ABSTRACT

Title of Dissertation: DE FACTO BILINGUAL EDUCATION: THE ROLE OF HOME LANGUAGE SUPPORT IN THE ACADEMIC ACHIEVEMENT OF DUAL LANGUAGE LEARNERS

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Despite a clear finding that immigrant children in bilingual education programs outperform children in English-only instruction, little is known about the underlying causes of this effect and the variability in the results. This study seeks to understand cases in which bilingual students with emerging English skills appear to experience success or rapid academic gains in English-only classrooms in the apparent absence of home language support in school. Using a sample of 2,428 Spanish-speaking bilingual students in 438 schools from the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011), multilevel models are employed to integrate multiple sources of data from parent interviews, self-administered teacher surveys, school administrator questionnaires, and one-on-one student assessments. Drawing from research on family language policy, which focuses on how bilingual

families manage and use languages, and on theories of bilingual education, this study shows that the academic support that parents provide using the home language gives bilingual children background knowledge or a network of contextual clues that helps them navigate English-only classrooms. This background knowledge gained through parental support in the home language allows bilingual learners with the lowest level of English proficiency to score higher in mathematics in English-only environments during the kindergarten year in the same way as home language support contributes to children's success in bilingual and dual language programs. This finding is an empirical verification of what has been called "de facto" bilingual education, a situation in which an emergent English learner succeeds in an English-only classroom due to parental academic support in the home language. In addition, this study shows that the parents' preference for a home language does not jeopardize the English language attainment of young children upon entry to kindergarten. These findings are of great significance to educators, policymakers, and researchers who strive for equitable educational practices that support the inclusion of all students in the classroom, as they provide a context for understanding oft-reported immigrant successes in English-only classrooms as "de facto" bilingual education provided by parents at home.

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Dedication

A mis padres y mi familia por el apoyo que me dan cada día.

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Chapter 1: Introduction

Problem Statement

Despite a clear finding that immigrant children enrolled in bilingual education programs outperform children in English-only instruction (August & Hakuta, 1997; August & Shanahan, 2006; Bialystok, 2018; Genesee, Lindholm-Leary, Saunders, & Christian, 2006; National Academies of Sciences, Engineering, & Medicine [NASEM], 2017; Rolstad, Mahoney & Glass, 2005), little is known about the underlying causes of this effect and the variability in the results. This study seeks to understand cases in which bilingual students with emerging English skills experience rapid academic gains in English-only classrooms in the apparent absence of home language support in schools. Drawing from research on family language policy (King, Fogle, & Logan-Terry, 2008; King & Lanza, 2019; Smith-Christmas, 2016), which focuses on how multilingual families manage and use their languages, and on theories of bilingual education (MacSwan, Thompson, Rolstad, McAlister, & Lobo, 2017), this study examines the patterns of language use among immigrant bilingual families of Spanish-speaking backgrounds using a sample of 2,428 bilingual students in 438 schools from the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011) (Tourangeau, et al., 2019).

Multilevel models with mixed effects (Fitzmaurice, Laird, & Ware, 2011) are employed to integrate multiple sources of data from parent interviews, self-administered teacher surveys, school administrator questionnaires, and one-on-one student assessments. The goal of this study is to investigate the extent to which patterns of

language use among immigrant families are associated with English language proficiency and gains in mathematics during elementary school in bilingual students, also known as Dual Language Learners (DLLs). DLL is a term adopted in this study to refer to children learning two or more languages simultaneously within a bilingual or multilingual home environment following the consensus study report of the National Academies of Sciences, Engineering, and Medicine (2017).

Although this study focuses on family language practices and parental home language support among DLLs, it also makes an important contribution to the growing evidence of the effectiveness of bilingual education since it connects parental home language support with math achievement upon entry to kindergarten and in later years of elementary school. Krashen (1999) indicates that bilingual instruction reduces achievement differences between bilingual and monolingual English-speaking children because it allows DLLs to continue making academic gains while they struggle to learn and understand English. In addition, Krashen (1996) coined the term "de facto" bilingual education to refer to cases in which an emergent English learner does well in an English-only classroom in the apparent absence of language instruction at school because he or she has the advantage of background knowledge (Ramos & Krashen, 2013). This study contributes to the understanding of the effectiveness of bilingual education by providing empirical evidence of cases of *de facto* bilingual education among DLLs of Spanish-speaking background upon entry to kindergarten.

Using a large nationally representative sample from the ECLS-K:2011 dataset, this study shows that DLLs with the lowest level of English proficiency benefitted more from parental academic support in the home language in situations where the school

offered language support only in English (e.g., English as a Second Language [ESL] programs) or no language support at all (i.e., submersion contexts). For the students with the lowest level of English proficiency, findings shows that there were significant positive differences in math scores in DLLs with parental support always in the home language when compared to DLLs with parental support sometimes in English across different instructional settings including ESL, bilingual education, and submersion classrooms.

Following Krashen's (1996) explanation of cases of *de facto* bilingual education and drawing from MacSwan's et al. (2017) transfer theory in bilingual education, this study argues that the differences in math scores observed among DLLs with the lowest level of English proficiency across different school language programs and contexts are because the academic support that parents provide using the home language gives DLLs background knowledge or a network of contextual clues that allows them to make rapid gains in math in English-only environments in the same way as first language or home language support contributes to children's success in bilingual and dual language programs. Krashen (1996) and Ramos and Krashen (2013) explains cases of success without bilingual education across different ages and educational contexts by conjecturing about the strength of the student background knowledge gained either through parental academic help or prior years of education in the first language. This study focuses on the role of parental support using the home language among Spanish-speaking DLLs upon entry to kindergarten and it offers evidence of cases of *de facto* bilingual education in early childhood education.

This study also contributes to the understanding of early childhood bilingualism in relation to academic achievement, specifically English language development in mainstream classrooms among DLLs of Spanish-speaking background. Findings of this study revealed that parents' preference for using a home language does not jeopardize the English language attainment of young children upon entry to kindergarten. These findings are of great significance to educators, policymakers, and researchers who strive for equitable educational practices that support the inclusion of all students in the classroom, since they provide a context for understanding often reported immigrant successes in English-only classrooms as "de facto" bilingual education provided by parents at home.

Rationale and Research Questions

Families are one of the most influential contexts impacting children's cognitive and linguistic development (Galindo & Sheldon, 2012). However, multilingual families are still frequently characterized as lacking in terms of cultural and linguistic resources by educators and policymakers (Baquedano-López, Alexander & Hernández, 2013). By investigating the role of using the home language in providing academic support beyond the school setting, this study contributes to the understanding of the value using the student home language in education. Research on family language policy provides the context to understand and conceptualize the linguistic practices of the immigrant families in this study. The extensive research on the effectiveness of bilingual education programs, including empirical evaluations of theoretical models for educating bilingual learners (MacSwan, et al., 2017) offers a framework to understand how the use of the home language provide DLLs with accessible content knowledge necessary to succeed in

the classroom. The findings of this study make an important contribution to understanding the effectiveness of education delivered in the home language and support the creation of bilingual programs to level the achievement of language minority students. This study address a gap in the research on the effectiveness of bilingual education by offering an empirical verification of what has been called "de facto" bilingual education (Krashen, 1999), a situation in which an emergent English learner does well in an English-only classroom due to parental academic support in the home language.

The research questions that guide this study are:

RQ1. What are the patterns of family language practices among dual language learners (DLLs) from kindergarten to fifth grade?

RQ2. To what extent are identified family language practices accounting for variance in English language proficiency in DLLs upon entry to kindergarten?

RQ3. To what extent are identified family language practices accounting for variance in academic achievement or gains in mathematics in DLLs from kindergarten to fifth grade?

The Participants

Data for the study come from the ECLS-K:2011 (National Center for Education Statistics [NCES], 2018), a nationally representative sample of elementary school students who were followed from kindergarten in 2010-11 to fifth grade in 2016. An initial sample of 2,428 bilingual students or DLLs from 438 schools was drawn from the ECLS-K:2011 study. The students selected were identified as Hispanic, had a non-English home language as reported by the parents, and participated in an English

language skills instructional program at any moment between kindergarten and fifth grade. About 99 percent of the participants selected in this study spoke Spanish at home on a weekly basis. About one percent of the families reported using other languages like French or Portuguese. Most of the parents in the sample of this study were immigrants. About 91 percent of the mothers and about 93 percent of the fathers were born outside the United States. Although there is a variety of educational background and income levels among the families selected in the sample, levels of education and income were in general low. Regarding parental levels of education, the median or 50 percent of the parents had between 9th and 12th grade completed or lower levels of education. The median average family annual income level for the sample was between $20,001 and $25,000 for the year prior entry to kindergarten. The average self-reported parental level of English proficiency for the sample was between 2 (= not very well) and 3 (= pretty well) for both parents using a four-point scale ranging from 1 (not well at all) to 4 (very well). Children in the sample had an average of 1.65 siblings in the year of kindergarten.

Definitions of Terms

The following definitions represent the meaning of terms and how they will be used in this study.

Dual Language Learner (DLL)

The term Dual Language Learner (DLL) was adopted following the consensus study report of the National Academies of Sciences, Engineering, and Medicine (2017), which uses this term to refer "to the broader group of children and adolescents ages birth to 21" (p. 1). Since this study uses secondary data from the ECLS-K:2011 dataset, little is

known about the language development of the students' home language. For this reason, the term DLL was preferred over other terms such as bilingual learner because it offers the ambiguity of referring to young learners learning two languages in multiple contexts. For instance, the term DLLs refers to children learning two or more languages simultaneously within a bilingual or multilingual home environment. In addition, DLLs also refers to children learning a second language (L2) while continuing to develop their first language (L1) or home language because they attend a bilingual program. DLLs also refer to children who are learning an L2 because they receive formal instruction in English but parents or close relatives use a non-English home language to communicate with them in the household. All these multiple bilingual language experiences are represented in the ECLS-K:2011 study.

In this study, DLLs were school-age bilinguals followed from kindergarten through the fifth grade. DLLs were identified as speakers of Spanish at home by a parent, a teacher or a school administrator. DLLs may have been also identified as English language learners (ELLs) or students with limited proficiency in English (LEP) by the school district or their classroom teacher although this information is not available in the ECLS-K:2011 data set. DLLs may also be identified as language-minority learners (Mancilla-Martinez & Kieffer, 2010) in contrast to their English-speaking peers also known as language-majority learners (Martin-Beltrán, 2014). The term ELL or LEP will only be used when reviewing scholarly work that employs this label.

Home Language

Home language refers to the language or languages spoken at the children's home. In this study, home language refers mostly to Spanish, a non-English language that

was regularly spoken in the child's home—i.e., occurring at least weekly by a parent or the participant child living in the same household, according to parental report (Tourangeau, Nord, Lê, Wallner-Allen, Hagedorn, Leggitt, & Najarian, 2015). About 99 percent of the sample selected in this study spoke Spanish at home, except for 17 families who reported using other languages like French or Portuguese. Since this study uses data from a nationally representative dataset, the term home is understood in a restricted sense, referring specifically to the child's household. In most cases, home language overlaps with the child's L1, although not always. For instance, Pérez Báez (2013) investigated Zapotec families who relocated to the US, where they shifted away from Zapotec to Spanish to communicate at home as they joined a larger well-established Spanish-speaking community.

Information about the child's home language come from parent interviews collected by the ECLS-K:2011 researchers. One limitation of working with the ECLS-K:2011dataset is that it does not include enough information about the conditions in which the participants acquired the language. For this reason, the term home language is preferred over more specific terms such as *heritage language* (Kupish & Rothman, 2018; Rothman, 2009) to accommodate for the multiple linguistic experiences that the participants in the sample have in this study. The term home language also overlaps with the term *Other Language than English (LOTE)* in particular when discussing the role of the student home language in the school context. This study prefers to use the term home language instead of LOTE because of the reference *home language* makes to the home or household of the participants (Cunningham, 2019). Participants for this sample were selected based on whether they actively spoke a different language than English in their

households. Families who reported speaking English exclusively at home were not selected for this study. Home language use and home language support are terms that are used in this study to refer to how families employ the non-English language at home. It also refers to situations in which school offers instructional support in the language that students use at home (i.e., bilingual education). These terms were used interchangeably in this study.

Family Language Practices

Family language practices refer to the language preferences that the parents and child have when communicating at home. In this study, data from the parent interview give a measure of the weekly frequency of parents' and child home language use in contrast to English. Family language practice is a term defined within the framework of family language policies, which have been described as "planning in relation to language use within the home among family members" (King, Fogle & Logan-Terry, 2008, p. 907). In this study, family language policy refers to management including planning related to language use in the students' home that involves parental language goals, attitudes, or intentions in relation to language use among family members.

Parental Academic Support

Questions from the ECLS-K:2011 study about parental engagement that were asked to parents in the fall of 2010 (upon entry to kindergarten) were conceptualized as parental academic support. Parents answered about the weekly frequency they were engaged in range of activities. For example, they were asked whether they tell stories, sing songs, do art and crafts, do chores, play games or do puzzles, talk about nature or do science projects, build things together or play with construction toys, play sports, and

practice reading, writing or working with numbers with their children. This set of questions was conceptualized as *parental academic support* because the parental engagement activities resemble what children do and learn in a kindergarten program. Parents were also asked about how frequently they used the home language to engage children in the activities listed before. Data to this response were conceptualized as *home language use for academic support* and is considered another aspect of the ECLS-K:2011 family language practices investigated in this study. A limitation of this study is that parental academic support in connection to home language use is limited to the kindergarten year.

Academic Achievement

Following Han (2012) and Galindo and Sheldon (2012), academic achievement is defined as gains in specific academic areas such as mathematics over certain period of time. In this study, math standardized tests scores from kindergarten to fifth grade were used as indicators of academic achievement over the year of elementary school. For more detail about the scores, please see the methods section.

English as a Second Language (ESL)

Following Tourangeau et al. (2015), the researchers that collected the ECLS-K:2011 data set, ESL is an instructional program designed to teach listening, speaking, reading, and writing English language skills to DLLs. The program may focus on a student's level of proficiency in general English and typically, there no language support in the home language. According to Baker (2011), the goal of ESL programs is to "mainstream" language-minority students (p. 211).

