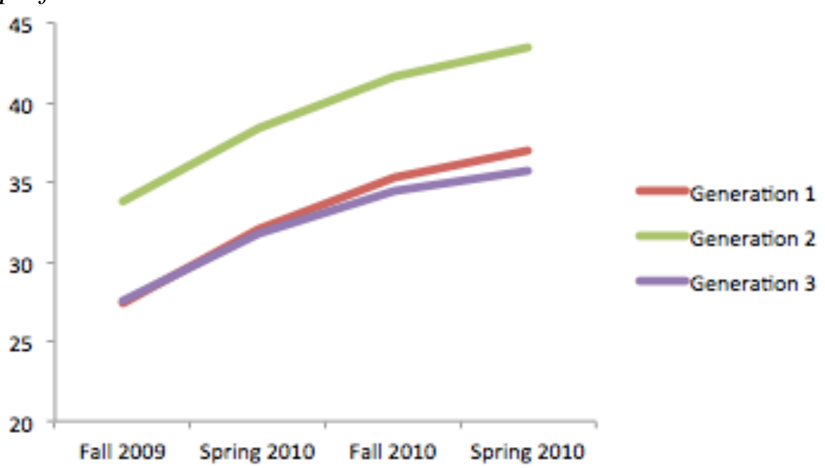

Figure 4.8. *Morphology Growth trajectories disaggregated by Generation Status*

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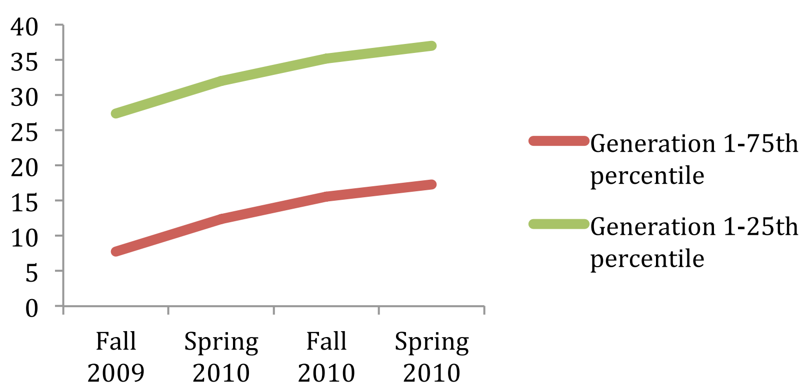

Figure 4.9 *Generation 1 Morphology Growth Trajectories disaggregated by Spanish Syntax Performance*

Table 4.45 *Model building process for Cross-Language Morphology Growth Trajectory*

		Fixed Effects	Model 1	Model 2	Model 3	Model 4	Model 5
Level 1 Predictor		**Intercept**	33.20 (2.02)***	34.29 (1.94)***	33.58 (1.75)***	35.62 (1.79)***	35.09 (1.75)***
Level 2 Predictors	Control Variables	Cohort 1	-11.92 (2.81)***	-12.36 (2.70)***	-10.96 (2.42)***	-12.46 (2.31)***	-11.76 (2.25)***
		Cohort 2	.801 (2.94)	.102 (2.72)	.921 (2.43)	.240 (2.31)	1.12 (2.26)
	Spanish Language	Vocabulary		-.163 (.215)	-.207 (.193)	_	_
		Syntax		.367 (.160)*	.341 (.144)*	.200 (.086)*	.294 (.090)**
	Immigrant Status	Generation 1				-8.41 (2.86)**	-4.99 (3.03)
		Generation 3				-3.72 (3.05)	-3.21 (2.96)
		Generation 1 * Syntax					-.701 (.251)**
Level 1 Predictor		**Time**	1.96 (1.90)***	1.92 (1.66)	4.00 (.842)***	3.95 (.857)***	3.95 (.857)***
Level 2 Predictors	Control Variables	Cohort 1	7.04 (2.65)*	6.59 (2.31)**	2.31 (.634)**	2.62 (.615)***	2.62 (.616)***
		Cohort 2	2.89 (2.76)	2.93 (2.32)	.589 .637)	.644 (.620)	.645 (.620)
	Spanish Language	Vocabulary		-.167 (.184)	-.030 (.051)	_	_
		Syntax		.083 (.137)	-.007 (.308)	_	_
	Immigrant Status	Generation 1				.278 (.769)	.278 (.769)
		Generation 3				-1.31 (.818)	-1.31 (.818)
Level 1 Predictor		**Quadratic**	-1.71 (.725)*	.029 (.458)	-.666 (.235)***	-.667 (.235)**	-.667 (.235)**
Level 2 Predictors	Control Variables	Cohort 1	-1.71 (.724)*	-1.43 (.640)**	_	_	_
		Cohort 2	-.919 (.753)	-.775 (.216)	_	_	_
	Spanish Language	Vocabulary		.046 (.051)	_	_	_
		Syntax		.025 (.038)	_	_	_
		Random Effects					
		Intercept	91.15 (17.38)***	74.24 (14.31)***	47.75 (11.65)***	51.17 (10.62)***	47.54 (10.05)***
		Time	54.17 (16.64)**	31.30 (11.72)**	1.37 (.875)	1.25 (.868)	1.25 (.858)
		Quadratic	2.98 (1.36)*	1.63 (1.01)	_	_	_
		Residual Variance	16.08 (2.60)***	12.67 (2.06)***	16.81 (1.93)***	16.82 (1.93)***	16.82 (1.93)***
		Deviance Statistic	2000.99	1936.55	1960.92	1926.71	1919.13

*Note:[1] Model fitted the Spanish language variables in the model, but without the random quadratic effect; ᵗ<.10 *p<.05, **p<.01, ***p<.001*

Syntax. To test for group differences separate ANOVAs by site, cohort, and generation status were run; these analyses can be found in Tables 4.46-4.48. ANOVA analyses warranted the inclusion of Site and Cohort as Covariates. While both Cohort 2 and Cohort 3 significantly outperformed Cohort1, there were no significant differences between Cohort 2 and Cohort 3. There were no significant differences by Generation Status.

Table 4.46 *Mean Raw Scores for Syntax Disaggregated by Site*

	Sample (n=112)	Site 1 (n=81)	Site 2 (n=31)
Time 0	30.87 (8.80)	30.12 (8.02)	32.77 (10.41)
Time 1	33.98 (9.35)	31.95 (8.78)	39.03 (8.92)[a]
Time 2	34.34 (10.19)	32.05 (9.71)	40.85 (8.73)[a]
Time 3	36.29 (9.54)	34.65 (9.68)	40.52 (7.82)[a]

Note: [a]=Site 2 significantly outperforms Site 1

Table 4.47 *Mean Raw Scores for Syntax Disaggregated by Cohort*

	Sample (n=112)	Cohort 1 (n=39)	Cohort 2 (n=39)	Cohort 3 (n=34)
Time 0	30.87 (8.80)	27.35 (8.25)	33.47 (7.68)[a]	31.79 (9.50)[b]
Time 1	33.98 (9.35)	29.86 (10.08)	36.49 (7.34)[a]	35.74 (9.21)[b]
Time 2	34.34 (10.19)	28.85 (11.48)	37.46 (7.20)[a]	36.84 (9.32)[b]
Time 3	36.29 (9.54)	30.78 (10.52)	39.65 (7.49)[a]	38.68 (7.72)[b]

Note: [a]=Cohort 2 Significantly outperforms Cohort 1; [b]= Cohort 3 significantly outperforms Cohort 1

Table 4.48 *Mean Raw Scores for Syntax Disaggregated by Generation Status*

	Sample (n=112)	Generation 1 (n=16)	Generation 2 (n=82)	Generation 3 (n=14)
Time 0	30.87 (8.80)	28.60 (10.25)	31.88 (7.94)	27.57 (11.07)
Time 1	33.98 (9.35)	32.53 (7.28)	34.61 (9.54)	31.77 (10.39)
Time 2	34.34 (10.19)	34.25 (11.78)	35.17 (9.40)	29.50 (12.01)
Time 3	36.29 (9.54)	33.88 (12.08)	37.43 (885)	32.25 (9.11)

Table 4.49 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the intraclass correlation coefficient (ICC). The ICC

calculation suggested that without accounting for any other variables, 74.7% of the variation lies between individuals. Addition of the linear effect of time improved model fit [χ^2(2, N=448) =59.35, p<.001], but while the fixed effect for time was significant (β_{10}=1.82; p<.001), the random effect was non-significant (r_{10}=1.22, p>.05). Non-significance of the random effect for the linear term suggested that while time had a significant effect on vocabulary growth, the variance in growth did not vary across between individuals and should therefore the linear term should be fixed; however given interest in main and moderating effects of Spanish and generation status, the model building process continued with the inclusion of the random effect for time. Inclusion of the quadratic term was neither significant, nor did it improve model fit.

Table 4.49 *Unconditional Means and Growth Models for Syntax*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	33.48 (.985)***	30.76 (1.03)***	30.73 (.854)***
Linear		1.82 (.240)***	1.90 (.733)*
Quadratic			-.028 (.342)
Random Effects			
Intercept	69.65 (12.21)***	70.53 (13.30)***	41.35 (6.81)***
Linear		1.22 (.814)	1.34 (.000)
Quadratic			4.99 (.000)
Residual Variance	23.80 (2.21)***	16.27 (1.86)**	15.34 (1.80)***
Deviance Statistic(AIC)	2055.01	1995.66	2154.77

*Note :^{t}<.10 *p<.05, **p<.01, ***p<.001*

Table 4.50 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 adds Site and Cohort control variables; Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=34.48, p<.001) and time (β_{10}=2.67, p<.001) were statistically significant. Further, Site (β_{03}=-3.79, p<.10) and Cohort 1 (β_{01}=-4.46; p<.10) had a statistically significant effect on the intercept such that students in Cohort 1 started at 4.46 W-points behind their Cohort 2 and Cohort 3 peers and students at the MidAtlantic site were predicted to perform an additional 3.79 points lower. Cohort covariates were retained in the model for the following iterations, however the non-significant effect Site on Time was dropped. Model 2 added Spanish Vocabulary and Syntax. Fixed effects results revealed that that the parameter estimates for intercept (β_{00}=33.71, p<.001) and time (β_{10}=2.11, p<.001) remained significant and both Spanish Vocabulary and Spanish Syntax waere predictive for the intercept (β_{04}=-.483, p<.05 and β_{05}=..469, p<.001, respectively). Cohort 1 (β_{01}=-4.74, p<.05) was also predictive of initial status. With the exception of the Cohort covariates, all other non-significant variables and dropped from the model for the next iteration.