Bilingual Education

Bilingual education refers to instruction in school that employs the children home language to varying degrees, in conjunction with English, to teach English and academic content to DLLs. In this study, bilingual education is used as a general term that includes transitional bilingual programs that aim to shift the child from the home language to English. It also includes two-way/dual language programs, where language- majority and language- minority students are mixed and instruction targets biliteracy in both home language and English by providing language and content instruction in both languages.

Submersion Student

According to Baker (2011), submersion is an educational context in which a language-minority child is placed in a mainstream classroom alongside with language-majority students. In this study, a submersion student is a DLL who did not receive any language support (i.e., ESL or bilingual education) during the kindergarten year but later participated in an instructional program designed to teach English language skills at any moment between first grade and fifth grade.

Non-English Speaker

For the ECLS-K:2011 data set, information on children's basic English language proficiency was collected with the *preLAS* 2000 (Duncan & De Avila, 1998) in kindergarten and first grade. These scores were used to identify the children in three levels of English language proficiency using the recommendation of the publisher in Duncan and De Avila (2000). Following Duncan and De Avila (2000), students with the lowest level of English language proficiency were labeled as Non-English Speakers (NES). Students with the highest level of English proficiency were labeled as Fluent

English Speakers (FES), and students with intermediate levels of English proficiency were named Limited-English Speakers (LES). For more detail about how these groups were created please go Chapter 3.

Purpose and Significance of the Study

One of the purposes of this study is to contribute to the understanding of early childhood bilingualism and the effectiveness of bilingual education by studying the use of the home language to academically support language-minority students beyond the classroom. This study also seeks to contribute to the understanding of early childhood bilingualism in relation to academic achievement, specifically English language development in mainstream classrooms. Although there is considerable research examining the effectiveness of bilingual programs serving DLLs (e.g., Rolstad, et al., 2005; Slavin & Cheung, 2005, among others), more research is needed to understand the language development of DLLs in mainstream classroom in connection to family language practices.

This study is of great significance to educators, policymakers, and researchers who strive for equitable educational practices that support the inclusion of all students in the classroom. If we recognize the need to understand the fluid and dynamic language practices of multilingual families to support them better at school, more research is required to understand how different patterns of family language practices in conjunction with bilingual education may impact the academic trajectory of young learners. The findings of this study contribute to research that seek to connect the language of home and the language of school to overcome deficit perspectives on the linguistic and cultural resources of multilingual students (MacSwan & Rolstad, 2010).

Chapter 2: Theoretical Framework and Literature Review

Introduction

This chapter is divided in two parts. The first part focuses on the theoretical framework that guides this study. As explained before, this study draws from studies in family language policy (King, Fogle & Logan-Terry, 2008; Spolsky, 2012) to conceptualize how immigrant families use the home language and English to support the language development and academic achievement of their children. This study also draws from theories on bilingual education (e.g., MacSwan & Rolstad, 2005; Krashen, 1999) to hypothesize how parental use of the home language to academically support language-minority students benefit DLLs who do not have access to bilingual education in school.

The second part of this chapter presents an empirical literature review of quantitative studies investigating issues of bilingualism, academic achievement and the role of home language use among immigrant families. This set of studies were reviewed to better understand the potentials of using nationally representative datasets and the limitations of working with secondary data—i.e., data collected by somebody else than the user. Although none of these studies draw on family language policy research or from theories on bilingual education, this empirical literature review was crucial to operationalize the concepts discussed in the theoretical framework as variables of interests and background variables to carry out the present quantitative study using ECLS-K:2011 data.

Part 1: Theoretical Framework

Two strands of research inform the theoretical background to explore the relationship between family language practices, English language proficiency and gains in academic achievement in DLLs: studies on family language policy (e.g., King, et al., 2008, King & Lanza, 2019; Smith-Christmas, 2016), and theories on bilingual education (e.g., Krashen, 1999; MacSwan & Rolstad, 2005; MacSwan, et al., 2017). Since the participants of this study are young bilingual learners in elementary school, research on bilingual education (e.g., Bialystok, 2018) and bilingualism in early childhood (e.g., Kupisch & Rothman, 2018; Paradis, 2009) also informs the theoretical framework. This study draws from research on the effectiveness of bilingual education to interpret the findings rather than evaluate the effectiveness of bilingual programs attended by the participants. FLP studies and research on bilingualism and bilingual education provide the conceptual framework in which key concepts such as family language practices, home language, and academic achievement are defined. This section is organized in three sub-sections that inform the theoretical framework of the study: (1) family language policy; (2) research on bilingual education; and (3) bilingualism in early childhood.

Family Language Policy

King (2013) defines family language policy as a field that encompasses the "study of *language ideologies* (how family members think about language), *language practices* (what they do with language), and *language management* (what they try to do with language)" (p. 49-50). More narrowly, King, et al. (2008) defined family language policy as explicit and open "planning in relation to language use within the home among family members" (p. 907). Family language policy (FLP) is relatively new field that has

attracted many researchers interested in studying the dynamics of family language use in the context of immigration, minority language maintenance, ideology, identity, and language policy (King & Lanza, 2019). One of the fundamental questions that guided the work of early FLP researchers (e.g., De Houwer, 1999) was why some children being raised in bilingual environments achieve relatively equal competence in their minority language (Smith-Christmas, 2016). In addition, the work of Spolky (2012) and Curdt-Christiansen (2015) connect studies in FLP to macro-political policy decisions about language and education. Over the last two decades, FLP researchers have also shown interest in family-based language learning and multilingualism in the context of globalization, immigration, ideology, and identity (King & Lanza, 2019). In the words of King and Lanza (2019) "researchers are increasingly interested in how families are constructed through multilingual language practices, and how language functions as a resource for this process of family making and meaning-making in contexts of transmigration, social media and technology saturation, and hypermobility" (p. 717).

This study draws from FLP research to understand the *language practices* of the immigrant families in the ECLS-K:2011 data set. However, this study departs from research in FLP (mostly ethnographic) in that it employs a large secondary data set and is limited to the data collected by the ECLS-K:2011 researchers. Questions about language maintenance or the ideological motivation of parents for using the home language cannot be addressed with the ECLS-K:2011 data. However, this study makes an important contribution to the field of FLP by providing a quantitative analysis of the patterns of language use of a nationally representative sample of immigrant families with young

bilingual learners attending school in the United States. In what follows, a review of FLP as a field is presented.

Family Language Policy as an Interdisciplinary Field

Curdt-Christiansen (2015) highlighted the interdisciplinary aspect of FLP, which draws on theoretical frames of language policy, language socialization, home literacy studies and child language acquisition. According to Curdt-Christiansen (2015) FLP "seeks to gain insights into how macro-political policy decisions and sociolinguistic contexts (external factors) influence and interact with micro-level parental language-discourse strategies" (p. 257). Schwartz and Verschik (2013) situated FLP at the intersection of micro and macro approaches to multilingualism and Spolsky (2004) identified families as the intermediate level between the individual and the community. In particular, the work of Spolsky (2012) connected family language practices with the broaden perspective of language policy using the metaphor of ecology, which underscored the interaction between language and environment.

Families, Family Language Policy, and the Larger Socio-Economical and Ideological Context

Situating family as a crucial domain to language policy, Spolsky (2004, 2012) recognized the influence of families on other domains such as the government or the public school system, producing an interrelated and dynamic network where domains influence each other. For instance, the public school system may seek to explicitly influence language use in the larger society using legal and regulatory means by reinforcing the use of the majority language or the language of the community members with more prestige. In contrast, families may follow ethnic cultural patterns (Spolsky,

2012), which do not always align with state-controlled education, particularly in the case of immigrants or minority language groups. Language policy outcomes can be unexpected and explanations for policy failure can be elusive. For instance, government efforts to influence family language practices range from highly successful outcomes, such as the promotion of Hebrew in Israel (Spolsky & Shohamy, 1999) to disappointing results like in the case of Cajun French in Louisiana (Caldas, 2006).

In general, FLP research shows that parental attitudes to languages do not escape broader sociolinguistic forces and political discourse. Curdt-Christiansen (2009) conducted an ethnographic inquiry examining how ten Chinese immigrant families in Quebec, Canada, planned their FLPs with regard to their children's language and literacy education in Chinese, English, and French. Children attended Chinese heritage language school on Saturdays while attending French public school or a private English-French bilingual school. Parents had clear and unambiguous beliefs and goals with regard to how multilingualism and cultural knowledge would benefit their children and acted upon their beliefs by setting up their parenting goals, establishing an FLP, and providing the educational support they believed their children needed. Her findings suggest that FLP is strongly influenced by socio-political and economical factors. Parents' educational background, their immigration experiences and their cultural disposition, in this case pervaded by Confucian thinking, shaped the parents believes and expectation about their children's bilingualism.

In another example, Curdt-Christiansen (2013) analyzed how parents took different measures to resist or surrender to the pressures of the larger society. For example, parents send their children to heritage language schools (Curdt-Christiansen

2009), other parents seek advice and support from self-help literature and online forums (Piller & Gerber, 2018), while others maintain minority language literacy skills through daily socialization routines (Curdt-Christiansen 2013). In words of Curdt-Christiansen (2013) "at the home front, some parents make conscious decisions and plans to enrich their children's linguistic repertoire or to maintain their home language" (p. 278). One example is the English-Chinese speaking family interviewed by Curdt-Christiansen (2013). The mother used the home language to supervise their children's homework, making sure that the child had access to both social and academic vocabularies in Chinese.

Research in FLP has strived to investigate the relationships between private domains and public spheres and "reveal the conflicts that family members must negotiate between the realities of social pressure, political impositions, and public education demands" (Curdt-Christiansen, 2013b, p. 1). Curdt-Christiansen (2013b) indicates that the study of family language policies and practices not only help researchers understand better processes of language shift and change, but research in FLP also sheds lights on broader language policy issues at societal levels. In addition, recent studies in FLP have begun to pay attention not only to how parents and children negotiate their policies in everyday interactions but also how mixed language practices such as code-switching play a role in these negotiations. For example, in another study by Curdt-Christiansen's (2013) explored how English-Chinese mothers in Singapore used different strategies to negotiate the rules of speaking during literacy events around daily homework routines. Another example is Curdt-Christiansen (2015) who used surveys and ethnographic observations to investigate code-switching as a distinctive feature of English-Chinese families in

Singapore. However, she also found that Singaporean families as well as the local government did not welcome or embrace language mixing. Many parents and policymakers viewed languages as separate and discrete entities.

In addition, the work by Fogle and King (2013), and King (2013) connects language policy with child language acquisition studies. For example, King (2013) conducted a longitudinal case study that focused on three young sisters (aged 1, 12, and 17) in a bilingual, transnational Ecuadorian–U.S. family. Through an ethnographic lens, King examined how each of the three sisters was positioned and positioned herself discursively as a language learner and user. It also investigated how locally held ideologies about language and language learning shaped the ways in which identities and family roles were constructed and enacted around language practices. For example, the older sister who immigrated to the United States when she was 14 was constructed in the family as unsuccessful and uncommitted because of the parental expectations that she would quickly become fluent in English. In contrast, the younger sisters were fluent in English but their Spanish was weaker, leading to the teasing and mocking of other family members. In another study, Fogle and King (2013) investigated how children's active roles shaped parents' ideologies and practices in transnational families in the US (Russian adoptive families and Spanish-English bilingual homes). For example, a family routine set up by the English-speaking father of telling about one bad thing and one good thing that happened during the day was resisted and transformed by the Russian-adopted children by engaging in other types of story-telling talk that left the father outside the conversation.

This body of research has closely examined how parents' language decisions, practices, and beliefs influence children academic achievement and language development. King, et al. (2008) argued that parents' language decision can shape children's developmental trajectories, connecting in significant ways with children's formal school success, besides contributing to the maintenance and future status of minority languages. For example, Schwartz and Moin (2012) investigated parents' assessment of their children's bilingual language development in connection to the choice of bilingual versus monolingual preschool education. They found that parents' expectations about different educational settings (monolingual versus bilingual kindergarten) and beliefs towards children's bilingual development played a role in the choice of bilingual versus monolingual kindergarten.

Researchers also documented cases of families who attempted to raise bilingual children despite parents needing to use and teach a language that was not their L1, nor the primary language of the home or wider community. King and Fogle (2006) investigated 24 Anglo families who sought to achieve Spanish-English bilingualism in the US. Their conclusion was that FLP for the promotion of additive bilingualism have become incorporated into mainstream parenting practices in the US by middle class parents through self-help literature and popular literature discussing bilingual parenting. However, they also found that these parents' efforts faced considerable challenges and could be better supported.

More recently, Piller and Gerber (2018) discussed how bilingual parenting has become a topic of discussion in online forums and parenting literature, adding to the anxiety of multilingual parents who strive to pass the home language to their children but

fear they will jeopardize the acquisition of the majority language. The authors examine how parents in a general Australian online parenting forum discuss the desires they have for their children's bilingualism and the challenges they experience to their bilingual parenting. Their findings show that public discourses about bilingual parenting are permeated by contradictory ideologies that depict bilingualism simultaneously as a benefit and as a threat. Parents in the Australian online forum discussed individual bilingualism in the abstract in highly favorable terms, as way to give economic and academic advantages to the children. However, parents expressed concerns about how introducing a minority language in the early years of a child could adversely impact English language development and the child's future school success. Parents were also aware that English language proficiency among immigrants was a frequent topic of political and media discussion that presented bilingualism as a threat, especially when it involved "small or powerless languages" (p. 11). The researchers found that parents favored a very narrow definition of what bilingualism was associated with a rigid implementation of one parent one language strategy with each parent consistently speaking their 'native' language to the child. The implication of this view was that bilingualism was best achieved via two sets of clearly separated monolingual language practices from an early age.

These studies speak about the vital role that parent and children play in the language development and academic trajectories of bilingual learners. As a theoretical framework, FLP brings together micro and macro approaches to language policy and the study of multilingualism. It situates families as a crucial intermediate level between the language learner or individual and the larger community or school. FLP also situates the

concept of family language practices in a broader social and economical context. Although there is evidence that parent beliefs and decisions about language management influence children academic trajectories and language development, more research is needed to understand the role of these decisions in the context of school. This study seeks to address this gap by looking at different patterns of family language practices across DLLs attending bilingual education and English-only instruction. In what follows, the literature on FLP is reviewed with a focus on (a) parental strategies according to the type, situation, and context of the families studied, (b) parental attitudes that may impact the language practices, (c) the role of siblings in FLP, (d) the influence of teachers and other educators into the family language practices, and (e) the development of biliteracy in addition to bilingualism.