Model 3 added Generation Status; results revealed significant variation around the intercept (β_{00}=34.90, p<.001) and Time (β_{10}=1.96, p<.001). Cohort 1 (β_{01}=-6.60, p<.01), Spanish Vocabulary (β_{03}=-.400, p<.01), Spanish Syntax (β_{04}=.481, p<.01), Generation 1 (β_{05}=-9.20, p<.001) and Generation 3 (β_{06}=-5.22, p<.10) were significantly predictive of the intercept, such that Generation 1, Generation 2, and Generation 3 were all predicted to begin significantly different points. Generation 1 was also significantly predictive for Time (β_{13}=1.57, p<.05), such that students in Generation 2 were predicted to grow 1.57 points more per time point when compared to their Generation 2 and Generation 3 peers. Results from the final model provide intriguing interpretations. Significant negative effect for Spanish Vocabulary on the intercept suggested that students with higher Spanish Vocabulary were predicted to perform lower than their less Spanish proficient peers. However, the significant positive effect for Spanish Syntax on the intercept suggested that students with higher Spanish Syntax were predicted to perform higher than their less Spanish proficient peers. When synthesized together, this finding suggested that perhaps there is a threshold of Spanish language proficiency (i.e., command of syntax is more sophisticated than vocabulary breadth) necessary before positive benefits of transfer can be detected. Effects for Spanish Language and Generation Status interactions were tested, however no significant interaction terms were found.

Figure 4.10 display the growth trajectory for English reading comprehension accounting for Spanish vocabulary and Spanish Syntax, respectively. As can be seen in Figure 4.10, students with higher Spanish vocabulary were predicted to start lower than their less Spanish proficient peers and students with higher Spanish syntax were predicted to begin higher than their less Spanish proficient peers.

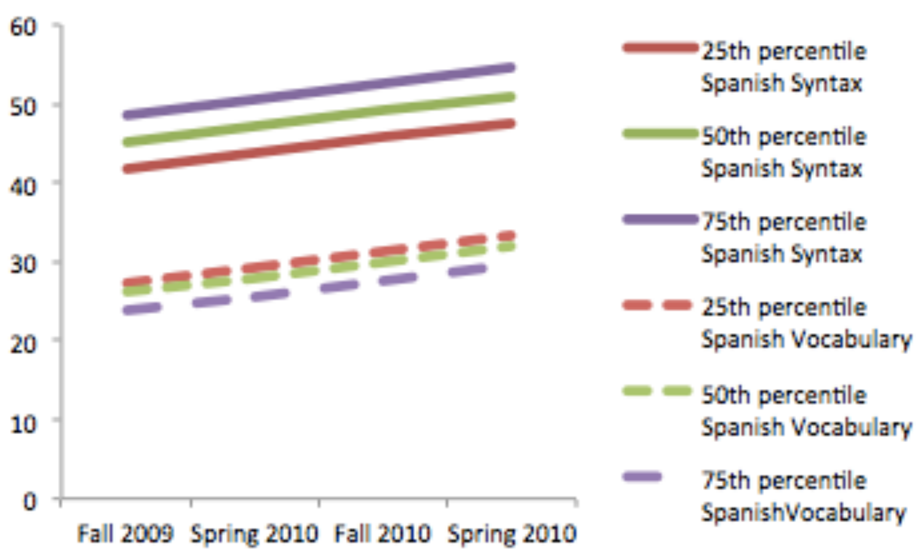

Figure 4.10 *Syntax Growth Trajectories disaggregated by Spanish Performance*

Figure 4.11 displays the growth trajectory for Model 3 with a separate line representing each Generation Status. Initial status for the each trajectory is statistically different and the growth trajectory for Generation 1 is significantly steeper when compared to Generation 2 and Generation 3 such that Generation 1 students catch up to the peers.

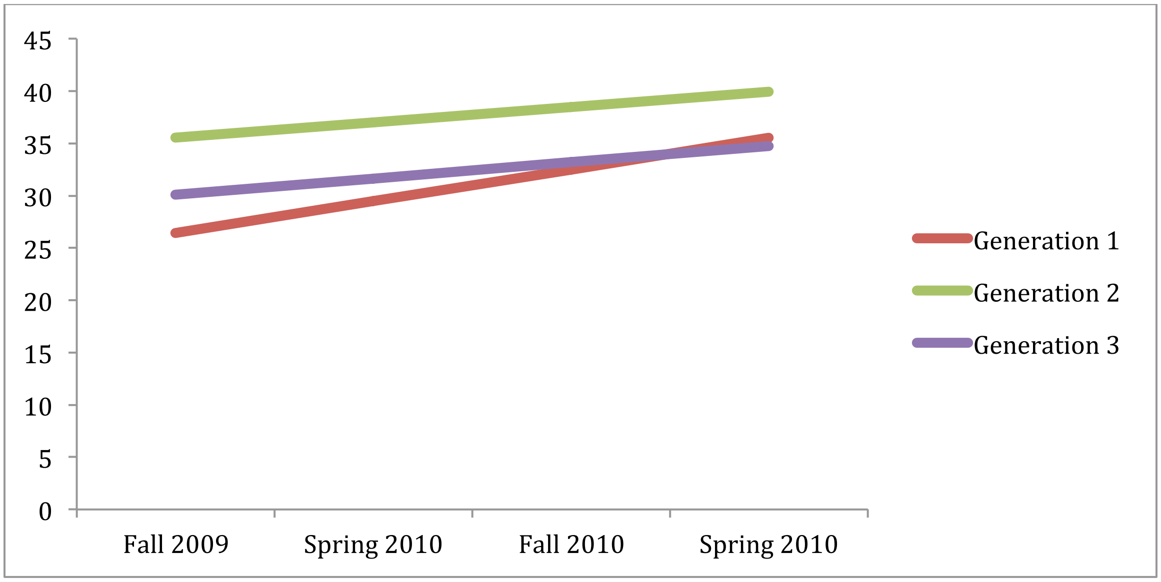

Figure 4.11 *Syntax Growth Trajectories disaggregated by Generation Status*

Table 4.50 *Model Building for Cross-Language Syntax Growth Trajectory*

		Fixed Effects	Model 1	Model 2	Model 3
Level 1 Predictor		**Intercept**	34.48 (2.12)***	33.71 (2.05)***	34.90 (1.69)***
Level 2 Predictors	Control Variables	Cohort 1	-4.46 (2.39)^t	-4.74 (2.42)*	-6.60 (2.22)**
		Cohort 2	1.93 (2.48)	1.92 (2.41)	.863 (2.20)
		Site	-3.79 (2.22)^t	-2.02 (2.16)	_
	Spanish Language	Vocabulary		-.483 (.202)*	-.400 (.169)*
		Syntax		.469 (.152)***	.481 (.124)***
	Immigrant Status	Generation 1			-9.20 (2.75)***
		Generation 3			-5.22 (2.90)^t
Level 1 Predictor		**Time**	2.67 (.517)***	2.11 (.434)***	1.96 (.453)***
Level 2 Predictors	Control Variables	Cohort 1	-.862 (.583)	-.677 (.601)	-.626 (.589)
		Cohort 2	-.405 (.606)	1.92 (2.41)	-.423 (.591)
		Site	-.581 (.543)	_	_
	Spanish Language	Vocabulary		.076 (.049)	_
		Syntax		-.021 (.036)	_
	Immigrant Status	Generation 1			1.57 (.738)*
		Generation 3			.093 (.787)
		Random Effects			
		Intercept	62.65 (12.26)***	54.77 (11.16)***	45.07 (9.57)***
		Time	1.15 (.818)	1.11 (.817)	1.02 (.802)
		Residual Variance	16.27 (1.86)***	16.2 (1.86)***	16.26 (1.86)***
		Deviance Statistic	1962.92	1966.62	1939.45

Note: ^{t}*<.10 *p<.05, **p<.01, ***p<.001*

Semantics. To test for group differences separate ANOVAs were run by site, cohort, and generation status; these analyses can be found in Tables 4.51-4.53. ANOVA analyses warranted the inclusion of Cohort as Covariates. While both Cohort 2 and Cohort 3 significantly outperformed Cohort1, there were no significant differences between Cohort 2 and Cohort 3.

Table 4.51 *Mean Raw Scores for Semantics Disaggregated by Site*

	Sample (n=135)	Site 1 (n=96)	Site 2-bc (n=39)
Time 0	6.46 (2.56)	6.22 (2.47)	7.06 (2.68)
Time 1	8.03 (2.83)	8.08 (2.89)	7.90 (2.69)
Time 2	8.69 (3.13)	8.39 (3.14)	9.52 (3.02)
Time 3	9.63 (3.03)	9.35 (3.24)	10.38 (2.31)

Table 4.52 *Mean Raw Scores for Semantics Disaggregated by Cohort*

	Sample (n=135)	Cohort 1 (n=46)	Cohort 2 (n=49)	Cohort 3 (n=40)
Time 0	6.46 (2.56)	4.76 (1.72)	7.13 (2.13)[a]	7.61 (2.82)[b]
Time 1	8.03 (2.83)	6.43 (2.56)	8.81 (2.38)[a]	8.91 (2.87)[b]
Time 2	8.69 (3.13)	7.03 (2.63)	9.40 (2.60)[a]	9.77 (3.57)[b]
Time 3	9.63 (3.03)	7.89 (2.55)	9.97 (2.71)[a]	11.25 (2.94)[b]

Note: [a]=Cohort 2 significantly outperforms Cohort 1; [b]=Cohort 3 significantly outperforms Cohort 1

Table 4.53 *Mean Raw Scores for Semantics Disaggregated by Generation Status*

	Sample (n=135)	Generation 1 (n=24)	Generation 2 (n=93)	Generation 3 (n=18)
Time 0	6.46 (2.56)	6.57 (2.61)	6.66 (2.49)	5.30 (2.71)
Time 1	8.03 (2.83)	7.73 (3.17)	8.18 (2.83)	7.46 (2.50)
Time 2	8.69 (3.13)	7.69 (3.36)	9.03 (3.04)	8.00 (3.22)
Time 3	9.63 (3.03)	8.75 (3.45)	10.09 (2.87)[a]	7.92 (2.84)

Note: [a]=Generation 2 significantly outperforms Generation 1and Generation 3

Table 4.54 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the intraclass correlation coefficient (ICC). The ICC calculation suggested that without accounting for any other variables, 45.2% of the variation lies between individuals. Addition of the linear effect of time improved model fit [χ^2(2, N=448) =98.13, p<.001] but while the fixed effect for time was significant (β_{10}=1.07; *p*<.001), the random effect was non-significant (r_{10}=.210, *p*>.05). Non-significance of the random effect for the linear term suggested that while time had a significant effect on vocabulary growth, the variance in growth did not vary across between individuals and should therefore the linear term should be fixed, however given interest in moderating effects for generation status and Spanish language, the random effect for time was retained in subsequent models. Inclusion of the quadratic term was neither significant, nor did it improve model fit.

Table 4.54 *Unconditional Means and Growth Models for Semantics*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	8.28 (.272)***	6.67 (.287)***	6.43 (.294)***
Linear		1.07 (.105)***	1.51 (.308)***
Quadratic			-.147 (.107)
Random Effects			
Intercept	4.40 (.942)***	4.14 (1.07)***	3.92 (1.00)***
Linear		.210 (.155)	.166 (.000)
Quadratic			.154 (.000)
Residual Variance	5.45 (.507)***	3.20 (.365)***	2.91 (.309)***
Deviance Statistic(AIC)	1516.52	1418.39	1434.57

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.55 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 adds Cohort control variables with Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=7.52, *p*<.001) and time (β_{10}=1.29, *p*<.001) was a statistically significant predictor of the intercept and Cohort 2 (β_{12}=-.544, *p*<.05) was a statistically significant predictor of Time. All other variables and with the exception of Cohort covariates, variables that were non-significant were dropped from the model for the next iteration. Model 2 added Spanish Vocabulary and Syntax. Fixed effects results revealed that Spanish Language was neither predictive of initial status nor time, however Cohort 1 (β_{01}=-2.61, p<.05) remained a significant predictor of initial status and Cohort 2 (β_{12}=-.440, p<.05) was significant predictor of Time. Spanish variables were dropped for the next iteration; Model 3 added Generation Status; results revealed significant variation around the intercept (β_{00}=8.09, p<.001) and Time (β_{10}=1.29, p<.001). Cohort 1 (β_{01}=-3.00, p<.001 and Generation 1 (β_{03}=-1.84, p<.001) were significantly predictive of the intercept. Generation Status was not predictive Time. Effects for Spanish Language and Generation Status interactions on Initial Status were tested, however no significant interaction terms were found. The final model suggested that there were no significant differences between Generation 2 and 3 and that on average, students were predicted to begin with 8.04 points, however students in Generation 1 were predicted to start 1.76 points behind their Generation 2 and Generation 3 peers. There were no significant differences by generation status on growth and students were predicted to grow, on average, 1.42 points per time points. Significant effects for Cohort suggested hat younger students (Cohort 1) were predicted to begin the study 2.82 behind their older peers and Cohort 2 were predicted to grow .593 of a point behind their Cohort 1 and Cohort 3 peers. Figure 4.12 displays the growth trajectory with a separate line representing each Generation Status.

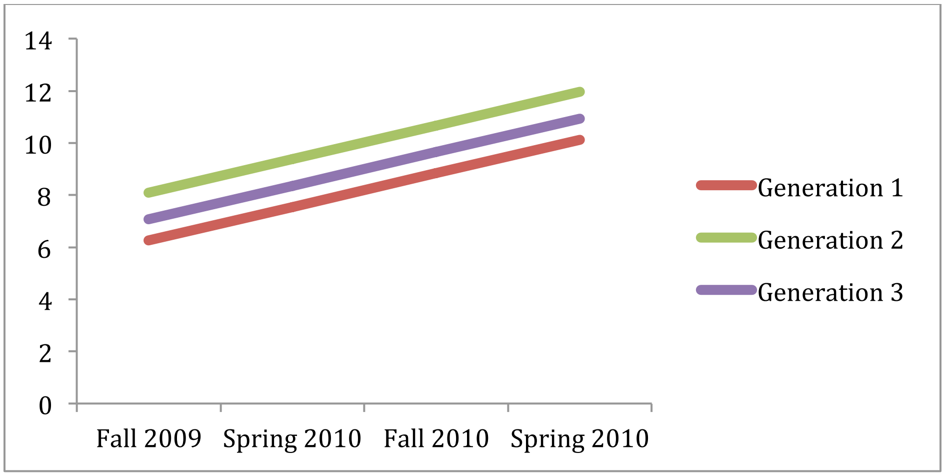

Figure 4.12. *Semantics Growth Trajectories disaggregated by Generation Status*

Table 4.55 *Model Building Process for Cross-Language Semantics Growth Trajectory*

		Fixed Effects	Model 1	Model 2	Model 3
Level 1 Predictor		**Intercept**	7.52 (.444)***	7.56 (.474)***	8.04 (.481)***
Level 2 Predictors	Control Variables	Cohort 1	-2.44 (.615)***	-2.48 (.661)***	-2.82 (.627)***
		Cohort 2	.108 (.687)	.107 (.661)	-.085 (.627)
	Spanish Language	Vocabulary		.042 (.053)	_
		Syntax		.034 (.039)	_
	Immigrant Status	Generation 1			-1.76 (.782)*
		Generation 3			-1.07 (.857)
Level 1 Predictor		**Time**	1.29 (.179)***	1.28 (.192)***	1.42 (.199)***
Level 2 Predictors	Control Variables	Cohort 1	-.168 (.248)	-.134 (.267)	-.247 (.259)
		Cohort 2	-.544 (.257)*	-.516 (.267)^{t}	-.593 (.259)*
	Spanish Language	Vocabulary		.006 (.021)	_
		Syntax		.011 (.016)	_
	Immigrant Status	Generation 1			-.384 (.323)
		Generation 3			-.328 (.353)
		Random Effects			
		Intercept	2.81 (.873)***	3.20 (.365)***	2.55 (.840)***
		Time	.181 (.153)	.196 (.157)	.179 (.154)
		Residual Variance	3.20 (.365)***	3.20 (.365)***	3.20 (.365***
		Deviance Statistic	1392.88	1413.31	1377.70

*Note: *p<.05, **p<.01, ***p<.001*

Reading Comprehension. Tables 4.56 – 4.58 display the ANOVA results disaggregated by site, cohort, and generation status, respectively. ANOVA revealed no differences by Site. However, Tukey-Post hoc results revealed differences between Cohort, thus warranting inclusion of Cohort covariates in the model. Results in Table 59 suggested that there were no significant differences between Generation 2 and Generation 3, although Generation 2 did significantly outperform Generation 1 at Time 2 and Time 3.

Table 4.56 *Mean W Scores for Reading comprehension Disaggregated by Site*

	Sample (n=112)	Site 1 (n=81)	Site 2 (n=31)
Time 0	477.64 (16.45)	477.36 (16.02)	478.35 (17.75)
Time 1	484.47 (12.20)	484.10 (12.31)	485.39 (12.09)
Time 2	485.30 (16.88)	484.09 (16.60)	488.73 (17.51)
Time 3	490.21 (14.87)	489.51 (14.72)	492.03 (15.36)

Table 4.57 *Mean W Scores for Reading comprehension Disaggregated by Cohort*

	Sample (n=112)	Cohort 1 (n=39)	Cohort 2 (n=39)	Cohort 3 (n=34)
Time 0	477.64 (16.45)	469.46 (16.15)	481.76 (12.28)[a]	481.94 (17.84)[b]
Time 1	484.47 (12.20)	477.03 (12.40)	488.40 (7.04)[a]	488.29 (12.90)[b]
Time 2	485.30 (16.88)	474.88 (16.87)	491.57 (13.40)[a]	489.65 (15.32)[b]
Time 3	490.21 (14.87)	483.17 (17.57)	495.16 (9.36)[a]	492.48 (14.11)[b]

Note: [a]=Cohort 2 significantly outperforms Cohort 1; [b]=Cohort 3 significantly outperforms Cohort 1

Table 4.58 *Mean W Scores for Reading comprehension Disaggregated by Generation Status*

	Sample (n=112)	Generation 1 (n=16)	Generation 2 (n=82)	Generation 3 (n=14)
Time 0	477.64 (16.45)	469.46 (16.15)	481.76 (12.28)	481.94 (17.84)
Time 1	484.47 (12.20)	477.03 (12.40)	488.41 (7.04)	488.29 (12.90)
Time 2	485.30 (16.88)	474.88 (16.87)	491.57 (13.40)[a]	489.65 (15.32)
Time 3	490.21 (14.87)	483.17 (17.57)	495.16 (9.36)[a]	492.48 (14.11)

Note: [a]=Generation 2 significantly outperforms Generation 1and Generation 3

Table 4.59 includes the fixed and random parameter estimates and standard errors for the model building process for the unconditional model. The Unconditional Means Model was used to calculate the intraclass correlation coefficient (ICC). Addition of the linear effect of time improved model fit [$\chi^2(1,$ N=448) =6.33, p<.01], but while the fixed effect for time was significant (β_{10}=4.60; p<.001), the random effect was non-significant (r_{10}=.3.08, p>.05). Inclusion of the quadratic term was neither significant (β_{30}=-2.99 and r_{30}=.6.28, p>.05) nor did it improve model fit.