Parental Strategies to Promote Bilingualism

Parental strategies employed to promote bilingualism can be classified according to the type, situation, and context of the families studied (Lanza, 1992). The one person–one language (OPOL) approach has been extensively studied in bilingual acquisition in childhood. In this approach, parents with different L1s choose to speak to the child in their L1 at home (e.g., De Houwer, 1990; Juan-Garau & Perez-Vidal, 2001). In this situation, a parent can have as a L1 the one spoken in the wider community, or majority language, while the other parent speaks a minority language. In other situations, parents following the OPOL approach may each speak a different minority language in the home, which creates a trilingual environment with the third language being the majority language used outside the home (e.g., Montanari, 2009).

Another variation of OPOL families includes parents who decide that one of them will use a minority language that is not their L1 in the home (e.g., King & Logan-Terry, 2008). For instance, King and Logan-Terry (2008) studied middle-class families in which native English-speaking mothers used their second language (L2), Spanish, to communicate with their children. In other families, researchers have documented non-OPOL types of language use in the home. These are situations in which both parents use a minority language that may not be their L1 (Shin, 2002). Non-OPOL family types include those that employ a mixed use of languages, where caretakers engage in codeswitching (Smith-Christmas, 2014). In general, the findings concerning the child outcomes of such different family language policies vary widely, illustrating both relatively successful and less successful bilingual development of the children studied. Finally, King and Fogle (2013) highlighted that lack of attention to language policy in the home tends to facilitate a shift towards the majority language. However, they also concluded that, although family language policy might be necessary, it is not sufficient for children's bilingual development.

Parental Attitudes that Impact Family Language Policy

Drawing from developmental psychology, De Houwer (1999) developed a three-tiered model that addresses the relationship between parental beliefs and attitudes and children's language development in bilingual families. In this model, parental beliefs and attitudes shape parental linguistic choices and interaction strategies, which in turn impact children's language development. King and colleagues (2008) revisited the model to identify four types of parental attitudes and beliefs that impact bilingual families'

language practices. According to King et al. (2008), parental attitudes and beliefs can be summarized as follows:

1. Attitudes towards the purpose of the languages being used.
2. Attitudes towards types of linguistic interactions such as code-switching.
3. Attitudes towards language learning and bilingualism, which includes impact beliefs (De Houwer, 1999) the degree to which parents see themselves as capable of and responsible for shaping their children's language repertoire.

Parental Attitudes Towards the Purpose of the Languages Being Used.

Parents may have clear ideas about which languages should be used for what purposes with their children. An example of this parental ideology was presented in Hornberger (1988). In this study, Quechua parents in the Peruvian Andes conceived schooling as a Spanish-only domain for formal learning and thus resisted Quechua medium schools, despite the government's effort to offer Quechua-Spanish bilingual education. Resistance towards language instruction in a minority language is not uncommon among some immigrant Latino parents in the United States (Farrugio, 2010).

Another example is Schecter and Bayley (1997) who studied four Mexican-descent families. These families viewed Spanish as a vehicle for affirmation of Mexican American cultural identity. However, they differed in the purpose they assigned to the maintenance of Spanish at home. For instance, one of the families associated speaking Spanish with "preservation of the cultivated Spanish of the educated Mexican elite" (p. 536) rejecting the variety spoken in their local community in California. As a consequence, this family was the least successful in the intergenerational transmission of Spanish. Similarly, Pérez Báez (2013) found that a community of Zapotec speakers from

Mexico experienced a rapid language shift. The first generation spoke mostly Zapotec but when they settled in the US they shifted towards Spanish and English. This was because Zapotec was viewed as a less useful language in the new setting.

Research on Chinese American families has documented a rapid language shift away from the family language. For example, Zhang and Slaughter-Defoe (2009) studied Chinese immigrant parents and their second-generation children attitudes toward the maintenance of Chinese in US. They found that while Chinese parents valued their home language as a resource and took positive actions to maintain it, the children did not necessarily see the relevance of home language learning in their life and often resisted parents' efforts in home language maintenance. Xia (2016), in her dissertation study, concluded that Chinese immigrant parents' language attitudes and ideologies were largely influenced by English-only ideology, which was documented by English-dominant home literacy practices and English-dominant language policy at home. In this study, she found that Chinese parents invested more in English literacy activities and materials for children, and very few parents implemented Chinese-only policy for their children. Finally, Shin (2005) found similar tendencies among immigrant Korean families in the US, who reported choosing to switch to English because of the parents' perception that English was critical for academic and social success in America.

Parental Attitudes Towards Types of Linguistic Interactions

Parents may have attitudes concerning particular types of interactions, such as mixing languages or using slang. Zentella (1997) documented how codeswitching among multiple generations of Puerto Ricans in New York provided a means for establishing a *Nuyorican* identity among the community members. As mentioned before, Schecter and

Bayley (1997) also registered parental attitudes towards types of language interactions, although this was not the focus of the study. In their sample of four families, two of them tolerated language mixing while tapping on the linguistic resources of their communities.

Parents also had attitudes towards different varieties of Spanish. As mentioned before, Schecter and Bayley (1997) documented one Mexican family who viewed Spanish as the language of educated Mexican elite and actively resisted the Spanish spoken in the local community. In addition, Raymond (2012) investigated the speech of Spanish-speaking families living in Los Angeles, California. In these households, the author found evidence of at least two distinct dialects coexisting, the parents' variety of Spanish from their homeland and the children's variety of Spanish spoken in the new community. This variety had characteristics of a *koiné* with features from rural Mexican Spanish dialects but with its own unique characteristics as well.

Finally, research has investigated how bilingual parents use their L1 with their children to mark an affective stance, to express emotion or in the context of dispute or discipline (Pavlenko, 2004). For instance, Song (2016) studied a Korean mother-son dyad living for a short term in the US. She found that the child would often use Korean to negotiate with his mother but switch to English to challenge her authority and deemphasize hierarchical relationships.

Parental Attitudes Towards Language Learning and Bilingualism

Parents have attitudes towards language learning and bilingualism that also come into play in influencing their interactional strategies. For example, King (2001) described how Indigenous Ecuadorian parents believed that early second language exposure confused children. Thus, their belief led them to promote Spanish only in the home and to

shift away from their Indigenous language. In another study already discussed in this chapter, King (2013) found that an Ecuadorian family with three girls framed the language skills of the middle daughter in different ways. While the family took pride on the English skills of the girl who was born and raised in the United States, they also mocked the girl's weaker Spanish skills. The family framed the girl's perceived Spanish-language shortcomings in favorable terms, "as if speaking Spanish less than perfectly elevated and made permanent her status within the United States" (p. 56). In addition, the family pride in the daughter's English at the expense of her Spanish suggested an ideological association between speaking good English and being a good U.S. citizen.

As mentioned before, Pérez Báez (2013) also found a community of Zapotec speakers quickly shifting towards Spanish and English when living in the United States. Her findings revealed that "parental language ideologies concerning the relationship between language and place of birth" (p. 27) disfavored the maintenance of Zapotec. For instance, some parents expressed a belief that children are born speaking the language associated with their place of birth. As a consequence, parents used only Spanish and English with children born in the US. This author found evidence that the parents had a weak impact belief (De Houwer, 1999). In other words, parents perceived that the level of control they could exercise over their children's language choices was low, thus their attitudes undermined their ability to engage in language interventions to maintain Zapotec in the community.

In contrast, as discussed before, King and Fogle (2006) investigated English-speaking families who attempted to achieve additive Spanish-English bilingualism for their children, although Spanish was not the parents' L1, or the language of the wider

community. To support their beliefs about the benefits of additive Spanish-English bilingualism, parents drew selectively from expert advice and popular literature. In general, the authors found that parents primarily relied on their own personal experiences with language learning in making decisions for their children. Piller and Gerber (2018), in a study already discussed before, investigated a group of bilingual parents living in Australia that turned to an online forum for advice and support to raise bilingual children. They found that parents viewed individual bilingualism in the abstract in highly favorable terms but were fearful that bilingualism in the early years might jeopardize their child's English language proficiency and hence school success. As a consequence, the mixed beliefs and attitudes that these parents held did not easily translate into effective bilingual parenting practices.

Not surprisingly, researchers often report a disconnection between parental attitudes towards language learning and bilingualism and actual practices at home. For instance, Lao (2004) surveyed 86 parents who enrolled their children in a Chinese–English bilingual preschool in San Francisco. Although parents in this study strongly supported bilingualism, most of them reported speaking only English at home.

The Role of Siblings in Family Language Policy

One of the possible answers to the variability in child outcomes in bilingual families could be a result of differences in language environment (Quay & Montanari, 2016), in particular in relation to the role of other family members besides parents such as siblings. For instance, the presence of older children like friends or siblings and order of birth can affect the transmission of the minority language (Parada, 2013, Shin, 2002). Shin (2002) investigated the effects of birth order on bilingual development in Korean

American families and found that firstborn children spoke more Korean with their parents while second-born or third-born children generally spoke more English according to a parent survey. This study investigates the role of siblings in the patterns of family language use of the immigrant families in the ECLS-K:2011.

Scholars researching Spanish-speaking communities in the US also found that older siblings tend to bring the majority language into the home. For instance, Parada (2013) conducted interviews and distributed questionnaires to 18 Latino families in Chicago, Illinois. Similarly to Shin (2002), her findings revealed that birth order suggested different language experiences among siblings. Children of higher birth order seemed to be exposed to larger amount of maternal input in Spanish than younger siblings.

Researchers also found that older siblings tend to bring the majority language into the home even when parents have a different FLP. Using a survey to investigate immigrant and American Indian families in the US, Wong Fillmore (1991) found that younger immigrant children were generally more English dominant than older ones were and showed greater loss of their home language. The eldest children in immigrant families tended to learn to speak English when they enter school, whereas the later-born children began speaking English before entering school because the elder siblings brought it into the home. Kibler, Palacios and Simpson Baird (2014) found that the number of older siblings was a significant predictor of children's oral language production toward other children in the home. Using survey-based data and mixed methods, they found that presence of an older sibling in the household indicated a lower probability that the younger sibling would speak only in Spanish in the home.

Other studies have described the opposite situation, in which older siblings were enlisted to explicitly assist with the maintenance of the minority language. For example, King (2013) researched an Ecuadorian family in the US where the eldest sister was "an anchor maintaining the heritage language, reminding us that the roles of siblings are much more varied and complicated than posited by previous studies of family language shift" (p. 61). These differences might depend on the diverse language experiences that older siblings may experience, such as age of their migration, or social areas of participation. Thus, the conclusion is that there is a wide range of ways in which siblings may influence FLP.

The Influence of Teachers and the School into the Family Language Policy

The Role of Parents in the School

Baquedano-López, et al. (2013) reviewed the literature on parental involvement in the US school system. The authors expressed concern with "approaches to parental involvement that construct restricted roles for parents in the education of their children" (p. 149). According to the authors, this was particularly problematic for parents whose background was at the intersections of race, class, and immigration. Baquedano-López and her colleagues indicated "that parental participation in schools is strongly shaped by perceptions of parents' background and of the roles expected of them by school administrators and teachers" (p. 150).

In addition, Whitehouse and Colvin (2001) indicated that schools often emphasized the language, culture and values of the mainstream families while language-minority families' child rearing practices were at risk of being judged from a deficit perspective. Another example is Valdés (1996) who conducted a long ethnographic study

and documented a deficit perspective towards Latino parents of lower socio-economic status. She argued that immigrant families brought a different set of goals, values and experiences that did not necessarily help them to understand what teachers expected from them and they actions may be interpreted as disinterest in their children's education.

Similarly, Ada and Zubizarreta (2001) conducted an ethnographic study and analyzed narratives from Latino parents. They found that many Latino parents "have not had the opportunity for much schooling and see themselves as having a limited contribution to their children's education" (p. 231). As a consequence, some parents believed that their role was "to lay the foundation at home, and trust[ed] that the school [would] take care of the rest" (p. 231).

In contrast, scholars have also documented programs and interventions that promoted bilingual literacy and parental involvement among Latino parents. Peercy, Martin-Beltrán and Daniel (2013) examined an after-school, bilingual family literacy program that brought together parents and teachers to support the literacy development of ELLs. Their findings showed that family literacy nights offered opportunities for collaboration between parents and teachers that did not exist during the regular school day. Similarly, Rivera and Lavan (2012) analyzed the impact of a family literacy program on promoting Latin American immigrant mothers' involvement in their children's education. The authors concluded that the program was effective in helping mothers to increase their involvement in their children's schools by supporting family literacy activities.

The Role of Teachers' Beliefs Towards Bilingual Learners

Researchers also investigated teachers' beliefs and attitude towards minority-language students. Through surveys and interviews with teachers in California public schools, Lee and Oxelson (2006) found that teachers who did not receive training as language educators expressed negative or indifferent attitudes toward heritage language maintenance and did not see a role for themselves and schools in heritage language maintenance efforts. Pettit (2011) conducted an extensive literature review on teachers' beliefs about ELLs in mainstream classrooms. Her findings are consistent with Lee and Oxelson (2006) and revealed that factors such as training in teaching ELLs, years of teaching experience, and exposure to language diversity are predictors of mainstream teachers' beliefs about language- minority learners. Regarding the use of codeswitching, Nava (2009) investigated the linguistic beliefs of more than 200 elementary teachers in South Texas using surveys and found that teachers had pervasive negative attitudes towards the students' use of codeswitching in school. In contrast, Palmer, Martínez, Mateus and Henderson (2014) documented the dynamic bilingual practices of two experienced bilingual teachers in a two-way dual language public school. Although the teachers worked in a school with a policy of strict language separation, the use of strategies such as codeswitching suggested powerful strategies to promote bilingual identities among language-minority students.

Overall, studies show that multilingual families of lower socio-economic status are at risk of deficit perspectives that circulate among educators and policymakers since they are constructed as lacking families in need of support (Baquedano-López et al., 2013). The pressures coming from some teachers' negative beliefs and attitude towards

multilingual may push bilingual families to discourage the use of the home language contributing to a rapid language shift towards English. However, studies like the one by Palmer and colleagues (2014) also reveal that engaged teachers can successfully promote dual language development. Studies like Peercy, et al. (2013), and Rivera and Lavan (2012) also show that engaged school community members can reach out language-minority parents to support them in their efforts to raise bilingual children.