Table 4.59 *Unconditional Means and Growth Models for Reading Comprehension*

	Unconditional means	Unconditional Linear Growth	Unconditional Quadratic Growth
Fixed Effects			
Intercepts	484.22 (1.51)***	477.32 (1.83)***	477.04 (1.73)***
Linear		4.60 (.466)***	5.49 (1.45)*
Quadratic			-2.99 (.537)
Random Effects			
Intercept	150.22 (28.90)***	213.81 (42.86)***	172.55 (30.75)***
Linear		3.08 (3.15)	4.53 (.000)***
Quadratic			6.28 (.000)
Residual Variance	109.54 (10.20)***	68.99 (7.89)	64.37 (6.67)
Deviance Statistic(AIC)	2473.52	2379.85	2483.62

*Note: *p<.05, **p<.01, ***p<.001*

Table 4.60 displays the parameter estimates for the model building process with the inclusion of predictor variables. Model 1 added LWID and the Cohort control variables with Cohort 3 was the referent group. REML revealed that the fixed effects for the intercept (β_{00}=478.10, p<.001) and time (β_{10}=4.26, p<.001) were significant. LWID was a statistically significant predictor of the intercept (β_{03}= 1.53, p<.001) and time (β_{13}=-.159, p<.05). Model 2 added Spanish Vocabulary and Syntax. Fixed effects results revealed a significant main effect for Spanish Syntax (β_{05}=.303, p<.10) for the intercept and LWID remained a significant predictor for both the intercept (β_{03}= 1.50, p<.001) and time (β_{13}=-.171, p<.05). Model 3 added Generation Status. Generation Status was not predictive of initial status or time. While the final model (Model 3) suggested no significant effects for Generation Status, the significant effect for Spanish syntax (β_{05}=.303, p<.10) suggested potential for cross-language transfer in a cross-language model for English reading comprehension. Figure 4.13 displays the reading comprehension trajectory (Model 3) disaggregated by percentile performance in Spanish. As can be seen, students who performed in the samples' 75th percentile of Spanish syntax had significantly higher English reading comprehension at the intercept.

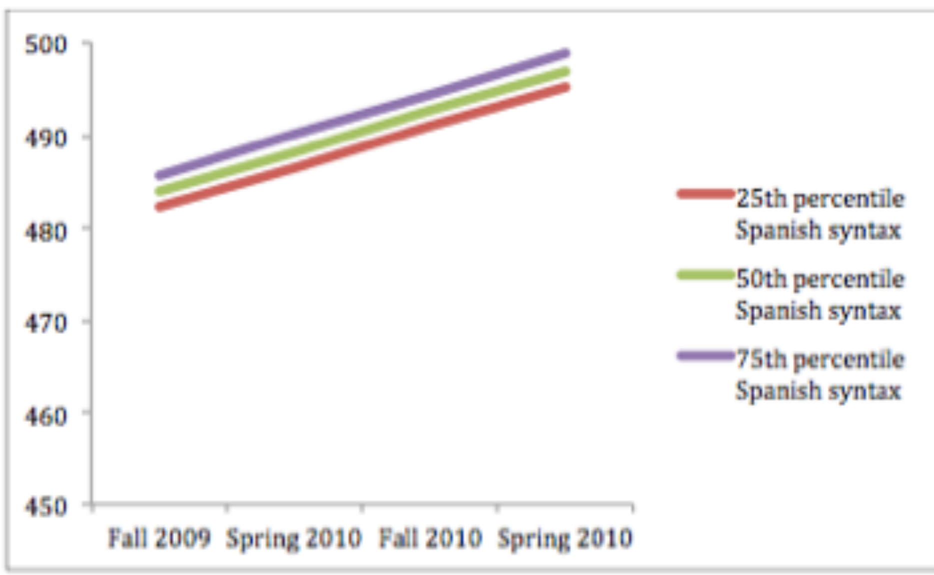

Figure 4.13 *Reading Comprehension Growth Trajectories disaggregated by Spanish Syntax Performance*

Table 4.60 *Model Building Process for Cross-Language Reading Comprehension Growth Trajectory*

		Fixed Effects	Model 1	Model 2	Model 3
Level 1 Predictor		**Intercept**	478.10 (2.02)***	477.16 (2.10)***	478.75 (1.27)***
Level 2 Predictor	Control Variables	Cohort 1	-2.08 (2.98)	-.517 (3.10)	-2.81 (3.17)
		Cohort 2	-2.03 (2.87)	-.673 (2.88)	-1.03 (2.81)
		LWID	1.53 (.159)***	1.50 (.157)***	1.42 (.168)***
	Spanish Language	Vocabulary		-.017 (.232)	_
		Syntax		.303 (.172)[t]	.247 (.099)*
	Immigrant Status	Generation 1			-6.27 (3.78)
		Generation 3			1.63 (3.84)
Level 1 Predictor		**Time**	4.26 (.793)***	4.58 (.844)***	4.36 (.936)***
Level 2 Predictors	Control Variables	Cohort 1	-.007 (1.17)	-.493 (1.25)	.142 (1.29)
		Cohort 2	1.27 (1.13)	.934 (1.16)	1.18 (1.32)
		LWID	-.159 (.062)***	-.171 (.063)*	-.165 (.069)**
	Spanish Language	Vocabulary		.065 (.093)	_
		Syntax		-.017 (.069)	_
	Immigrant Status	Generation 1			.604 (1.52)
		Generation 3			-1.95 (1.55)
		Random Effects			
		Intercept	53.95 (17.77)***	46.55 (17.27)***	45.88 (16.86)***
		Time	1.92 (3.03)	2.04 (3.07)	1.90 (3.06)
		Residual Variance	68.96 (7.88)***	68.93 (7.88)***	68.99 (7.89)***
		Deviance Statistic	2287.10	2291.91	2266.48

*Note: *p<.05, **p<.01, ***p<.001*

Research Question 2: In a dual-language model for English reading comprehension, are components of Spanish language, English language, and generation status predictive of the intercept or slope?

Table 4.61 displays the predicted mean intercepts for each of the four language components, disaggregated by generation status. The predicted average initial status was 482.32 W-points, with a range of 423.64-508.62. Average predicted initial status at for morphology was 29.75 raw score points, with a range of 6.98-46.29; it was 30.75 raw score points for syntax (range -12.90-44.00) and 6.47 raw score points for semantics (range 2.02-10.47). Table 4.62 displays the predicted mean slopes for each of the four language components, disaggregated by generation status. The predicted average growth for vocabulary over the 2 academic years was 3.25 W-points per time point (i.e., 6 months), with a range of 1.53-4.37. Average predicted growth for morphology was 4.33 raw score points per time point, with a range of 1.63-7.68; it was 1.82 raw score points for syntax (range .12-4.49) and 1.33 raw score points for semantics (range .51-2.32). ANOVA comparison revealed significant differences across Generation status for both the predicted slopes and intercepts.

Table 4.61 *Mean Predicted Intercepts for Cross-Language Growth Trajectories*

	Sample	Generation 1	Generation 2	Generation 3
Vocabulary	482.32 (13.17)	472.46 (18.51)	485.02 (11.06)[a]	477.77 (12.00)
Morphology	29.75 (9.24)	28.37 (5.69)	30.65 (9.48)	24.76 (10.53)
Syntax	30.75 (3.07)	26.06 (6.20)	32.27 (7.69)[b]	25.25 (9.42)
Semantics	6.48 (1.93)	6.31 (2.13)	6.72 (1.82)[c]	5.24 (2.01)

Note: [a]=Generation 2 significantly outperform Generation 1; [b]= Generation 2 significantly outperforms Generation 1 and Generation 3; [c]= Generation 2 significantly outperforms Generation 3

Table 4.62 *Mean Predicted Slopes for Cross-Language Growth Trajectories*

	Sample	Generation 1	Generation 2	Generation 3
Vocabulary	3.25 (.567)	2.76 (.810)	3.35 (.489)[a]	3.24 (.400)[a]
Morphology	4.33 (1.32)	3.82 (.512)	4.54 (1.34)[e]	3.37 (1.40)
Syntax	1.82 (.821)	3.36 (.690)[d]	1.58 (.577)	1.69 (.386)
Semantics	1.33 (.362)	.866 (.261)	1.31 (.231)[a]	1.95 (.196)[f]

Note: [a]=Generation 2 significantly outperform Generation 1; [b]=Generation 3 significantly outperforms Generation 1; [c]=Generation 2 significantly outperforms Generation 1 and Generation 3; [d]=Generation 1 significantly outperforms Generation 2 and Generation 3; [e]=Generation 2 significantly outperforms Generation 3;[f]=Generation 3 significantly outperforms Generation 1 and Generation 2

Bivariate correlations revealed that the predicted initial status for syntax was significantly correlated, albeit weak and negative to the initial status for vocabulary (r=-.233, p<.01) and morphology (r=-.344, p<.01), and semantics (r=.416, p<.01). Vocabulary slope was strongly correlated to the slopes of all other language variables (r range = .738-.804, ps<.01). Morphology slope was also strongly correlated with semantics slope (r=.793, p<.01) and syntax slope (r=.760, p<.01) as were the slopes for syntax and semantics (r=.754, p<.01). Negative correlations between respective slopes and intercepts of vocabulary (r=-.429, p<.01) and morphology (r=-.706, p<.01) suggested an inverse relationship such that students who were predicted to have lower scores at the inception of the study might grow a faster rate; alternatively, this could be interpreted such that students who were predicted to begin higher at the inception of the study were predicted to grow a slower rate. In contrast a positive significant relationship between the respective slopes and intercepts of semantics (r=.110, p<.05) suggested that for these two constructs students who were predicted to start with a higher score were also predicted to grow at a faster rate. Vocabulary intercept was significantly, negatively, and weakly correlated to the slopes of all other language variables (r range = -.201 -

.382), suggested that higher vocabulary at inception might be related to slower growth rates in other language components. Bivariate correlations are displayed in Table 4.63. These predicted slopes and intercepts were grand mean centered and used as Level 2 predictors for the following sub-questions.

Table 4.63 *Correlation Matrix for Mean Predicted Slopes and Intercepts*

	1.	2.	3.	4.	5.	6.	7.	8.
1. Vocabulary Sl.	1							
2. Vocabulary Int.	-.429**	1						
3. Morphology Sl.	.738**	-.218**	1					
4. Morphology Int.	-.477**	.039	-.706**	1				
5. Syntax Sl.	.804**	-.382**	.760**	-.376**	1			
6. Syntax Int.	.028	-.233**	.143*	-.344**	.064	1		
7. Semantics Sl.	.757**	-.201**	.793**	-.575**	.754**	.211**	1	
8. Semantics Int.	.271**	-.078	.144*	-.081	.244**	-.416**	.119*	1

*Note: *p<.05, **p<.01, ***p<.001*

To examine the role of language components on reading comprehension intercept I first referred to Model 3 (Table 4.60) from the English reading comprehension growth model. Based on Model 3 (Table 4.60), a new model was then fitted that included all significant fixed effects from Model 3, cohort covariates, and the intercepts of the predicted values as L2 predictors for the intercept; cohort covariates for both intercept and slope were retained so as to continue to adjust for cohort differences. This new model is displayed in Table 4.64. The predicted mean intercept for reading comprehension was 475.12 W-points with LWID (β_{02}=.534, p<.05) as a significant main predictors for intercept. Time was also significant ($\beta_{10} = 4.26,$ p<.001 with LWID ($\beta_{13} = -.168,$ p<.001) as a significant predictor for time. The predicted intercepts for vocabulary (β_{06}=.337, p<.01), morphology (β_{07}=.454, p<.05) and syntax (β_{09}=1.37, p<.10) were significant predictors for growth in reading comprehension. After the English variables were added, another iteration which tested generation status was fitted, however no effects were found and therefor this iteration is not tabled. The null findings for generation status were not surprising given the null effects for generation status in the previous reading comprehension model iterations (See Table 4.60). Thus, the final model suggested that for this cross-language model for reading comprehension, students did not vary by generation status, nor was Spanish a significant predictor. However, students were predicted to begin, on average, with 475. 12 W-points on reading comprehension and as on average LWID performance increased so did reading. The initial status of the vocabulary, morphology, and semantics trajectories were also predictive of initial status of reading comprehension such that students who were predicted to start with higher vocabulary, morphology, and semantics scores were also predicted to start with higher reading comprehension scores.

Table 4.64 *Cross-Language Model for English Reading Comprehension - Predicting Intercept*

	Fixed Effects	Model 1
	Intercept	475.12 (1.75)***
Control Variables	Cohort 1	4.68 (.793)
	Cohort 2	.826 (2.35)
	LWID	.534 (.214)*
Spanish Language	Syntax	.124 (.083)
English Language	Vocabulary	.337 (.096)**
	Morphology	.454 (.219)*
	Syntax	.065 (.165)
	Semantics	1.37 (.708)^t
	Time	4.26 (.793)***
Control Variables	Cohort 1	-.009 (1.17)
	Cohort 2	1.27 (1.23)
	LWID	-.168 (.062)**
	Random Effects	
	Intercept	15.80 (12.15)
	Time	1.89 (3.02)

Note: $^t p<.10$, $*p<.05$, $**p<.01$, $***p<.001$

To examine the role of language components on reading comprehension slope, I first referred to Model 3 (Table 4.60) from the English reading comprehension growth model. Based on Model 3 (Table 4.60), a new model was then fitted that included all significant fixed effects from Model 3, cohort covariates, and the intercepts of the predicted values as L2 predictors for the intercept. Similar to the last growth model, since generation was not a significant predictor in the cross-language model, I decided that proceeded with only the significant predictors (i.e., Spanish syntax, LWID) and the control covariates for Cohort. This new model is displayed in Table 4.65.

The predicted mean intercept for reading comprehension was 477.65 with LWID (β_{03}=1.51, p<.001) and Spanish Syntax (β_{04}=.138, p<.001) as significant main predictors for intercept. Time was also significant ($\beta_{10} = 2.95$, p<.001) with LWID (β_{13}=-.476, p<.001) and the predicted intercept for vocabulary (β_{14}=.174, p<.001) and predicted slope for syntax (β_{18}=1.46, p<.05) were significant predictors for growth in reading comprehension. After the English variables were added, another iteration which tested for main and moderating effects for Spanish language and generation status was fitted, however no effects were found and therefor this iteration is not tabled. The null findings for generation status and Spanish language were not surprising given the null effects for generation status in the previous reading comprehension model iterations (See Table 4.60). The final model suggested that there was no variation in reading comprehension between generation status and students were predicted, on average to begin the study with 477.65 W-points. Further, as average performance on LWID and Spanish Syntax increased so the initial status of reading comprehension. In regard to growth over the two academic years, students were predicted to grow, on average, 2.95 points per time point and as on average LWID increased students were expected to grow less. Substantively this suggests that students who relied more strongly on decoding grew less in reading. Finally, as average performance on initial status for vocabulary and growth in syntax increased, so did growth in reading. In other words who students who were predicted to have higher vocabulary scores at the inception of the study at a slightly faster rate than their peers with lower vocabulary scores at the inception of the study; similarly, students with higher syntax growth rates (i.e., slope).

Table 4.65 *Cross-Language Model for English Reading Comprehension – Predicting Slope*

		Fixed Effects	Model 1
Level 1 Predictor		**Intercept**	477.65 (1.99)***
Level 2 Predictors	Control Variables	Cohort 1	-1.31 (2.96)
		Cohort 2	-1.38 (2.84)
		LWID	1.51 (.156)***
	Spanish Language	Syntax	.138 (.088)
Level 1 Predictor		**Time**	2.95 (1.29)*
Level 2 Predictors	Control Variables	Cohort 1	3.23 (2.52)
		Cohort 2	2.07 (1.37)
		LWID	-.476 (.119)***
	English Language	Vocabulary (I)	.174 (.065)**
		Morphology (I)	.163 (.136)
		Syntax (I)	.021 (.084)
		Semantics (I)	.304 (.375)
		Vocabulary (S)	1.38 (1.16)
		Morphology (S)	.333 (.662)
		Syntax (S)	1.46 (.653)*
		Semantics (S)	.327 (1.31)
		Random Effects	
		Intercept	49.29 (17.21)***
		Time	5.87 (4.03)
		Residual Variance	68.98 (7.89)***
		Deviance Statistic	2266.05

*Note: *p<.05, **p<.01, ***p<.001*

Chapter 5: Discussion

For this dissertation, two studies were designed to shed light on a component view of reading for Spanish-English bilinguals. Findings from each study are discussed separately in detail below. Findings are presented as they relate to current research in reading comprehension (Study 1 and Study 2) and second language acquisition theory (Study 2 only). Each section also includes implications for research and practice, limitations, future research, and conclusion.

Study 1 Discussion

This study was designed to investigate the predictive relationship between components of English language and English reading comprehension within the context of immigration for bilingual Latino children in Grade 2 – Grade 5. Data from a two-year cohort-sequential design were used to build a model of English reading comprehension as predicted by English oral language controlling for cohort group effects and word reading ability. Where current research has asked the question of oral language on growth trajectories of reading comprehension (e.g., Kieffer, 2102, Mancilla-Martinez et al, 2009; Nakamoto et al, 2007), this study adds to the literature by identifying 4 components of English language, modeling respective growth trajectories for each component, and then modeling reading comprehension as a function of these trajectories. This study further adds to the literature by considering these developmental trajectories as they relate to students' immigrant generation status.

The Immigrant Paradox

One focus of this study was the immigrant paradox of intergenerational decline among immigrants and children of immigrants. Previous literature on this epidemiological paradox within the public health literature (e.g., Hamilton, 2015) and academic performance (e.g., Palacios et al., 2008) have documented an intergenerational decline such that first generation peers outperform their second and third generation peers. However, when this study exclusively examined reading comprehension, and respective English language components different patterns emerged.

Generation 1 students were outperformed by their peers. The first major finding was that for all language and reading comprehension trajectories modeled there was significant variation around Grade 2 initial status and Grade 2 – Grade 5 growth. Of particular interest was that for vocabulary, morphology and syntax, Generation 1 students were predicted to begin Grade 2 behind their Generation 2 and 3 counterparts. Further Generation 1 students were also predicted to develop their semantic awareness at a slower rate. These findings for Generation 1 are congruent with literature that has suggested that Generation 1 students are less likely to speak English (Hurtado & Vega, 2004). A similar trend was found with two of the three reading growth models. For the first reading growth model (no language predictors) Generation 1 students were predicted to begin Grade 2 behind their US born peers. From a practical standpoint these findings suggest that Latinos who are less likely to speak English, and therefore be more Spanish dominant (i.e, Generation 1 students), need additional support not just in early elementary school (i.e., Grade 2), but throughout elementary school.

These findings for Generation 1 are particularly curious. The work of Palacios, Guttmannova, and Chase-Lansdale (2008), for example, found that among 16,396 children from the ECLS-K dataset, Generation 1 and 2 children had higher achievement scores for reading, thus suggesting a paradoxical Generation 1 advantage. In contrast, the present study found a negative advantage for Generation 1 such that if no other variables were included in the model, students in Generation 1 students were outperformed by their second and third generation counterparts. Thus, where Palacios et al (2008) found a paradoxical trend that Generation 1 and 2 outperformed Generation 3, the present study found the opposite. Interestingly, however, when Palacios and colleagues included control covariates (e.g., school characteristics, race, family characteristics) the difference in achievement across generations was reduced. The present analyses found similar results in the reading models: once English language components were included in the model effects for generation were null. Thus, both studies suggest that while generation status serves as an interesting context to examine English language and reading development, the study of additional factors is warranted.

Intergenerational trends and the American dream. When considering notions of the "American dream", that is the idea that over time (i.e., across generations) immigrant groups are expected to do better, the present study's intergenerational trends are curious. Contrary to previous research (e.g., Hao & Bronsteaad-Burns, 1998; Hao & Ma, 2012; Palacios et al., 2008), when examining differences between Generation 1 and Generation 2 performance, notions of the American dream appear present: Generation 2 significantly outperforms Generation 1. This American dream trend, however, did not hold from Generation 2 to Generation 3, rather there were no differences in performance between Generation 2 and 3. One explanation may be due to the much smaller Generation 3 sample. Alternatively, the absence of differences between Generation 2 and 3 could be interpreted as paradoxical: immigrant populations are not improving intergenerationally. Another plausible argument may be that the American dream may be an ideal that is reflected in other factors beyond English language and reading comprehension. Previous literature (Glick & White, 2003), for example has also suggested that while generation status has been found to be predictive of academic performance, the best predictors of academic trajectories might be related to other contextual factors such as SES or family.

A Component View of Reading

This study was also concerned with examining a conceptual model of reading based on multiple components of language. By establishing growth models of language components and then modeling reading comprehension as a function of these trajectories, this study provided four main findings that contribute to the literature on reading comprehension, specifically among bilingual Latinos in elementary school.