Family Language Policy and the Development of Biliteracy

Bilingual parents may not only seek to promote bilingualism at home but may also encourage the development of biliteracy skills among their children. Biliteracy can be broadly defined as "any and all instances in which communication occurs in two (or more) languages in or around written material" (Hornberger, 1990, p. 213). Cases of relatively high levels of home language literacy have been studied. For instance, Tse (2001) interviewed ten U.S.-raised adults who managed to attain high levels of home language literacy in Spanish, Cantonese and Japanese. She found that having access to home language print in their home, having the assistance of more literate people, and often participating in religious worship or leisure literacy activities supported the participants' biliteracy development.

Bilingual parents may involve their children in a variety of reading events using the home language, such as reading together, reading aloud, helping with comprehension, and teaching the children reading strategies (Li, 2006). However, research has also shown that immigrant parents may find hard to dedicate family time to read in the home language. Li (2006), who surveyed 26 middle-class Chinese immigrant parents, found that about two thirds of the parents she interviewed read to their child in Chinese only

once or twice in a month. Other researchers have noticed a pattern of shift from the home language to English in literacy activities once children started school (Carreira & Kagan, 2011). Finally, using a home literacy survey, Zhang and Koda (2011) investigated a group of Chinese–English bilingual children learning to read in Chinese and found that the children's home language reading practice at home had a schoolwork orientation.

Recently, language-minority immigrant families have faced the challenge of actively constructing their lives and identities across borders because of deportation or reunification with family members. Gallo and Hornberger (2019) studied one such a case of a Latino child and her family. Facing the father's deportation to Mexico, this bilingual family struggled to make choices for their child's schooling in the context of monoglossic language ideologies in the US and then Mexican school system. After the father's departure, the mother and her two daughters decided to stay longer in the US to support the oldest daughter's incipient English literacy skills. In addition, given the family's imminent reunification in Mexico, it became evident that the oldest child also needed foundational Spanish literacy skills to survive a transition to schooling in Spanish. Although the focal child initially rejected the idea of leaving the US, she negotiated with her mother spaces for her biliteracy development at home. For example, she started asking her mother help with writing in Spanish to her deported father. On the level of educational policy, this study highlights the importance of additive bilingual schooling programs that prepare students with bilingual language and literacy resources that are reflective of their lives in the US or transnationally. In the next section, research on bilingual education in the US will be discussed.

Defining Family Language Practices in this Study

Following King's (2013) distinction of the study of language ideologies, language practices, and language management within the field of FLP, this study explicitly focuses on the *language practices* of immigrant families with young learners attending kindergarten to fifth grade. In this study, *language practices* are understood as what families in the study do with English and the home language (i.e., Spanish) as they carry out their daily lives in their households. In contrast to the many ethnographic studies revised in this section (e.g., Curdt-Christiansen, 2009; King, 2013; Pérez Báez, 2013), details about parents and children's beliefs, motivations, ideological orientations or goals regarding language use are not available due to the nature of the ECLS-K:2011 dataset. However, the data set contains valuable information about the weekly frequency in which a home language or English was used in the children's household during a period of five years (from kindergarten to fifth grade). ECLS-K:2011 researchers asked parents questions about how frequently both parents used the home language to speak with the child. They also asked parents how frequently the child used the home language to speak to the parents. The analyses conducted in research question 1 involving the parents' responses about their family language practices will inform our understanding of the patterns of language use among ECLS-K:2011 bilingual families.

Since FLP research indicates that children are important agents shaping the language interactions and parental decisions about language at home (Fogle & King, 2013), analyses for parents and children language practices were estimated separately. In addition, a set of covariates or background variables were included in the analyses based on the reviews of FLP research and studies in bilingualism in early childhood. For

instance, levels of parental education, parental self-reported English proficiency, and levels of income were included in all the analyses. In addition, the number of siblings that a child had was a background variable that was found relevant when investigating patterns of family language practices following the findings of Kibler, Palacios and Simpson Baird (2014) and Wong Fillmore (1991). Studies such as Schwartz and Moin (2012) and also Farrugio (2010), which will be discussed later, tied parents' beliefs about language with decisions about sending their children to specific language programs (i.e., bilingual education, English-only programs, etc.) For this reason, attending a bilingual program was also included as a background variable when investigating patterns of family language practices.

ECLS-K:2011 researchers also included questions for parents in the fall of kindergarten regarding parental involvement in school-type activities with children of pre-kindergarten age. The first parent interview in the fall of 2010 included nine items (which will be described in the next chapter) asking parents about their involvement in range of activities. For example, they were asked whether they tell stories, sing songs, do art and crafts, do chores, play games or do puzzles, talk about nature or do science projects, build things together or play with construction toys, play sports, and practice reading, writing or working with numbers with their children. As explained before, this set of questions was conceptualized as *parental academic support* because it includes a series of activities that resemble what children do and learn in a kindergarten program. Homework assistance was not part of the questions asked to parents because 4 and 5-year-old children attending kindergarten program do not usually have homework assignments like in later years of elementary school. In this sense, this study differs from

other FLP studies like Curd-Christiansen (2013) who investigated the use of the home language to support homework assistant in older students. The follow up question to this set of items asked parents about how frequently they used the home language to conduct these activities. Data to this response were conceptualized as *home language use for academic support* and is considered another aspect of the ECLS-K:2011 family language practices investigated with more depth in research question 3. As explained before, a limitation of this study is that parental academic support in connection to home language use is limited to data from the kindergarten year.

Research on Bilingual Education

As explained before, this study draws from research on the effectiveness of bilingual education to interpret the findings rather than evaluate the effectiveness of bilingual programs attended by the participants. This study also draws from research on bilingualism in early childhood to discuss the findings about the English language development of the DLLs in the ECLS-K:2011. In the next sections, a review of the research on bilingual education and bilingualism in early childhood will be presented.

Bilingual Education in the United States

In a review of bilingual education for young children, Bialystok (2018) writes that bilingual education has been a controversial topic since the beginning of the United States as a nation, and discussions about bilingual education have been imbued with political rhetoric in this country. The 1974 Supreme Court decision in *Lau v. Nichols* was a landmark in the development of instructional programs for bilingual learners. In the context of a court case brought on behalf of Chinese students against the San Francisco School District, the Supreme Court ruled that non-English speaking students had to be

provided with equal educational opportunities when instructed in a language they could not understand. Responding to *Lau* as well other important court decisions and legislation, school districts have since implemented a range of programs. Some programs offer intensive instruction in English and seek to maximize children's exposure to English, like in the case of structured English immersion (SEI). Other programs use children's home language or first language (L1) in different degrees as a support to help students keep up academically in school subjects while learning English, such as two way/dual language and bilingual education.

Thus, bilingual education can be defined as the use of two or more languages in classroom instruction and typically involves the L1 or home language of the students and the majority or dominant societal language (Wright & Baker, 2017). A distinction is usually made between L1 instruction and L1 support (Wright, 2013). When students receive bilingual education with L1 instruction, they receive some content-area instruction through the L1 or home language, while other content areas are taught through the majority societal language—i.e., English (García, 2009). In contrast, if students receive L1 support it means that students participate in regular mainstream or sheltered immersion classrooms where English is the medium of all content-area instruction, with occasional use of the L1 or home language to help students who lack proficiency in English (Wright, 2008).

Defining Bilingual Education in this Study

Bialystok (2018) draws our attention to an important distinction: bilingual education is different from the education of bilingual children. While researchers like Genesee (2004) defined bilingual education as "education that aims to promote bilingual

(or multilingual) competence by using both (or all) languages as media of instruction for significant portions of the academic curriculum" (p. 548), others have equated bilingual education with the education of bilingual students. For example, Rossell and Baker (1996) defined bilingual education as "teaching non-English-speaking students to read and write in their native tongue, teaching them content in their native tongue, and gradually transitioning them to English over a period of several years". This is a narrow definition of bilingual education that describes a different situation than the one defined by Genesee and carry distinct educational goals.

In this study, bilingual education is understood in the way Genesee (2004) defined, and the term refers to programs where students receive non-language instruction in English and in a language other than English. However, since the sample selected for this study only includes Hispanic students who speak mostly Spanish at home, bilingual education refers to programs where students receive content instruction in their home language or L1 in conjunction with English. In addition, Baker and Wright (2017) distinguish between weak forms and strong forms of bilingual education. In weak forms, L1 or home language content-area instruction is minimal and the goal is to move students as quickly as possible into mainstream classrooms. Weak programs as also known as subtractive, meaning they contribute to taking away students' home language and cultures (Wright, 2013). In contrast, strong forms of bilingual education are known as additive because their goal is to nurture students who are bilingual, biliterate, and bicultural. These bilingual programs help students develop and maintain high levels of proficiency and literacy in both their home language and English. Since the ECLS-K:2011 was not collected to specifically investigate issues of bilingual education, details

about the type of bilingual instruction the students received are lacking. For this reason, this study uses the term bilingual education to refer to any program that uses the student home language or L1 to deliver non-language instruction. Both types of weak and strong forms of bilingual education are included under the umbrella of bilingual education.

The next section is organized as follow. First, a history of bilingual education in the US will be presented. Then, research on the effectiveness of bilingual education is discussed. Finally, theories about the underlying causes of the positive effects associated with bilingual education will be reviewed.

History of Bilingual Education

The existence of bilingual education was documented in North America as early as the seventeenth century, according to Kloss' (1998) *The American Bilingual Tradition*. For instance, German-English bilingual education was offered in the seventeenth century throughout German communities in the country up to the time of the US participation in the First World War (Wiley, 1998). In addition, Spanish-English bilingual programs were available in the Southwest in the nineteenth century (Blanton, 2007; Wright, 2013).

As Wright and Baker (2017) Bialystok (2018) indicated, bilingual education is closely tied to political, economic, historical, and sociocultural factors. Although bilingual education has a long history, there have been periods in which bilingual education have been actively promoted, merely tolerated, or overtly restricted in the US (Wiley & Wright, 2004). For at least some groups, like the German immigrants, there was a general period of tolerance in the seventeenth and eighteenth centuries, followed by a period of restriction in the first half of the twentieth century during the First and Second World Wars (Wiley & Wright, 2004). A combination of nationalism and nativist

sentiment led to restrictions on bilingual programs for German and Japanese Americans and other minorities (Wiley, 2013). For instance, 35 states passed legislation mandating English as the language of instruction in schools in the 1920s (Leibowitz, 1971; Wiley, 2013).

In the context of the Civil Rights movement, possibilities for higher tolerance of minority languages increased. The National Education Association published a report in 1966 where the needs and high failure rates of Latino students were highlighted. It also emphasized the success of a few innovative bilingual education programs. Finally, the Bilingual Education Act (BEA) was passed in 1968, which provided official federal endorsement and support for bilingual programs. In addition, as discussed before, the Supreme Court made a decision in *Lau v. Nichols* that was a landmark in the development of instructional programs for bilingual learners in 1974.

Between 1974 and 1994, the BEA was re-authorized five times, reflecting "the social tensions and political debates surrounding bilingual education" (Wright, 2013, p. 601). This led to greater emphasis on transitional programs that had the goal of exiting students as quickly as possible to English-only classrooms. A higher percent of funds were also reserved for alternative instructional programs such as sheltered English immersion programs, which did not include instruction in the home language (Wright, 2013). In 1998, California voters passed Proposition 227, which resolved that all children in California public schools had to be taught in English. This meant that bilingual education was virtually eliminated from California and replaced by sheltered English-immersion programs (Crawford, 2004). A new wave of restrictions against bilingual education took also place in Arizona (2000) and Massachusetts (2002).

Finally, the BEA was eliminated with the passage of the federal No Child Left Behind (NCLB) Act of 2001. In 2015, the Every Student Succeeds Act (ESSA) was passed replacing NCLB. Although the ESSA strongly endorsed measures regarding bilingual learners, such as the requirement to establish statewide exit and entrance procedures for ELLs, the new federal law still focuses almost exclusively on English language development with no recognition of the value of bilingual education (ESSA, 2015).

Research on the Effectiveness of Bilingual Education

There has been considerable research on the effectiveness of bilingual education programs. Different systematic reviews found that the available evidence from research on bilingual education programs favored bilingual approaches (August & Hakuta, 1997; August & Shanahan, 2006; Genesee, et al., 2006; NASEM, 2017; among others). However, two reports co-authored by Keith Baker (Baker & de Kanter, 1981; Rossell & Baker, 1996) concluded that there was weak research evidence for bilingual education and have remained highly influential among advocates of English-intensive programs.

The report by Baker and de Kanter (1981) reviewed 28 studies on bilingual education and was released during a period of backlash against bilingual education (Wright, 2013). The authors examined the success of transitional bilingual education programs and concluded that there was not sufficient evidence for the effectiveness of transitional bilingual education to justify its promotion at the federal level. They also suggested that English-only immersion programs showed promising results and should be given more attention in program development. In addition, Rossell and Baker (1996) surveyed 72 transitional bilingual education program evaluations and found that

transitional bilingual programs were no better that English structured immersion programs. Both studies (Baker & de Kanter, 1981; Rossell & Baker, 1996) have been highly criticized for including studies that did not meet the authors' stated selection criteria, for assigning multiple "votes" to studies published in different forms, and for misclassifying program models (Greene, 1998; Krashen, 1996; McField & McField, 2014; Rolstad, Mahoney, & Glass, 2005).

In contrast, Slavin and Cheung (2005) reviewed 17 studies employing best-evidence synthesis, which uses a systematic literature search and quantification of outcomes as effect sizes. Slavin and Cheung compared academic outcomes between ELLs who were taught reading in bilingual classes with those who were taught using a structured English immersion approach, where reading instruction was in English only. The authors concluded that most methodologically rigorous studies favored bilingual approaches over English-only methods. Although a few studies reviewed by Slavin and Cheung did not find a statistical difference between the two types of programs, none favored English-only approaches over bilingual approaches.