Relationships between and within language components. When examining the relationship between the predicted initial status and growth of the language trajectories interesting patterns emerged. Strong relationships for Grade 2 performance in vocabulary, morphology, syntax, and semantics suggested that these facets of language are integrated. This finding supports the National Reading Panel's (NRP; 2000) claim that "dependence on a single vocabulary instruction method will not result in optimal learning" (section 4-4). Thus, the present study provides empirical support to the NRP's call for vocabulary instruction that emphasizes a variety of methods and rich context. While there is no question that the relationship between these linguistic components of reading are important, there are also interesting relationships within these trajectories. For example, negative correlations between respective components for Grade 2 performance and Grade 2 – Grade 5 growth suggested an inverse relationship such that students who were predicted to have low Grade 2 syntax and morphology were also predicted to grow at a faster rate. In other words, students who started lower were predicted to grow in their syntactic and morphological awareness faster. Alternatively, this could be interpreted such that students who were predicted to have higher Grade 2 syntax and morphology were predicted to grow at a slower rate. In practice, this finding seems logical as students who start Grade 2 lower (or higher) have more (or less) progress to gain as they progress into higher grades. These findings of morphology and syntax provide interesting implications for instruction.

In regard to morphology, for example, the quadratic growth curve is curious. Previous research has suggested that morphological awareness begins to develop in the early elementary school years and continue into the later grades. Further, the work of Berninger, Abbott, Nagy, and Carlisle (2010) suggested that some forms of morphology are steeper in the earlier grades. The present study is congruent with this finding. Three reviews of the literature (i.e., Bowers, Kirby, & Deacon, 2010; Goodwain & Ahn, 2013; Reed, 2008) have also suggested that morphological awareness instruction is beneficial for students learning to read and research has suggested that morphological development is especially beneficial for less proficient readers and instruction on morphological awareness is more effect when combined with other linguistic components. Similar work with a syntax and vocabulary targeted intervention (Phillips, 2014) for young monolinguals in preschool through kindergarten who were at high risk for reading difficulties, has suggested that explicit instruction around syntax is beneficial for syntax growth. Thus, Grade 2 students with lower morphological and syntactic awareness performance would benefit from targeted morphological awareness instruction. Indeed, research has documented that targeting morphological awareness instruction (e.g., Bowers & Kirby, 2010) and syntax (Phillips, 2014) is helpful for students in improving morphology, syntax, and in turn, reading comprehension.

In contrast to morphology and syntax, positive correlations between respective Grade 2 and Grade 2- Grade 5 growth of vocabulary and semantics suggested that students with higher Grade 2 performance also grow at a faster rate. These findings are not surprising as previous research with monolinguals has suggested that students who are good readers tend to make better gains than their less proficient peers (Stanovich, 1986). Thus, the finding that by Grade 2 those with higher vocabulary and semantics continue to grow a faster rate point to the importance of vocabulary and semantics development in the earlier grades.

Grade 2 language components were predictive of Grade 2 English reading comprehension. The first intra-language growth model examined the relationship between English language components and English reading comprehension. Specifically, this model examined the relationship between Grade 2 vocabulary, morphology, syntax, semantics, and reading comprehension. The first major finding within this intra-language model complements the existing literature that has suggested that for bilingual Latinos, multiple components (i.e., vocabulary, morphology, syntax) of language play a role in reading comprehension (e.g., Grant et al., 2011; Proctor et al., 2012; Leider et al., 2013). The finding of Grade 2 vocabulary as a significant predictor is congruent with previous research (e.g., Davison et al., 2011; Kieffer et al., 2012; Lesaux et al, 2010; Proctor et al., 2005) that has documented the predictive role of vocabulary in English reading comprehension. Previous research with bilingual Latinos has also documented the relationship between morphology and reading comprehension and where previous studies (e.g., Kieffer & Lesaux, 2008; Leider et al., 2013; Proctor et al., 2012) examined the predictive power of initial status of morphology with later reading comprehension outcomes, the present study's finding that Grade 2 morphology was a significant predictor for Grade 2 reading comprehension demonstrates the relationship between morphology and reading comprehension in the early grades. Thus, similar to work with older students (e.g., Kieffer & Lesaux, 2008) the present study suggests that this relationship between morphology and reading comprehension may also hold for younger student, thus, providing empirical support around the importance of explicit instruction around morphology in the earlier grades.

Previous research with students in the middle elementary grades Latino bilinguals (Leider et al., 2013, Proctor et al, 2012) and English monolinguals (Phillips, 2014; Mokhtari & Thompson, 2006) has found positive predictive relationships between English syntax and English reading comprehension. Interestingly, however, research with younger children (Swanson et al. 2008) found that with both syntax and vocabulary in the model, vocabulary was not predictive of reading comprehension. This is curious, as the present study found Grade 2 vocabulary and syntax to be significant predictors for Grade 2 reading comprehension. Thus, the present study suggests a robust relationship between vocabulary, syntax, and reading comprehension as early as Grade 2.

It is curious that semantics was the sole Grade 2 language component that was not predictive of Grade 2 reading comprehension. This finding is inconsistent with previous literature that has found semantics to be predictive of reading comprehension (Proctor et al., 2012; Leider et al., 2013). Previous research, however, used actual values of the initial status of semantics for the predictor. In contrast, the present study first modeled semantics from Grade 2 to Grade 5 and then predicted reading comprehension at Grade 2 with the predicted values for Grade 2 semantics. Further, previous research was not concerned with the relationships between these constructs at the same grade level, let alone at Grade 2. Perhaps the null finding for semantics is due to the fact that the present model predicted reading comprehension at Grade 2 and at the earlier grades this relationship is not as robust. Another explanation for the null finding may be due the semantics assessment used in the study. The assessment used to operationalize this component required students to first listen to four words and then identify the two words that were the most semantically related. Arguably the cognitive demand for this test was quite high, perhaps limiting performance, especially for younger students.

Another similar explanation for the null effects for semantics may be the nature of the reading comprehension assessment. For example, in an intervention focused on developing metalinguistic ability around semantic awareness for 46 third graders (Zipke, Ehri, &Cairins, 2009) reading comprehension improved for a cloze exercise, but not on a multiple choice passage-recall test. This is curious as the work of Leider et al. (2013) found the opposite: semantics was predictive of a multiple choice passage-recall task, but not for the cloze exercise. Given the fact that the work of Leider and colleagues work was with older children (Grades 3-5) suggests that the relationship between semantics and reading comprehension is more robust in the later grades. Indeed, when these same language components were used to predict reading comprehension slope (to be discussed in greater detail in the following section), the initial status of semantics was predictive of English reading comprehension slope.

Findings from this intra-language model of reading comprehension point to the powerful relationship between components of language and reading comprehension. Indeed, even when only considering correlations of the predicted values for each Grade 2 language components, they were significantly and strongly correlated with each other. Further, the predictive relationship between Grade 2 vocabulary, morphology, and syntax on Grade 2 reading comprehension further suggests the robust relationship between language components and reading comprehension. From a practical standpoint, these relationships are especially important as it emphasizes the important role of oral language in reading comprehension, as early as Grade 2. Thus, in order to most effectively help bilingual Latinos achieve the gold standard of English reading comprehension, educators must be cognizant of the need to help students develop English oral language. Further, given the finding that multiple components of English language were predictive of Grade 2 reading comprehension, educators should implement instruction that focuses on multi-dimensional components of language.

Developmental trajectories of language from grade 2 – grade 5 were predictive of growth in English reading comprehension. The second intra-language growth model examined the relationship between English language components and English reading comprehension. Specifically, this model simultaneously tested the relationships between Grade 2 performance (i.e., initial status) and Grade 2-Grade 5 growth (i.e., slope) of vocabulary, morphology, syntax, and semantics on the development of English reading comprehension from Grade 2 – Grade 5. Findings from the final model yield several implications for research on English reading comprehension.

Where previous research with Latinos has suggested that multiple of components of language are related to reading comprehension (e.g., Grant et al., 2011; Leider et al., 2013), the longitudinal nature of present study demonstrates how these relationships hold over time. For example, while previous research has documented the predictive relationship for vocabulary on reading comprehension (e.g., Lesaux et al., 2010), the present study suggested that not only is vocabulary predictive of reading comprehension, but it is predictive of reading comprehension development through elementary school. This finding is noteworthy, as previous research that has examined this relationship has yielded null effects (Kieffer, 2012; Mancilla-Martinez et al., 2009; Neufiled et al., 2006). Further, this finding held for syntax and semantics such that Grade 2 performance in vocabulary, syntax, and semantics was predictive of reading comprehension growth, suggesting the need for multi-faceted language instruction. The finding that Grade 2 morphology was not predictive of growth of reading comprehension from Grade 2 – Grade 5 was curious, but perhaps is explained by the developmental nature of morphology. Previous work, for example, has suggested the developmental trajectory for morphology has a longer span than other language components (e.g., Beringer et al., 2010; Nagy et al., 2006) and the present study also found morphology trajectory to have a quadratic fit. Further, previous work with fifth and fourth graders (Kieffer & Lesaux, 2008) found morphology to have a stronger relationship to reading comprehension in the later grades. While the present study found a null relationship between Grade 2 morphology on reading comprehension growth, perhaps morphology performance at the later grades might yield different results.

While these findings add to the research base on reading comprehension for Latinos, there are also implications for practice. For example, recent intervention work with native English speakers has suggested that targeted instruction on syntax (Moktari & Thompson, 2006; Phillips, 2014) and semantics (Zipke et al. 2009) not only improves these language components, but also yields results in better reading comprehension performance.

Components of language and reading vary by context. While the focus of this study was on generation status, language, and reading, it is curious that language and reading trajectories were also affected by additional factors. Given the nature of the dual-site study, site was included as covariate. Effects for site were significant on Grade 2 – Grade 5 development and Grade 2 syntax, such that that mid-Atlantic site were outperformed by their Northeast peers. While site differences suggest that there may be differences of instruction or assessment between the two sites, it is curious as then one might suspect this trend to hold across all language components. In contrast, the differences between vocabulary development and Grade 2 syntax could be interpreted as a function of specific instruction or curriculum at the Northeast site that targeted vocabulary and syntax. More information on the curricular and instructional differences between the two sites could serve useful to unpacking these differences. Given the cohort sequential design, covariates for Cohort were also included. Students in Cohort 2 were predicted to have higher Grade 2 morphology, syntax, and semantics. While the distribution of students were relatively equal across cohorts, 13 of the 24 Generation 1 students were in Cohort 3. Thus, the cohort effects might be a function of the limited English language proficiency of the Generation 1 students in Cohort 3.