The National Literacy Panel on Language-Minority Children and Youth created in 2002 by the U.S. Department of Education's Institute of Education Science (IES) undertook a rigorous review of the literature about bilingual programs. A major finding was that oral proficiency and literacy in the L1 can be used to facilitate literacy development in English (August & Shanahan, 2006). Another major review of the research on bilingual education was conducted by a team of researchers affiliated with the Center for Research on Education, Diversity, and Excellence (CREDE) at University of California Berkeley. This panel also arrived to similar conclusions and suggested that

bilingual students are more successful when they participate in programs that are specially designed to meet their linguistic needs than in mainstream English classrooms. In addition, bilingual students are also more successful when the program is consistent throughout the student education (Genesee, et al., 2006). Finally, the report by the consensus study report of the NASEM (2017) highlighted that all children have the capacity to become bilingual if they are given appropriate opportunities. The report also concluded that bilingual learners' strong acquisition of their L1 can serve as a foundation for learning English.

Since Baker and de Kanter's (1981) report, there have been five major syntheses documenting the effectiveness of bilingual education. Willig (1985) found advantages of bilingual education across content areas and languages using a meta-analysis and employing the same studies as Baker and de Kanter but with some modifications of the inclusion criteria. Greene (1997) conducted another meta-analysis revising the study by Rossell and Baker (1996). Similarly to Willig, Greene reduced the number of studies included using a stricter inclusion criteria and corrected for other methodological issues. The author concluded that the use of at least some L1 in the instruction of bilingual children had moderate beneficial effects relative to English-only instruction.

Rolstad et al. (2005) conducted a new meta-analysis using 17 studies on bilingual education published after Willig's (1985) analysis. The authors found that bilingual education was superior to English-only approaches, and they additionally discovered that developmental bilingual education programs, which continue to support children's L1 long after they develop proficiency in English, were even more effective at promoting

children's academic achievement than transitional, early-exit bilingual education programs, which emphasized transitioning to all-English instruction as soon as possible.

Finally, McField and McField (2014) conducted a meta-analysis of all previous meta-analyses of bilingual education in the US, drawing similar conclusions regarding the effectiveness of bilingual approaches. Reljic, Ferring and Martin (2015) conducted a meta-analysis in the European context and drew similar conclusions regarding the effectiveness of bilingual approaches. Overall, this extensive body of research has consistently found that home language support at school is a more effective strategy than the use of English alone at promoting bilingual learners' academic achievement.

Theories of Bilingual Education

Although considerable research has been done on the effectiveness of bilingual education programs, there is little empirical research that evaluates specific theories about the underlying causes of the positive effects associated with the use of L1 or home language support in instructional settings. MacSwan, et al. (2017) empirically evaluated three theoretical models for educating bilingual learners with a focus on the role of language factors in explaining different academic attainment among bilingual learners.

MacSwan and colleagues (2017) evaluated the time-on-task theory, which posits that spending time in English, the L2, will result in higher achievement among ELLs, according to Rossell and Baker (1996). They also evaluated two theories that support bilingual education as the most suitable program to support higher academic achievement among bilingual learners. One is the threshold hypothesis (Cummins, 1976; 1979; 2000), a leading theory of academic achievement differences among bilingual students. Another is the "transfer hypothesis" (MacSwan et al., 2017, p. 223), developed by MacSwan and

Rolstad (2005), which specifically differentiates between language and conceptual understanding of school subject. In the next section, each theory will be discussed.

Time-on-Task Theory

Rossell and Baker (1996) proposed a "time-on-task principle" (p. 22), which argues that "the best way to learn English and subject matter in English is to maximize the time spent in English" (p. 26). According to the authors, the amount of time students spend learning a subject is the greatest predictor of achievement in that subject. Their conclusion is that the more time children spend hearing, speaking, or studying English, the higher their level of L2 proficiency will be, which in turn will translate into higher scores on academic achievement measures. Other advocates of English-only instruction, like Porter (1990), concluded similarly that "the more time spent learning a language, the better you do in it, all other factors being equal" (p. 119). Besides the fact that there is extensive research supporting the effectiveness of bilingual programs over English-only instruction, this theory has the shortcoming that it does not distinguish between learning a language and learning school content in a language. In contrast with the next two theories that are reviewed, the time-on-task hypothesis does not contemplate the possibility of any transfer between the L1 and L2.

Threshold Hypothesis

This hypothesis was originally introduced by Cummins (1976) and Toukomaa and Skutnabb-Kangas (1977) as a theoretical model for explaining the effects of bilingualism on academic success in children. The threshold hypothesis suggests that the effects of bilingualism are actually mediated by the degree of competence in each language, rather than the state of being bilingual. This means that children who are balanced bilinguals, or

competent in both languages, would experience positive cognitive advantages, whereas children who are developmentally competent in only one of their two languages, that is they are dominant bilinguals, would not experience either positive or negative effects. Finally, children whose competence in both languages is low or limited would experience low academic achievement and negative cognitive effects.

The stage of low ability in both languages included literacy and language and was initially called "semilingualism" (Cummins, 1976; Toukomaa & Skutnabb- Kangas, 1977). MacSwan (2000) noted that there is no empirical evidence to believe that a semilingual state exists for normally developing bilingual children (e.g., Edelsky, Hudelson, Flores, Barkin, Altweger & Jilbert, 1983). In addition, the notion of semilingualism closely resembles a prescriptivist perspective, which is the view that one variety of language has an inherently higher value than others and has long been recognized as a deficit view of the language of marginalized groups (MacSwan, 2000).

In contrast to the time-on-task theory, Cummins (1981) expanded his theory to include a common underlying proficiency model which draws from the knowledge of one language to help learn a second or additional language. In words of Cummins,

> What this hypothesis implies is that in, for example, a dual language Spanish-English bilingual program in the United States, Spanish instruction that develops Spanish reading and writing skills is not just developing Spanish skills, it is also developing a deeper conceptual and linguistic proficiency that is strongly related to the development of literacy in the majority language (English). In other words, although the surface aspects (e.g., pronunciation, fluency, etc.) of different languages can be distinguished, there is an underlying cognitive/academic

> proficiency that is common across languages. This common underlying proficiency makes possible the transfer of cognitive/academic or literacy-related proficiency from one language to another. (Cummins, 2017, p. 106)

However, one of the shortcomings of Cummins' conceptualization of bilingualism is that different aspects of language proficiency are confounded in the threshold hypothesis and the later linguistic interdependence hypothesis, which posits the ability to transfer L1 and L1 literacy skills to the L2.

Cummins (1979) further elaborated the threshold hypothesis with the introduction of the developmental interdependence hypothesis. To explain the greater academic success of bilingual students in bilingual programs, Cummins proposed that a higher degree of L1 attainment prepared the students for academic learning in their L2. Like in the case of the threshold hypothesis, L1 attainment was understood in terms of literacy readiness skills, which are defined as vocabulary concept knowledge, metalinguistic insights, and decontextualized language. Thus, Cummins holds that students who are more prepared to read in their L1 will be more ready to start reading in their second (or subsequent) language, once they are exposure to that language, like in the case of participating in an bilingual immersion program.

MacSwan and Rolstad (2005) noted that a major shortcoming of Cummins' theory is that it does not distinguish between language use and language-related academic content knowledge. Thus, this theory would predict growth in academic subjects as a result of receiving instruction in the L1 since language proficiency is understood to include aspects of school knowledge, according to Cummins. However, this theory also implies that language developed around nonschool contexts is less developed than the

language variety used at school. This criticism can be extended to both the threshold hypothesis and the linguistic interdependence hypothesis (MacSwan, 2017). The next theory that will be reviewed was elaborated by MacSwan and Rolstad (2005) and includes an approach to transfer theory but differentiates between language and conceptual understanding of school subject matter.

Transfer Theory

Drawing from neurocognitive research and psychological modularity, MacSwan and Rolstad (2005) argued that transfer of academic subject knowledge occurs in bilingual settings because knowledge is accessible to any language or languages a child happens to know. In contrast to Cummins, content knowledge is independent of linguistic knowledge since the mind is viewed as consisting of discrete mental modules and transfer is understood as a metaphor for a process. In this sense, transfer means simply that "what one learns in one language is available in a second" (MacSwan & Rolstad, 2005, p. 228).

Evidence from neurocognitive research showed that language is conceptualized as cognitively special and discrete, different from literacy skills. For instance, MacSwan and Rolstad (2005) summarized a series of cases were dissociation between language and other cognitive abilities in development were present. One of these cases was Genie, a girl who was tragically isolated from birth to past age 13 and received no linguistic input during these years (Curtiss, 1977). Studies of Genie's speech following her isolation revealed that she never passed beyond very basic syntactic and morphological ability (Curtiss, 1977). In addition, literacy, which refers to reading and writing, is a relatively recent invention and does not exist in all human cultures although it relies upon a wide

variety of cognitive faculties including language and systems of reasoning (MacSwan & Rolstad, 2003).

Krashen's Theory of Transfer. Similarly to Cummins and MacSwan and Rolstad (2005), Krashen (1996) emphasized the role of transfer across languages but without specifically drawing upon Cummins' linguistic interdependency hypothesis. Krashen (1999) argued that subject matter knowledge gained in the L1 makes English input more comprehensible, and "literacy development in the first language facilitates literacy development in English" (Krashen, 1999, p. 11). Bilingual instruction is effective because it allows bilingual learners to keep up academically with their English-speaking peers since they have access to content knowledge in their home language or L1 while they learn English.

Krashen also theorized that bilingual students in all-English instruction who achieved well were able to do so because they likely had educational resources at home that provided a "de facto bilingual education" (Krashen, 1999, p. ix). A *de facto* bilingual education implies that exposure to academic content in L1 will allows children to achieve higher levels of proficiency in L2 because it provides a network of contextual clues for children to make inferences regarding the meaning of new words and linguistic structures presented in English (MacSwan et al., 2017). There is robust empirical evidence that knowledge of school subjects, and literacy in particular, transfers across children's two languages (e.g., August & Shanahan, 2006). However, little is known about the anomalous cases in which bilingual students with low levels of English skills experience academic success in English-only classrooms in the apparent absence of home language

support. This study was designed to address this gap in the research of bilingual education.

To conclude, using both FLP and theories of bilingual education as conceptual frameworks, the present study seeks to address a gap in the field of bilingual education and early childhood bilingualism by investigating how parents using the home language can academically support language-minority students using the home language while students attend a variety of school language programs ranging from bilingual education to English-only instruction. In addition, this study draws from MacSwan and Rolstad (2005) and MacSwan et al. (2017) to interpret and understand the findings of this study regarding cases of *de facto* bilingual education as situations of transfer of academic subject knowledge. In the next section, research on bilingualism in early childhood will be discussed.

Bilingualism in Early Childhood

Bilingual and multilingual are widely used terms to denote individuals who have obtained the ability to use more than one language (Butler, 2013). There are several ways to classify bilinguals, which is a reflection of the highly complex social, psychological, and linguistic phenomena that bilingualism encompasses. Although in recent years researchers have argued for the importance of distinguishing between bilinguals and multilinguals (e.g., De Angelis, 2007), it is important to keep in mind that the boundary between bilinguals and multilinguals is not always clear (Butler, 2013). For example, the difference between language versus dialects or language varieties may be debatable in certain cases, which complicates the counting of languages that a bilingual or multilingual knows (Kemp, 2009). More importantly, there is substantial variability in

language use and acquisition among multilinguals (Kemp, 2009). For these reason, this study will refer to bilingual and multilingual learners as bilinguals or dual language learners. This section summarizes and discusses the following topics: (a) the complexity of classifying bilinguals; (b) research on child second language acquisition (SLA); (c) bilingualism and deficit perspectives in school; and (d) current development of research in early SLA.

The Complexity of Classifying Bilinguals

There are different ways of classifying bilinguals, echoing the multidimensionality of the phenomenon. For example, some classifications focus on the relationship between language proficiencies in two languages, like in the case of *balanced* and *dominant* bilinguals proposed by Peal and Lambert (1962) and adopted by Cummins in the threshold hypothesis and interdependence hypothesis. Bilinguals who achieve equal level of proficiency in L2 with L1 are called *balanced*, while bilinguals varying degrees of L2 proficiency but not the same as L1 are known as *dominant*.

Other classifications focus on the age of acquisition, which distinguishes between *simultaneous*, *sequential*, and *late bilinguals*. Genesee, Hamers, Lambert, Mononen, Seitz, and Starck (1978) proposed this classification in a study that investigated three subgroups of French-English adult bilinguals that became bilinguals at infancy, around age 5, and at secondary school age. Using neurolinguistic techniques, the authors noted differentiated brain activity across the three groups. Adults who were exposed to two languages from birth were identified as *simultaneous* bilinguals. Participants who were exposed to the L2 after development of the L1 were called *sequential* bilinguals, and those who became bilinguals during adulthood were identified as *late* bilinguals.

Finally, some classifications are centered on the effect of L2 learning environment on the retention of the L1, such as in the case of *additive* and *subtractive* bilingualism (Lambert, 1974). *Additive* bilingualism is understood as learning the L2 as enrichment without the loss of the L1 while *subtractive* bilingualism implies that the L1 is replaced by the L2. According to Lambert (1974), social values associated to the L1 influence the retention and development of the L1. School programs that support literacy development in L1 and L2 have a greater impact in promoting additive bilingualism as it was discussed previously. In the next section, research on child second language acquisition will be revised.

Child Second Language Acquisition

Traditionally the study of Second Language Acquisition (SLA) has focused on adults learning an L2 with few studies investigating child SLA, although adults and children have distinct characteristics and learning processes (Oliver & Azkarai, 2017). There has been a renewed interest in studying child SLA in recent years in part because clinical and special education researchers are seeking to distinguish between language difference and language disorder in multilingual populations (Paradis, 2009). Although the term "child bilingual" is often used as synonym of "child L2 learner," the variety and complexity of learning contexts that may impact child language acquisition denote that these are two different populations (Paradis, 2009). Simultaneous bilingual children learn both their languages in the preschool years (De Houwer, 2009; Genesee & Nicoladis, 2009), while L2 children have established one language before they begin learning the second one, and typically speak the L1 at home and the L2 in school (Paradis, 2009).

Considering the particular learning context in which child language acquisition takes place, De Houwer (2009) distinguishes between *Monolingual First Language Acquisition*, in which children hear one language (L1) from birth, and *Early Second Language Acquisition* (ESLA), where monolingual children's language environment changes in a way that they begin to be exposed to a second language with some regularity over and above their L1. The term *Bilingual First Language Acquisition* (BFLA) is reserved for the "development of language in young children who hear two languages spoken to them from birth" (De Houwer, 2009, p. 2). In addition, Nicoladis (2018) also uses the term *simultaneous bilingual children* to refer to children who are exposed to two languages from early development, including toddlerhood. As Genesee and Nicoladis (2009) indicate, different criteria have been proposed to distinguish between BFLA and ESLA and the debate still continues among researchers. De Houwer (1995) proposed the stringent cut-off of exposure to two languages within one month of birth while Genesee and Nicoladis (2009) consider that BFLA is possible from birth to about 4 years of age. They also noted that there is considerable heterogeneity among BFLA learners.

Similarly, Paradis (2009) and Butler (2013) noted that there are striking individual differences in rates of child SLA, even in cases when children have similar amounts of classroom exposure to the L2 and participate in similar instructional programs. Research investigating the sources of individual differences in L2 acquisition has considered various factors, including motivation, aptitude, age of acquisition, and socio economic status, among others. Age of acquisition is a factor that has played a significant role in child SLA research (Oliver & Azkarai, 2017) because of the debate around the notion of a critical period for language acquisition (Butler, 2013). Popularized by Lenneberg

(1967), the critical period is understood as being a limited developmental window during which native-like language attainment is possible. There is still little consensus as to when the onset and the offset of the critical period takes place. Some researchers have suggested an offset time of 5 or 6 years old (Pinker, 1994). Others have suggested a closure time of 12 years old or puberty (Lenneberg, 1967), while others have proposed multiple critical periods in different linguistic domains (Seliger, 1978).

More recently, MacSwan, Guzman, McAlisted and Marcus (2020) evaluated the role of home language policies pertaining to codeswitching on successful multilingual acquisition in 80 sixth grade students with Spanish-speaking backgrounds by testing students and interviewing parents. Their findings showed that there were no language-related differences between children raised in codeswitching homes and those raised in non-codeswitching homes in terms of language acquisition of both majority and minority languages, and academic achievement in terms of the Stanford Achievement Test, 9th edition (SAT-9) scores in reading and math. More importantly for this study, there a large body of research that indicates that L2-speaking children develop academic verbal skills comparable to their monolingual English-speaking peers after five to seven years in an English school (Hakuta, Butler, & Witt, 2000). Hakuta, Butler and Witt (2000) analyzed standardized measures of English oral proficiency for more than 1,800 first language-minority children in San Francisco. Their conclusion was that these children needed five years of schooling in English to perform like their English monolingual students. MacSwan and Pray (2005) found that L2-speaking children achieved parity with monolingual English speakers in a range of 1 to 6.5 years on measures of English language. They also found that children in bilingual education programs learned English

as fast as or faster than children in all-English programs, and that older school-age children learned English faster than younger children.

Bilingualism and Deficit Perspectives in School and Larger Society

MacSwan and Rolstad (2010) argued that a stigmatizing view of language variation in minority children in school stems from "a traditional prescriptivist perspective on language [which is] inconsistent with linguistic research" (p. 173). As Steffensen (1978) indicated, in the 1960s' there were a number of studies documenting the supposedly language deficit of language-minority children in the mist of language remediation programs and concerns about the inadequate school performance of children in the inner city. The ideology that attributed linguistic deficit to minority children could be traced back to the work of Bereiter and collaborators in 1960s' (Bereiter & Engelmann, 1966; Bereiter, Engelmann, Osborn & Reidford, 1966).

In "Teaching Disadvantaged Children in the Preschool," Bereiter and Engelmann (1966) proposed a construct they called giant-word syndrome to argue that culturally-deprived children do not segment the stream of speech into word-size units but rather process it as a chunk of information. In another study directed by Bereiter and his colleagues, they investigated a group of four-year-old African-Americans and found that they communicated by rudimentary gestures, "single words," and "a series of badly connected words or phrases" (Bereiter, Engelmann, Osborn & Reidford, 1966, p. 114). According to Bereiter and colleagues, these children could "without exaggeration … make no statements of any kind," and could not ask questions (Bereiter, et al., 1966, p. 114).

Regarding deficit perspectives associated to bilingual children, Portes and Hao (2002) noted that until 1960s there was "a powerful intellectual current" that viewed bilingualism and cognitive development as negatively related (p. 891). Hakuta (1986) discussed how social scientists reflected on social concerns around recent immigrants who were not adapting well to the American society and whose children were failing at school. By the 1920s a group of psychologists known as "hereditarian" considered retention of foreign languages as an additional sign of the basic intellectual inferiority of immigrants. Another group known as "environmentalists" viewed bilingualism itself as the cause of immigrant children's delayed mental development (Hakuta, 1986, p. 3). As Portes and Hao highlighted, the turning point in research in bilingualism came with Peal and Lambert (1962), a landmark study conducted among bilingual French-Canadian children. The authors found that bilinguals performed significantly better than monolinguals on both verbal and nonverbal tests. Currently, more recent studies have found more balanced results, identifying areas in which bilingual children excel and others in which bilingualism has no effect on their development (Bialystok, 2017).

As it was discussed before, Baquedano-López et al. (2013) and Pettit (2011) documented deficit perspectives on bilingualism and minority language use among teachers and policymakers. For example, mainstream teacher have expressed beliefs that the use of an L1 at home interferes with learning a second language or English (Clair, 1995; Karabenick & Noda, 2004; Reeves, 2004). Reeves (2004) also found that certain teachers think that the use of a native language or a home language in the classroom interferes with the acquisition of English.

Multilingual parents of all backgrounds are not immune to deficit perspectives on bilingualism. Piller and Gerber (2018), in a study previously discussed, showed how bilingual middle class parents in an online Australian forum favored individual bilingualism in the abstract but simultaneously feared that bilingual parenting would jeopardize their child's English skills and would lead to failure in school or social isolation. Farrugio (2010) documented the perspectives of Latino parents who refused bilingual education and opted for English-only instruction for their children because of beliefs that "bilingual classes taught no English, or not enough English, and inferior Spanish" (p. 17).

In the broader social context of the United States, Lewis and Davies (2018) show that although media opinion disseminated in six major US news outlets (i.e., New York Times, Washington Post, LA Times, Time, U.S. News, and Dallas News) were mostly in favor of bilingual education, 39 percent of the Editorials and Letters-to-the-Editor analyzed opposed bilingual education between 2006 and 2016. The arguments against bilingual education were made in terms of lack of effectiveness of bilingual education, or bilingual programs leading to minority segregation, or bilingualism as un-American characteristic. In the words of Lewis and Davies (2018) "Many of the voices in opposition to bilingual education exhibited a fear that non-native English speaking students would not become proficient in English if they received bilingual instruction" (p. 50). Underlying the argument of those who oppose bilingual education was a belief that language proficiency in a language other than English would lead to cultural fragmentation and resistance to "American culture" (p. 51).

In cases when bilingual children engage in codeswitching, these negative perspectives can be stronger like in the case studied by Nava (2009) discussed previously. A reason for this stigma is a persistent conventional view on educational and economic disparities that associates minority groups with lower performance in school due to limited or impoverish language skills (Dudley-Marling & Lucas, 2009; Gee, 2014). The next section will focus on the current development of research in early second language acquisition.

Current Development of Research in Early SLA

Bialystok (2017) summarized research findings in bilingualism and early SLA and the impact on early cognitive development. According to Bialystok, there are three main outcomes from research in psychology and linguistics. First, it was found that bilingual children tend to have a smaller vocabulary in each language than monolingual children in their language (Bialystok, Luk, Peets, & Yang, 2010). In a study measuring receptive vocabulary in over 1,700 children between the ages of three and ten years old, Bialystok and her colleagues found that bilingual children obtained lower scores in each language that do monolingual children of that language. The difference in scores did not change with different language pairs and was largely confined to words relevant to a home context rather than a school context. The authors also indicated that the bilingual children's understanding of linguistic structure, called metalinguistic awareness, was at least as good as and often better than that of comparable monolinguals (Bialystok, Majumder, & Martin, 2003).

A second finding in bilingualism and early SLA was that the acquisition of literacy skills in bilingual children depends on the relationship between the two

languages—e.g., whether the languages share the same orthographic system (like English and Spanish) or not (like English and Mandarin). The level of proficiency in the second language was another factor that influenced the development of literacy skills in bilingual learners. According to Bialystok, children learning to read in two languages that share a writing system (e.g., English and Spanish) will show accelerated progress in learning to read; children whose two languages are written in different systems (e.g., English and Mandarin) will not show any special advantage, but neither do they demonstrate any deficit relative to monolinguals. The benefit of learning to read in two languages, however, requires that children be bilingual and not second-language learners whose competence in one of the languages is still developing (Bialystok, McBride-Chang, & Luk, 2005).

Finally, Bialystok and her colleagues found that bilingual children between four- and eight-years old had a superior ability to ignore misleading information and attend to relevant cues and structures. This advantage was not confined to language processing, but included a variety of non-verbal tasks that require controlled attention and selectivity in such problems as forming conceptual categories (Bialystok & Martin, 2004). These differences persisted across the lifespan conferring cognitive benefits to bilinguals at all ages. In conclusion, research has shown that bilingualism has no effect on the cognitive development of young children as it was feared in the past. Additionally, research has shown that bilingualism may confer small cognitive advantages in specific areas throughout lifespan. The next section will present a literature review of studies investigating bilingualism, home language use, and academic achievement in young learners using large data sets.

Defining Bilingual Learners and English Language Proficiency in this Study

Children participating in this study have range of linguistic experiences and variety of language proficiency in both English and Spanish, identified here as the home language. One of the limitations of the ECLS-K:2011 is that there is limited information about the linguistic history of the participants (parents and children). In this dataset, parents and teachers identified the children as speakers of a language other than English at home (i.e., the children's household) with no other information about the children's language skills in the home language, other contexts in which these children use the home language or the age when they were first exposed to the home language. However, other important information available in the dataset allows us to infer that the selected students in the ECLS-K:2011 have a range of bilingual experiences representative of the situation of young minority bilingual learners in the United States.

Information about the parents' background such as whether the parents were immigrants, parental levels of education and income, and a parental self-assessment of their level of English will be used as controls in the analyses of this study because research in FLP (e.g., King & Lanza, 2019) and child second language acquisition have shown that these factors impact the language development of young bilingual learners. For example, parents who are immigrants and report having low levels of English may indicate a household were most of the activities are conducted in the home language, which in turn may affect the quality and quantity of input and interactions in the majority and home languages (Paradis, 2018; Oliver & Azkarai, 2017). As it was discussed when reviewing FLP studies, parental levels of education and income may impact parental expectations and actions regarding the amount and types of language input parents want

to offer to the children in a bilingual household (e.g., Curdt-Christiansen, 2009, 2013; King, 2013; Schecter & Bayley, 1997).

In addition, the ECLS-K:2011 includes English proficiency scores from a language screener based on the *preLAS 2000* (Duncan & De Avila, 2000). These scores will be used to classify the students in levels of language proficiency following the directions of the publisher and the prior decisions of the ECLS-K:2011 researchers. Research question 2 investigates the possible role of using a home language in the development of English, adding to the evidence that growing in a bilingual environment does not jeopardize language acquisition of the majority language (Bialystok, 2018).

More importantly, parents reported the frequency parents and children used the home language to communicate at home during a period of five years, offering a unique opportunity to learn about the language patterns of these families. Although previous research with large nationally representative datasets have classified children in groups according to degrees of bilingualism using parent reports on the use of the home language (e.g., Han, 2012), no attempt will be made in this study to classify bilingual students given the complexity of child language acquisition in the context of immigration in the United States.

Defining Home Language in this Study

As it was explained before, *home language* refers to the language or languages spoken at the children's home, which in this study is Spanish. This term overlaps with the concept of *heritage language* (Kupish & Rothman, 2018; Rothman, 2009), which refers to a "language spoken at home or otherwise readily available to young children, and crucially this language is not a dominant language of the larger (national) society"

(Rothman, 2009, p. 156). However, *home language* as it is defined in this study differs from heritage language in that "the *heritage language* is acquired on the basis of an interaction with naturalistic input and whatever in-born linguistic mechanisms are at play in any instance of child language acquisition" (Rothman, 2009, p. 156). As it was previously discussed, the ECLS-K:2011 does not include enough information about the conditions in which the participants acquired the language, although it is possible to conjecture that children learned Spanish through interaction with naturalistic input in their household. For this reason, the term *home language* is preferred over more specific terms such as *heritage language* to accommodate for the multiple linguistic experiences that the participants in the sample have in this study.

In addition, the term *home language* makes reference to the question that the ECLS-K:2011 researchers asked parents when they collected data about the non-English language. The question for the parents was whether there any language other than English was regularly spoken in their home (Tourangeau, et al., 2015). As the instruction for the interviewer expressed, home was interpreted in the narrow sense of the child's household. In this sense, in this study *home language use* (or the alternative *use of the home language*) is terms that refer to the use of Spanish, the non-English language, within the child's household.

Following Zarate and Pineda (2014), this study acknowledges that the term *home language use* involves a "package of variables" (p. 2), which potentially reflects multiple factors, such as acculturation, biculturalism, and language proficiency. Research in FLP also shows that the use of the *home language* extends beyond the participants' household such as neighborhoods, churches, heritage language schools or extended family members

(Spolky, 2012). To address some of these limitations, this study will use all the available data in the ECLS-K:2011 regarding home language use to investigate patterns of language use over a period of five years.

Part 2: Empirical Literature

Scope and Delimitations

One of the goals of this literature review is to understand the potentials and limitations of working with secondary data—i.e., data collected by somebody else than the user. For this reason, all the studies reviewed, except one (Portes & Hao, 2002), employ secondary data collected by the U.S. Department of Education or school districts. These data sets tend to be large (between 14,000 and 26,000 participants), have several waves of data collection, and use complex survey methods to select and collect data from participants in most cases. An exception is Portes and Hao (2002), which is based on data from the Children of Immigrants Longitudinal Study [CILS] (Portes & Rumbaut, 2006). Although the CILS was partially designed to respond some of the questions that Portes and Hao (2002) investigated, the scale of the project (more than 5,000 participants across three waves of data collection) and the limitations of the data set makes this study comparable to those using secondary data.