Limitations and Future Research

By drawing on the data from a two-year cohort-sequential design this study built on the existing literature base which has examined relationships between English reading comprehension and oral language for bilingual Latinos. While this study provides useful insights for research and practice, there are several limitations. First, while the accelerated longitudinal design allowed for a data collection period of two years to be modeled over 4 years, the nature of the cohort-sequential design limits generalizability. Further, as evidenced by effects for cohort, there was difficulty in the interpretation of the variability of the data. Future studies on the development of language and reading would benefit from a "true" longitudinal design where one cohort of students is followed over several years.

Second, since this study relied on language and literacy data that was administered outside of the norming sample we were unable to derive standardized scores for all our language variables. Thus, further limiting the generalization and interpretation of our findings. Arguably, however, since the language and literacy assessments included in the English language battery are normed on a monolingual English-speaking population the use of normed-referenced scores might not be appropriate for Spanish-English bilinguals. The language and literacy battery itself may also be a limitation. For example, all language measures were not only strongly correlated with each other, but some individual subtests were also derived from the same language batteries (i.e., WMLS-R: vocabulary, word reading, reading comprehension; CELF-4: syntax, semantics). This issues limits the interpretation of the findings in the intra-language reading model, as it raises the question of whether the associations between language components and reading comprehension are due to the battery. Thus, future research would benefit from more distinct measures of language and literacy.

Another limitation with this study is the nature of the analyses. While the use of HLM to model Grade 2 – Grade 5 growth was useful, there were limitations, particularly around using the slope values at Level 2. An alternative statistical approach would be to treat the language components as time varying at Level 1. This approach would have allowed for more robust questions of the associations between developmental change in reading as a function of developmental change in language.

While the present study accounted for multiple components of language and their relationship to reading comprehension, a major limitation in this study is that the language data was limited to English data. Future research would benefit from a multi-dimensional model of reading comprehension that accounted for both the English and Spanish language proficiencies of bilingual Latinos. Similarly, while this study accounted for variation due to immigrant generation status, there are several additional factors that are related to English language and reading development among Latinos. For example, prior school experience and time of arrival for the Generation 1 students, primary language(s) spoken in the home, age of English language acquisition, and additional information on school environment and classroom curriculum could all serve as useful variables of interest. Thus, future research would also benefit from the inclusion of additional contextual factors that might explain further variation in language and reading performance.

Finally, this study addresses the immigrant paradox by questioning whether the documented intergenerational decline in factors of health and general academic achievement holds for English language and reading. This study found some evidence for a paradox (the lack of growth from Generation 2 to 3), but it also provided evidence against the documented first generation advantage. However, these interesting findings are limited to English language and reading development, thus making interpretations of how language and literacy fit into the immigrant paradox limiting.

Study 1 Conclusion

Although future research is needed, the present study points to the important role of English language in English reading comprehension, specifically for bilingual Latinos. Findings from this study add to the empirical research on reading comprehension performance and growth and provides empirical support for the NRP's (2000) recommendation to move beyond single vocabulary instruction. Findings also support the Institute of Education Science (IES; 2007) recommendations for intensive and varied vocabulary instruction, particularly when working with ELLs. At the same time, findings also suggest an interesting trend for immigrant generation status. For instance, when looking specifically at English oral language proficiency and English reading comprehension, the present study found that Generation 1 students were predicted to perform significantly behind their Generation 2 and Generation 3 peers. When considering intergenerational language trends, this finding emphasizes the need for educators to be cognizant of linguistic differences within the bilingual population – particularly for newcomers and students who are less likely to speak English. As recommended, in order to best support bilingual Latinos in achieving the gold standard of English reading comprehension educators, researchers, and policy-makers alike must be sensitive to multiple components of language and the variation of performance within each of these constructs.

Study 2 Discussion

This study was designed to investigate the relationships between components of Spanish language, components of English language and English reading comprehension within the context of immigration for bilingual Latino children. Language and literacy data that were collected over two academic years were used to build on the existing literature base concerned with cross language effects for Spanish on English reading comprehension and oral language. Current literature has provided some evidence for the predictive power of components of Spanish language to English reading comprehension, however findings are often small (Nakamoto et al., 2008), negative (Leider et al., 2013), or non-significant (e.g., Kieffer, 2012; Lesaux et al., 2013). Further, while potential for cross-language transfer has been studied in regard to reading comprehension, potential for cross-language effects have been less thoroughly examined for dimensions of oral language. This study adds to the literature by developing 7 cross-language trajectories of language and reading comprehension. This study further adds to the literature by considering these developmental trajectories as they relate to students' immigrant generation status. This study yielded several important findings that contribute to the conversations on second language acquisition theory, empirical research on cross-language transfer, and implications for instruction of bilingual students.

Intergenerational Trends

Research and Census Bureau data have documented interesting trends in the English and Spanish language patterns across generations such that Spanish language proficiency is more prevalent among first generation Latinos and English language proficiency is more prevalent among their second and, even more so, third generation peers (Alba et al, 2002; Buriel & Cardoza, 1988; Portes & Hao, 1998; Hurtado & Vega 2004; Fry & Passel, 2009; U.S. Census Bureau, 1993; Veltman, 1983). The present study found similar trends: Generation 1 students demonstrated higher Spanish proficiency and lower English proficiency when compared to their second and third generation peers. This trend however, did not hold for English reading comprehension, in fact, there were no intergenerational differences for reading. This finding is particularly curious as previous research has suggested academic achievement varies between generations (e.g., Hao & Bronsteaad-Burns, 1998; Hao & Ma, 2012; Palacios et al., 2008). Further, when comparing Generation 2 and 3, save for English syntax, there were no differences between the two groups.

Similar to the other language trajectories, Generation 1 students were predicted to have an initial status of English syntax that was significantly lower than their Generation 2 peers, however, Generation 3 peers were also predicted to begin behind Generation 2. This pattern is interesting as it is the only language component where Generation 3 fared worse than their Generation 2 peers. The syntax trajectory is of even more interest as this is also the only trajectory where generation status had a significant effect for growth. Generation 1 students were predicted to not only grow at a faster rate and catch up, but also surpass their American born peers. One interpretation is given their lower English language proficiency, Generation 1 has more syntactical awareness to develop and therefore with more room to grow, the growth rate deems logical. This pattern of rapid growth is similar to the work of Mancilla-Martinez & Lesaux (2011), which found vocabulary growth rates for bilingual rates to exceed national norms. This growth rate pattern, however, did not hold for Generation 3, which was also predicted to begin fare worse than their Generation 2 peers. Indeed, this generational growth trajectory difference is paradoxical. Generation 1 started lower, however they were predicted to grow faster than their Generation 2 and 3 peers.

Of final interest in regard to generation status and growth trajectories was the null finding for generation status was the consistent finding across all three reading trajectories. This finding is particularly interesting as generation status had an effect for all language growth trajectories and, arguably, English reading comprehension is the best indicator of academic performance among all our variables of interest. Thus, given the literature which has found generational differences in academic performances (e.g., Gibson, 1997; Kimball, 1968; Nielsen & Fernandez, 1981; Portes & Rumbaut, 1996; Schumaker & Getter, 1977; Suarez-Orozco & Suarez-Orozco, 1995; Vigil, 1997Glick & White, 2003; Golash-Boza, 2005; Hao & Bronstead-Burns), while this study suggested generational differences in language performance, these findings did not hold for reading.

The intergenerational trends are curious. While these trends fit within the Census Bureau data and research on language shift among Latinos, the findings are interesting when considering how immigrant generation status has been examined in areas of health (e.g., Hamilton, 2015) and broader academic performance (e.g., Portes & Rumbaut, 1996; Schumaker & Getter, 1977; Suarez-Orozco & Suarez-Orozco, 1995). Where prior research that has examined health and academic performance has documented a first generation advantage, the present study consistently found a Generation 1 disadvantage, save for English syntactical awareness development. While the focus of this study was exclusively on language and reading, the findings are curious as the intergenerational increase in English language (present study) alongside an intergenerational decline in academic performance and health suggests that acculturation into American culture might actually be detrimental to immigrants.

Generation Status Moderates Cross-Language Transfer

Interesting moderating effects for Spanish syntax and generation status provided interesting implications for the development of English morphology and English syntax. In regard to English morphology trajectory, Spanish syntax was found to positively predict the initial status. In practice, this meant that as Spanish syntax performance increased, initial status of morphology was also expected to increase. However, moderating effects for generation status meant that Generation 1 students actually had a negative effect for Spanish syntax. In other words, for Generation 1 students who are less likely to be English proficient (Hurtado & Vega, 2004) Spanish syntax is not beneficial. However, for more proficient English speakers (i.e, Generation 2 and Generation 3) Spanish language may prove beneficial.

Research on English morphology has suggested that morphological development is especially beneficial for less proficient readers (for review see: Bowers, Kirby, & Deacon, 2010; Goodwain & Ahn, 2013; Reed, 2008). Indeed, the finding that Generation 1 students begin morphology lower is of concern. Research on morphology interventions, however, has also suggested that the most effective morphological instruction is that which targeted at the student's reading developmental level (Reed, 2008). Thus, interpretation of the moderating effects for generation status on cross-language transfer suggest that instruction around morphology should be differentiated, depending on a student's English proficiency level.

A Component View of Linguistic Interdependence and Reading

While there were effects for generation status on reading, this study also provided interesting results for second language theory and research for Spanish-English bilinguals and reading comprehension. The following sub-sections present 4 major findings.

Evidence for cross-language transfer: Spanish language predicts English language. The present study provides some empirical evidence for cross-language transfer from Spanish to English. First, Spanish vocabulary was found to negatively predict English syntax, such that higher Spanish vocabulary was associated with lower English syntax at initial status. In other words, students with more Spanish vocabulary performed lower at the start of the study on English syntax. This finding seems logical, as more Spanish vocabulary could be interpreted as less English proficiency. Spanish syntax, however, was found to positively predict English syntax. This finding is particularly noteworthy for a number of reasons. First, as second language acquisition theory suggests, learning English is not like developing an entire new language, but rather a process of adapting and extending existing skills and knowledge (Corder, 1973; Cummins, 1978, 1979) and the positive relationship between Spanish syntax and English syntax supports this very idea. Second, research with Latino immigrants (Buriel & Cardoza, 1988; Duran, 1983; Portes & Rambaut, 2001) has found higher Spanish proficiency to be positively associated with academic achievement. Further, as previous research has shown (e.g., see Study 1) English syntax is an important component in English reading comprehension, which is one of the gold standards in academic achievement in education. Thus, the finding of a positive effect for Spanish syntax on English syntax further supports the research which has found higher Spanish proficiency to be beneficial for Latinos (Buriel & Cardoza, 1988, Portes & Rambaut, 2001).