Another selection criterion was a preference for studies employing the Early Childhood Longitudinal Study (ECLS) datasets, either the Birth Cohort (ECLS-B) study (NCES, 2009) or the Kindergarten Class of 1998-99 (ECLS-K) study (NCES, 2006), although relevant studies using other data sets were also included. Since the present study will use the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011; NCES, 2018), preference was given to studies using cohorts of the ECLS. The

goal of this review is to learn about different ways researchers have operationalized concepts such as *bilingualism* or *home language* employing data sources that are very similar to those this study will use. However, studies using other longitudinal data sets, such as the National Educational Longitudinal [NELS:88] (NCES, 1996) or school district data, were also included when research questions or findings were relevant to this study.

Finally, studies in this literature review are limited to the U.S. context given that ECLS is a project conducted by the U.S. Department of Education. In addition, as it was discussed before when reviewing research on child SLA and FLP, the development of bilingualism in early childhood and its connections to academic trajectories is intertwined with the social-economic conditions of immigrant and language-minority families. Some of these conditions are unique to the U.S. context, such as being classified as an ELL or attending public schools with English as a second language (ESL) services. This literature review seeks to illuminate the social-economic factors unique to the U.S. context that need to be included in the analysis to explore the connections between language practices at home and academic trajectories with a nationally representative data set.

The studies included in this section are organized chronologically and were divided in two parts. The first section is dedicated to review studies that focus on bilingualism and academic achievement although they also discuss the contributions of family language use to academic trajectories and language development. The second section focused on studies discussing parental involvement, home language use, and academic achievement. None of the studies use the term FLP; however, they investigate

constructs that overlaps with the conceptualization of FLP discussed before. Table 2.1 at the end of the chapter summarizes the datasets, participants and methods used in the studies in this empirical literature review. Finally, a summary and conclusion revising the gaps of the research closes this section.

A Note About the ECLS Program

The ECLS study comprises three nationally representative longitudinal studies that examine child development, school readiness, and early school experiences. This program drew together information from multiple sources, including school administrators, parents, teachers, early care and education providers, and children, providing data that enable researchers to analyze how a wide range of child, family, school, classroom, nonparental care and education provider, and community characteristics relate to children's development and to their experiences and success in school. Data collection involved a multi-stage sampling design that included sampling primary sampling units (PSUs) and schools with probabilities proportional to the number of children and selecting a fixed number of children per school. A clustered design was used to minimize data collection costs, which means that data collection was restricted to a limited number of geographic areas and to as few schools as possible helps to minimize costs while still achieving an acceptable level of precision in the estimates produced with the data (Tourangeau et al., 2015).

The birth cohort of the ECLS-B is a sample of 14,000 children born in the U.S. in 2001 and followed from birth through kindergarten entry (Najarian, Snow, Lennon, & Kinsey, 2010). The kindergarten class of 1998-99 cohort (ECLS-K) is a sample of about 21,000 children assessed in the fall of 1998 and followed from kindergarten through the

eighth grade (Tourangeau, Nord, Lê, Sorongon, & Najarian, 2009). The kindergarten class of 2010-11 cohort (ECLS-K:2011) is a sample of about 18,000 children who were followed from kindergarten (the 2010–11 school year) through the 2015–16 school year (fifth grade) (Tourangeau et al., 2019). This will be the main data source for this study.

Bilingualism and Academic Achievement

This set of studies was selected because they discuss the contributions of family language use to academic achievement although the main focus is on the children's bilingualism rather than how parents engage linguistically with children at home. Since these studies exemplify how scholars have conceptualized bilingualism and its connections to language development and academic achievement, these studies are relevant to the present study. Half of them employ samples from the ECLS data sets (Han, 2012; Winsler, Burchinal, Tien, Peisner-Feinberg, Espinosa, Castro, LaForett, Kim, & De Feyter, 2014). The other half employs different datasets (Mouw & Xie, 1999; Portes & Hao, 2002). All of them examine the connections between being bilingual at a young age and the language development and academic trajectories of the participants.

Mouw and Xie (1999)

This study tested whether bilingualism had a positive effect on the academic achievement of immigrant children. Using data from the 1988 National Educational Longitudinal Study (NELS:88), the authors argued that the benefits of bilingualism are a result of "the functional ability of children to communicate with their parents" and proposed that "bilingualism is important for immigrant children's academic achievement only because it prevents a language gap from emerging between them and their parents" (p. 238). They based this hypothesis on the observation that "school-age immigrant

children typically learn English much more quickly than do their parents" (p. 238). Thus, they posited that "the importance of bilingualism and native-language use for academic achievement is 'transitional' because it disappears as soon as parent-child communication can proceed efficiently in English" (p. 238, emphasis in the original). They summarized their position saying that the beneficial effects of bilingualism were temporary and conditional on parents' language skills in their sample.

They selected a sample of 892 first- and second-generation Asian American students with Asian parents. Students were in 8th grade when the panel study started in 1988. The NELS:88, like in the case of the ECLS, is a large, nationally representative data set that was also collected by the U.S. Department of Education and NCES. They used the NELS student self-reported measures of English and non-English language ability to classify the learners as English dominant (fluent in English), fluent bilingual (fluent in both English and home language), native-language dominant (fluent in home language), and subtractive bilingual (not fluent in either English or home language).

The NELS:88 data also included several variables measuring home language use between students and their parents and parents' self reports on their level of English proficiency. These measures are very similar to those used in ECLS. Using multivariate regression analyses, the authors found that there was no positive effect of bilingualism on math scores for Asian Americans. They also found that home language use resulted in significant positive effects on math scores when parents were not proficient in English, but no effect if parents were proficient in English. The conclusion was that bilingualism had a positive effect when parents did not learn English as fast as their children but once

parents and children could communicate in English at home, the effect would disappeared.

Mouw and Xie (1999) have two important limitations. One is an oversimplified conceptualization of parent-child interactions particularly regarding language use, which is followed by a suggestion that immigrant families should concentrate on learning English and shift away from the home language. Although researchers have found that bilingual students reported higher levels of solidarity in family relations and experienced fewer conflict with their parents than immigrant children who reported preference for English (Portes & Hao, 2002), it was also documented that communication with parents goes beyond the ability to speak one language at home. Portes and Hao (2002) viewed the home language as a "key social resource at a critical juncture" in the lives of young students because the home language helped to "anchor youthful identities by facilitating knowledge and understanding of parental cultures" (p. 907).

In addition, research on FLP has documented the complexities of the negotiations between parents and children around language use at home (e.g., Schecter & Bayley, 1997; King, 2013; Gallo & Hornberger, 2019). Using ethnographic methods, King (2013) and also Gallo and Hornberger (2019) have documented how family language practices change overtime and how children engage with, resist, and refashion family language and literacy policies alongside their parents as a response to pressures to quickly adopt a new language and culture. Schecter and Bayley (1997), who also conducted an ethnographic study, documented four immigrant families with different degrees of adaptation to the local culture who negotiated language practices at home to preserve the home language but also to promote learning of English, the language of schooling.

Another limitation in Mouw and Xie is the authors' classification of bilinguals, in particular the creation of the category of subtractive bilinguals. This group, according to the authors, were neither fluent in English or the home language. As it was discussed before when reviewing the threshold hypothesis and the work of Cummins (1976), there is no empirical evidence to believe that such a state exists for normally developing bilingual children (MacSwan, 2000). Research in linguistics posits that language acquisition may be directed by an internal "bioprogram" (Bickerton, 1981). This bioprogram is comparable to a set of innate principles that guide acquisition through a narrowly delineated hypothesis space for the language learner who would use linguistic input from the community to acquire a language (Pinker, 1994; Berwick, Pietroski, Yankama, & Chomsky (2011). See MacSwan & Rolstad (2010) for a discussion of language as a theoretical construct in the school setting). Conceptualizations of bilingualism such as semilingualism, limited bilingualism, or subtractive bilingualism to denote low level in both L2 and home language had been much criticized. For instance, Martin-Jones and Romaine (1986) referred to semilingualism as "a half-baked theory of communicative competence" in the title of a highly critical article.

Portes and Hao (2002)

The authors conducted an influential study using data from the Children of Immigrants Longitudinal Study [CILS] (Portes & Rumbaut, 2006), a panel data set of immigrant students from the metropolitan areas of Miami/Ft. Lauderdale in Florida and San Diego, California. The CILS included data on second-generation students in the eighth and ninth grades, who were followed until their high school graduation and later in adulthood. Native-born youths with at least one foreign-born parent and those born

abroad who had lived in the United States for at least five years at the moment of the first survey were invited to participate in 1992. The total sample size was 5,262 children across 49 schools and the data collection efforts were coordinated by Alejandro Portes and Rubén Rumbaut. A parental survey was also included with the first follow-up when students were about to graduate.

Classifying students as English monolinguals, fluent bilinguals, limited bilinguals, and foreign bilinguals, Portes and Hao investigated the linguistic adaptation of these youth in connection to family solidarity and conflict, personality adjustment, and educational aspirations. They also revisited Mouw and Xie's (1999) hypotheses by examining the interactions between the children's linguistic adaptation and parental knowledge of English.

Their findings showed that linguistic adaptation is "not an either/or process, but features instead a plurality of empirically identifiable types" (p. 907). The authors also concluded that "it is fluent bilingualism rather than English monolingualism that is associated with the more desirable results in terms of family relations and psycho-social adjustment" (p. 907). As it was discussed previously, Portes and Hao found that fluent bilingual but also foreign bilinguals (i.e., students who mostly speak the home language) had statistically significant higher levels of solidarity in family relations and experienced fewer conflict with their parents than other groups of bilinguals. Fluent bilinguals also displayed higher levels of educational aspirations but no significant interaction was found between parental levels of English knowledge and family relations, personality outcomes or educational aspirations. They concluded that "transition towards English monolingualism does not represent the most desirable outcome for immigrant families or

their offspring" (p. 907) but fluent bilingualism is important to facilitate integration in the new society and maintain intergeneration solidarity among family members.

Although the work of Portes and Hao (2002) has been very influential and had a large impact on research looking at bilingualism and academic achievement, it suffers from the same limitation than Mouw and Xie (1999). Their view of bilingualism, particularly the notion of limited bilinguals, is problematic as it was explained before. In addition, the authors strongly suggest that only way to harvest the benefits of bilingualism is to become a fluent bilingual, a conceptualization that is similar to the notion of balanced bilingual. As the literature about FLP and child SLA indicate, there is considerable variation in language outcomes among children growing up in bilingual families (Fogle & Logan-Terry, 2008) due to factors such as socioeconomic status, age of language acquisition (Butler, 2013; Paradis, 2009), family structure (Shin, 2002), access to bilingual education (Schwartz & Moin, 2012), parental believes (Pérez Báez, 2013), among other factors. Given all these factors influencing bilingual early childhood language acquisition, fluent bilingualism may not a viable option for all immigrant families.

Han (2012)

Building on the work of Portes and Hao (2002), Han (2012) investigated bilingualism in connection to academic developmental trajectories and school resources. Using a sample from the ECLS-K, her study makes use of the longitudinal nature of the ECLS-K. Han compared bilingual with monolingual children to examine their academic gains from kindergarten to fifth grade and found that despite starting with lower math

scores in kindergarten, bilingual children fully closed the math gap with their White English monolingual peers by fifth grade.

Han (2012) restricted her analysis to children from Latino and Asian backgrounds as well as native-born non-Hispanic White who served as the reference group. She selected 16,380 children from the ECLS-K and classified them as English monolinguals, English-dominant bilinguals, mixed bilinguals, non-English-dominant bilinguals, and non-English monolinguals. The category of mixed bilinguals is comparable to the category of fluent bilinguals in Mouw and Xie (1999) and Portes and Hao (2002), since speakers in this group seem "to have good usage of both languages" (p. 305) according to Han. The author created these categories by combining data from the parent survey on home language use and passing scores on a language screening that was given to children who were identified as non-English language speakers.

Han used a three-level growth-curve modeling approach to estimate the associations between language status and children's academic trajectories, with longitudinal data involving five assessment points. Analyses were estimated with Level 1 as time (i.e., within individual effects), Level 2 as individuals (i.e., between-individual and within-school effects), and Level 3 as schools (i.e., between-school effects). An advantage of growth-curve models is that they are able to compare the rate of growth of each group over time. The use of growth-curve models contrasts with Mouw and Xie (1999) and Portes and Hao (2002), who investigated the associations between bilingualism and academic trajectories with one single assessment point.

Her results revealed that, upon entry to kindergarten, children speaking a non-English language tended to have lower reading and math scores than their English-

speaking peers. She found that mixed bilinguals, bilinguals with "good usage of both languages," fully closed the math gap with their White English monolingual peers by fifth grade. Her conclusion was that "this promising result complement[ed] previous findings of a positive relationship between bilingual fluency and academic achievement" (p. 317). Her results also showed that non-English- dominant bilinguals and non-English monolinguals did not have significantly faster learning rates compared with the other groups and that they still had significantly lower scores in math and reading by fifth grade. Non-English monolingual children actually had decreasing reading scores from kindergarten to 5.

Additionally, she investigated the effect of school-level factors such as availability of ESL instruction and services for ESL families (e.g., translators for parent-teacher conferences). She found that having access to more ESL instruction was helpful for the reading trajectories, whereas having more services available to ESL families was beneficial to the math trajectories. She concluded that offering relevant resources and services to bilingual students and families may boost academic performance and language learners may be able to perform on par with their mainstream peers.

Han's analysis has several advantages. One is her use of a method that allows for evaluation of growth rate over time to discuss academic gains. Another one is her careful classification of bilingual speakers, although this classification still reveals some of the limitations that were indicated in the case of Mouw and Xie (1999) and Portes and Hao (2002). Although Han does not explicitly posit the idea that students need to become fluent or balanced bilinguals to benefit from bilingualism, like Portes and Hao suggest, this idea is still present in her study. Her classification of bilingual speakers is complex

but is not supported by theory or a discussion of bilingualism in early childhood. Thus, her conceptualization of bilingualism lacks a theoretical discussion of how and why early bilinguals differ in their language skills to warrant such a classification.