These two findings for cross-language transfer on English syntax are particularly interesting when interpreted together. From a theoretical perspective, linguistic interdependence suggests that a certain level of linguistic competence in one language is necessary in order to see the positive benefits in the other (Cummins, 1978; Toukomaa & Skutnabb-Kangas, 1977). Arguably, Spanish syntax is more a sophisticated component of language than Spanish vocabulary as syntax requires command of grammatical and functional uses of the language where vocabulary is concerned with breadth (at least for this particular study that is how the two components were operationalized).   Thus, the finding that Spanish vocabulary was negative and Spanish syntax was positive provides evidence for the threshold hypothesis of linguistic interdependence: higher Spanish proficiency (i.e., syntax) served advantageous in English syntax performance where lower Spanish proficiency (i.e., vocabulary) did not. In other words, for students who demonstrated a better command of Spanish, as evidenced by their performance on the Spanish syntax subtest, cross-language transfer was beneficial. These findings, however, should be interpreted with caution. It is important to note that the English and Spanish syntax sub-tests were parallel measures. Thus, positive associations between English and Spanish syntax might be a result of the measures at hand.

Spanish syntax was also a positive predictor for English morphology initial status such that as Spanish syntax performance increased, initial status of morphology was also expected to increase. When considering implications for cross-language transfer, this finding is interesting. First, intervention work with 349 non-native English speakers and

133 native English speakers (Kieffer & Lesaux, 2012) found that explicit instruction on the syntaxtic aspects of morphology increased morphological awareness. Further, this gain was stronger for the non-native English speakers. While this study was constrained to English language (i.e., not focused on cross-language transfer), the finding of Kieffer & Lesaux (2012) clearly point to the role of syntax influencing morphology development. The present study suggests that this relationship might also hold across languages and therefore supports the idea higher Spanish proficiency contributing to English language development.

English language washes away Spanish language effects for English reading. The growth model for reading which did not include English language components as predictors Spanish syntax was found to be a positive predictor for English reading comprehension initial status. This finding is noteworthy as it is congruent with previous research with bilingual Latino immigrants which has suggested that higher Spanish proficiency has been positively associated with academic achievement (e.g., Buriel & Cardoza, 1988). This is also interesting as previous work this population found Spanish syntax to be a negative predictor for English reading comprehension (Leider et al., 2013). The reading model, however, of Leider and colleagues (2013) included English language components, where the present model did not. However, in the present study's subsequent models which did include English language components, the effect for Spanish was null. This is congruent with previous literature (e.g., Kieffer, 2012) that found Spanish oral language and English reading to be related, but when they were simultaneously included as predictors only English was a significant predictor. Similar work with bilingual Latinos has also found a similar pattern of English language washing away effects for positive transfer from Spanish language to English reading (e.g., Gottardo & Mueller, 2009; Lesaux et al., 2010; Swanson et al., 2008). Further, in the research where dual-language reading models had a significant effect of Spanish (e.g., Manis et al., 2007; Nakamoto et al, 2008), English language components were always stronger and Spanish language effects were minimal.

English language components predict initial status in reading comprehension. Where previous research with bilingual Latinos has found vocabulary (Davison et al., 2011; Kieffer, 2012; Lesaux et al., 2013; Leider et al., 2013) morphology (Kieffer & Lesaux, 2008; Leider et al., 2013; Proctor et al., 2012), and syntax (Leider et al., 2013; Proctor et al., 2012; Swanson et al., 2008) to be predictive of reading comprehension performance, the present study tested the robustness of these relationships by simultaneously examining multiple components. Further, of the aforementioned studies, few were longitudinal in nature. However, of the work with Latino bilinguals (Kieffer, 2012; Mancilla-Martinez & Lesaux, 2010) has implored growth modeling techniques, the present study yielded similar results: initial status of vocabulary was predictive of later reading comprehension ability. Further, the present study found this relationship to hold for morphology and syntax. This is noteworthy, as recent intervention work with monolinguals has suggested that targeting morphology (Reed, 2008) and syntax (Phillips, 2014) serves beneficial in improving reading comprehension.

English language components predict growth in reading comprehension. The final growth model included the initial status and slopes of English vocabulary, morphology, syntax, and semantics as predictors for English reading comprehension slope. Findings revealed a significant effect for vocabulary initial status and syntax slope on the slope of

English reading comprehension. This finding yields interesting implications in the research on reading comprehension. First, this finding is particularly noteworthy as recent growth modeling research with Latino bilinguals has not found English language components to be predictive of English reading comprehension growth (e.g., Kieffer, 2012; Mancilla-Martinez et al., 2009). The significant effect for syntax slope on reading comprehension slope is particular interesting.

Previous work with bilingual Latinos (e.g., Leider et al., 2013; Swanson et al, 2008) and monolingual English speakers (Mokhtari & Thompson, 2006; Phillips, 2014) has found a relationship between syntax and reading comprehension, however, the present study provides evidence for an even more robust relationship between the two components as the slope of syntax was predictive of the reading comprehension slope. In other words, not only is there a relationship between English syntax and English reading comprehension, but the present study suggests that positive growth in syntax over time is predictive of growth in reading comprehension. From a practical standpoint this would suggest that the development in English syntax would aid in the development of English reading comprehension.

Implications for Practice

Findings from this study add to the empirical research on reading comprehension performance and growth and provides empirical support for the NRP's (2000) recommendation to move beyond single vocabulary instructional methods. For example, the present study found both Spanish and English to play a role in the English reading comprehension of bilingual Latinos. In fact, Spanish syntax was a positive predictor for the initial status of English syntax, morphology, and reading comprehension (when

English was not in the model). Thus, where the NRP (2000) recommends a variety of methods, the present study suggests that one consideration for bilingual children might be including instruction around the native language. Further, if sophisticated Spanish language development is positively associated with English language and literacy performance, then perhaps dual language development (i.e., bilingual education) is a useful model of education for bilingual Latinos as it allows for the learning of both Spanish and English.

Reading research (NRP, 2000) has posed the question of specific vocabulary instruction needs of students at different grade and ability levels. The present study addresses this question in a number of ways. First, the finding for generational differences across different components language suggest that Latinos who are less likely to speak English, and therefore more Spanish dominant (i.e, Generation 1 students), need additional support not just in early elementary school, but throughout their English language development. Further, the developmental trajectories of language and reading established in this study point to the need for targeted instruction in linguistic components in the early grades.

Limitations and Future Research

While this study provides useful insights for research and practice, there are several limitations. First, while this study was longitudinal in nature, it collapsed three different cohorts of students, thus limiting interpretation of results within a two year academic period. Future research could benefit from a longer, "true" longitudinal design where one cohort of students would be followed over several years. Second, since this study relied on language and literacy data that was normed on a monolingual population and the present study did not include monolinguals. Future research could benefit from more appropriate language and literacy batteries for Spanish-English bilinguals. Further, the language battery was administered outside of the norming sample I was unable to derive standardized language variables, which further limits generalizability of the results. Additional limitations with the language and literacy battery are related to the interpretation of the findings. Findings provided evidence for cross-language transfer from Spanish to English, however this should be interpreted with caution as respective English and Spanish language measures were similar. Further, measures correlated highly with each other, leading to the question of whether positive cross-language association can be interpreted as a incidences of transfer or merely correlation between assessments. Perhaps the significant effects for Spanish syntax and null findings for Spanish vocabulary were actually a function of the language battery.

Another limitation within this study is due to the nature of the study design. This two-year longitudinal study collapsed three cohorts from second, third, and fourth grade into one sample. Further, the participants were from two different school districts. To control for site and cohort differences, covariates were included at all stages of the analyses. Consist cohort effects limit the interpretation of these findings, particularly when considering the variables of interest. Significant effects for site also suggest that curriculum or instructional differences might be present, further limiting the interpretation of the findings.

While the present study accounted for multiple components of language in both English and Spanish, a major limitation in this study is that there was no Spanish reading measure. A related limitation is that the Spanish language data that was included was not longitudinal, but only a "snapshot" of Spanish language proficiency. Thus, future research would benefit from a multi-dimensional model that included both Spanish language and literacy data that was longitudinal. It would be interesting to replicate these growth models with Spanish language and reading data. A final related limitation is that while this study accounted for variation due to immigrant generation status, there are several additional factors that are related to English language and reading development among Latinos. Particularly given the cross-language focus of this study additional information around previous instruction in Spanish language for the Generation 1 students, primary language spoken in the home, initial age of English language acquisition, and additional information around Spanish language use, exposure, and instruction would serve informative in future work. Thus, future research would also benefit from the inclusion of additional contextual factors that might explain further variation in language and reading performance.

Study 2 Conclusion

Although future research is still warranted, the present study points to the important role of both Spanish language and English language in English reading comprehension for bilingual Latinos. Findings from this study add to the empirical literature base on reading comprehension performance and growth. Prior research, for example, has not accounted for the role of Spanish language on English language and reading development. As suggested in the present study and previous work, language learning develops over time. The finding that Spanish might not be detrimental to this English language development, particularly for US born children, speaks to the need for educators to be more inclusive of children's non-native languages. This study also provides empirical evidence for the predictive power of multiple components of language, thus suggesting the developmental need for educators to focus efforts on supporting multiple dimensions of English oral language. At the same time, findings also suggest an interesting trend for immigrant generation status. When considering intergenerational language trends, the present study emphasizes the need for educators to be cognizant of linguistic differences within the bilingual population – particularly for newcomers and students who are less likely to speak English. In order to best support bilingual Latinos in achieving the gold standard of English reading comprehension educators, researchers, and policy-makers alike must be sensitive to multiple components of language and the variation of performance within each of these constructs.

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