The author also noted the importance of considering "family background" (p. 318) factors more in depth in future studies. This is particularly important when certain groups with a language profile (e.g., low levels of English knowledge) show an association with lower levels of family income or socio economic status which may interact with their selection of school. Han found that "Latino and Asian children were more likely than White children to attend public schools or schools with a higher composition of poor/minority students, low stability, a poorer student learning environment, less school support for teachers, and shoddier physical resources" (p. 309). The present study will draw on Han's research to include not only school factors but also family background factors into the analysis. This study will also expand Han's focus on bilingualism by placing family language practices at the forefront of the study. An advantage of this new focus is that research on FLP can contextualize and give theoretical foundation to the discussion of the role of early childhood bilingualism on academic trajectories.

Winsler, et al. (2014)

These authors conducted an exhaustive study that examined children's outcomes and growth from 9 months to 5.4 years as a function of language used in the home at 24 months. They selected a sample of 9,250 children from the ECLS-B. Using the 24-month self-reported parent interview items about the languages spoken at home, the authors classified their participants in three groups: English only (n = 7750); heritage language

only (n = 450); and speakers of some combination of English and a heritage language used regularly at home (n = 1600). Both groups of children who were not part of the English-only language group were called Dual Language Learners (DLLs).

The authors used descriptive analyses to investigate differences between DLL and non-DLL children in various measures including cognitive and motor assessments, mother-child engagement, literacy and math, social skills, and problem behavior. They also used two-level hierarchical linear model analyses to examine levels of, and change in, each of the developmental outcomes based on two repeated measures for each assessment by language group. A complex picture emerged from their results, showing that immigrant and language-minority families are a heterogeneous group. The authors reminded us that "simple global categories such as 'immigrant' or 'DLL' families may obscure important variability within these groups in children's outcomes as well as in understanding processes and predictors of outcomes" (p. 760).

The authors reported finding differences between children in immigrant and non-immigrant families for a few outcomes depending on the language(s) used in the home. For instance, for children with U.S.-born parents, the more English used in the home, the better it was for early cognitive outcomes. However, being from an immigrant family was linked with poorer early cognitive outcomes if the family spoke exclusively English in the home, but when other languages than English were spoken in the home, children with U.S.-born and those with foreign-born mothers were performing more similarly. They concluded that "for early cognitive development and math skills upon school entry, there is some evidence…that use of the heritage language at home was a protective factor for children of immigrant families" (p. 760).

The authors explained their findings by suggesting that "perhaps what is most important to general language development is not a particular language that is spoken in the home, but that children receive rich exposure to at least one language in the home" (p. 702). They commented that offering language "rich exposure" may be more difficult for immigrant parents if they speak only English to the child but they are not fully fluent in English themselves. The policy implication that the authors drew is that we need to direct more outreach efforts to immigrant and language-minority parents to explain the importance of the use of the heritage language at home. They also pointed out to the need to bridge culture and language gaps between school and home.

The findings and conclusions of Winsler et al. (2014) are relevant to this study because it provides some empirical evidence to the transfer theory as MacSwan and Rolstad (2005) discussed it. The use of a home language at home may provide a "protective factor for children of immigrant families" (Winsler et al., 2014, p. 760) for early cognitive development and math skills because the home language is a medium that allow parents to offer academic and literacy support to their children. A as it was explained before, this knowledge is accessible to any language (or languages) a child happens to know, according to the transfer theory. However, Winsler et al. (2014) are careful with their results and indicate that "that these results are quite preliminary and in need of replication given that this pattern was not found for other outcomes and when the pattern was present, it involved some groups with relatively small sample sizes." (p. 761). Although this is a limitation of Winsler and colleagues' study, it is also an invitation to pursue similar research questions with other data sets to investigate whether similar patterns may emerge.

Building upon Winsler and colleagues (2014) and also Han (2012), this study explores the question of bilingualism in connection to language development and academic trajectories but with a focus on family language practices using FLP and theories of bilingual education as conceptual frameworks. The focus on family language practices has the advantage of situating bilingualism within the complexity of language-minority family interactions, which were discussed when the literature about FLP was reviewed. Instead of focusing on classifying participants according to degrees of bilingualism, like Han (2012) or Portes and Hao (2002), this study will take Winsler et al. (2014) approach and will expand it with an examination of the patterns of language interaction between parents and children using self-reported parent interview data on the home language environment. In order to investigate how families use language at home, it is important to review research that have examined family interactions involving language use to understand the ways patterns of home language use have been conceptualized. This is the focus of the next section.

Parental Involvement, Home Language Use, and Academic Achievement

The studies reviewed in this section focus on how parents engage with their children at home and the role that language play in games, joint reading, telling stories, and other activities. Although none of them use the term family language policy, they were selected because the construct they investigate (i.e., parental involvement at home, parental home literacy involvement, home language use) partially overlaps with the notion of parents managing language use within the home. Most of these studies employ data from the ECLS data sets, which provides an overview of how previous research had conceptualized and investigated parental interview data very similar to the data set this

study will use. In this sense, these studies inform the present study conceptually and methodologically, facilitating the identification of relevant variables and design of the final study. In what follows, four studies are reviewed: Lahaie (2008), Mancilla-Martinez and Kieffer (2010), Galindo and Sheldon (2012), and Bachman et al. (2020).

Lahaie (2008)

This author analyzed the link between parental involvement and the English proficiency and math scores of children of immigrants using a sample of kindergartners from the ECLS-K (13,078 children in total, 2,678 of whom were children of immigrants). The author focused on children tested in the fall of 1998, which corresponded with the children's first months in kindergarten. Parental involvement was broadly conceptualized as "different forms of participation in education and with the schools" (Lahaie, 2008, p. 685). One of these forms of participation was labeled as cognitive learning at home and it represented frequencies of parent-child literacy activities (e.g., reading a book to the child, telling stories to the child). It also included activities with an academic content (e.g., building projects, teaching about nature, creating art, singing songs, and playing games), and other activities without academic content (e.g., playing sports, doing chores).

Parental language use for both parents was included in the analysis using a dummy variable to indicate parents' use of a non-English language at home: both parents spoke only English at home; only the mother spoke only English at home; only the father spoke only English at home; or both parents spoke a language other than English at home. Lahaie's (2008) main hypothesis was that differences in parental involvement between immigrants and the native born were linked to the differing educational outcomes of the two groups. The author employed a logistic regression method to test for

English proficiency, which was represented by a dichotomous variable. She used Ordinary Least Squares (OLS) regression method to test for differences in math score, a continuous variable. Standard errors were corrected for the nonindependence of observations within schools.

Lahaie (2008) found that children of immigrants with a mother and father speaking a non-English language at home had an 81 percent higher chance to be considered not proficient in English and to score 1.28 points less in math than children of immigrants who have both parents speaking English at home. Her results also showed that children of immigrants where only the mother or only the father spoke English at home were not performing significantly worse than the ones with both parents speaking only English at home. She concluded that there was a strong association between parental level of English proficiency and children's early math scores and their English proficiency.

Lahaie (2008) seem to support a perspective that switching to English use at home will support academic achievement among language-minority and immigrant students. More concretely, Lahaie (2008) concluded that her study demonstrated that "when entering school for the first time, children with immigrant parents who both speak a non-English language at home do significantly worse in English and math than children of immigrant parents who both speak only English at home" (p. 702). She also suggested that preschool teachers and parents should collaborate together "to improve their home learning environment … of both immigrant and native-born children" (p. 704).

As discussed previously, several researchers warned us against deficit perspectives that depict the home (and by extension the language-minority parent) as not

effective to ensure the well-being of children (Baquedano-López et al., 2013, Dudley-Marling & Lucas, 2009; Gee, 2014). According to Baquedano-López et al. (2013), this deficit framing of language-minority parents tend to be coupled with the documentation of poor academic performance of language-minority children, often in comparison to White English monolingual peers like in the case of Lahaie (2008) or Bachman et al. (2020). Regarding the use of a non-English language at home, questions remain about whether using a home language is a parental choice or the only available resource for communication if parents do not have enough English knowledge. In the latter case, use of a non-English language at home may be an indicator of recent immigration, lower levels of income, or lower levels of formal education, and may imply less familiarity with the U.S. school system (Zarate, 2007). Future studies like the present one need to take into account not only the parents' choice of language use at home but also their levels of English proficiency.

Lahaie (2008) presents results that challenge theories of bilingual education positing that transfer of academic subject knowledge is possible because knowledge is accessible to any language or languages a child knows (MacSwan & Rolstad, 2005). Although these theories seek to explain the effectiveness of bilingual education programs, it is possible to assume that academic knowledge gained at home through the means of a non-English language would also be available in the school setting. This situation corresponds to Krashen's *de facto* bilingual education, which was previously discussed. More research is needed to explore the connections between language use at home, English language development, and academic trajectories, given that other researchers

like Winsler et al. (2014) have found a "protective effect" associated with using a home language at home in immigrant families.

Mancilla-Martinez and Kieffer (2010)

These authors investigated change in the home language environment of language-minority learners between kindergarten and 8th grade using the ECLS-K Cohort. They selected a sample of 1,538 children whose parents reported a language other than English spoken at home to any extent and for whom relevant data were available for kindergarten and 8th grade. They used Mantel-Haenszel chi-square tests to show that patterns of language use in the home were dynamic and that the shifts towards less frequent use of the home language or more use of the home language were statistically significant. The authors used the mothers' reports on whether they spoke a language other than English at home, and if so, the frequency with which they spoke this language to the participating child and vice versa (the frequency with which the child spoke the home language to the mother). They found that half of the sample did not report changes in language use. But more than one third of the sample shifted toward less frequent use of the home language and about 13% of the sample shifted toward more use of the home language.

They concluded that language- minority children's home language background "cannot be treated as time-invariant" (p. 546). They also highlighted that it is unlikely that gaining English proficiency needs to be synonymous with home language loss. Their study makes a call for designs, analyses, and theoretical models that account for the time-varying nature of language-minority students and "investigate how changes in students' reported home language use relate to other variables such as academic achievement and

social mobility over time" (p. 546). None of these relations between home language, language development and academic achievement were explored in Mancilla-Martinez and Kieffer (2010), since they exclusively focused on change in the home language environment of language-minority learners. Although this is an important limitation of this study, the authors make an important contribution by highlighting the dynamic nature of home language use among immigrant and language-minority groups.

Galindo and Sheldon (2012)

Recognizing that children's home and school are the most influential contexts in which learning and development occur during early childhood, Galindo and Sheldon (2012) investigated school and family connections and their relationships to parental involvement and students' achievement gains. The authors drew from ecological and sociological theories to guide their analyses of a sample of kindergartners from the ECLS-K database (16,425 students from 864 schools). The authors adopted a multidimensional definition of parental involvement and distinguished three types: family involvement at home, family involvement at school, and parental expectations. They tested whether each type of involvement was differentially related to kindergarteners' gains in reading and math achievement. They also tested the hypothesis that school outreach was related to gains in achievement in kindergarten by getting parents more engaged.

Family involvement at home was measured using the average of 11 items on the frequency of participation of parent and child on the following activities collected in the fall of kindergarten: read books, tell stories, sing songs, do art and crafts, do chores, play games or do puzzles, talk about nature or do science projects, play sports, child looked at

picture books outside of school, child read or pretended to read, and build things together or play with construction toys. Family involvement at school was the average of 7 items that measured parents' participation in school-related activities such as attending open house or back-to-school nights. Parents' educational expectations for their children were measured by the parents' indication of how far in school they believed their child would go.

The authors used a two-level hierarchical linear modeling (HLM) approach with students representing the level-1 units and school representing the level-2 units to account for the nested data and obtain accurate estimates that takes into account the complex structure of the error terms. The main findings were that school outreach efforts had a positive association with family involvement at school, which suggested that school efforts to encourage families to participate in school activities were effective in terms of getting parents to interact with the school. However, they also found that family involvement at home was not significantly associated with reading or math gains. The authors concluded that the association between outreach and achievement in kindergarten was partially mediated by family involvement at school, and that outreach had an independent and positive relationship with children's achievement gains in kindergarten above and beyond family involvement.

This study builds on Galindo and Sheldon (2012) by investigating parental involvement at home but reconceptualizing it as family language policy which foregrounds bilingual language practices at home. Using a similar set of questions from the parents' interviews in the ECLS-K:2011 but including questions about language use and frequency in the analysis, the present study hopes to illuminate the different patterns

of language use among bilingual families and explore whether these patterns are associated with gains in reading and math. As Galindo and Sheldon (2012) indicated, one of the limitations of their study is that they did not take advantage of the longitudinal nature of the ECLS-K data set. They also noted that family involvement levels differ across socioeconomic and ethnic groups. This study will address this gap by examining patterns of home language use across different sub-groups of families and by investigating variations in the relationships among FLP, type of school program (bilingual/English-only), and children's achievement at different grade levels.

Although Galindo and Sheldon (2012) did not find that family involvement at home was significantly associated with reading or math gains in kindergarten, other studies seem to suggest that there is a connection between families who engage in home literacy activities such as shared reading books and precursory reading skills (Baker, 2014) and math skills (Lahaie, 2008) in early childhood. Lahaie (2008) took into account parental language use (English versus non-English language) and parent's proficiency English proficiency when examining the relationship between home literacy activities and incipient reading and math skills.

Bachman, Elliott, Scott, and Navarro (2020)

Bachman and colleagues examined early academic, social, and behavioral trajectories from kindergarten to third grade for Latino children from English- and Spanish-speaking homes who experienced public pre-k, Head Start, private center care, or no preschool experience. The authors used ECLS-K:2011 to select a sample of 3,650 students and investigated associations of home language and preschool experience for trajectories of reading and math achievement, social skills, and externalizing behavior

problems. Using latent growth curve models, their findings showed that Latino children from English-speaking households attained higher scores in reading and math when compared to children from Spanish-speaking families across public pre-k, Head Start, and no preschool groups upon kindergarten entry. They also found that these early home language differences greatly diminished by third grade. In addition, the authors investigated social skills in connection to home language differences in English and Spanish-speaking Latino students. Few home language differences were detected in social or behavioral skill ratings at fall of kindergarten or in trajectories within preschool types. Nonetheless, home language differences in externalizing problems grew by third grade among Latino children who had attended Head Start, such that children from English-speaking homes received higher behavior problem ratings from teachers than peers from Spanish-speaking homes.

Although Bachman and colleagues and the present study drew a sample of Hispanic or Latino children from ECLS-K:2011, one important difference is that this study did not include a comparison of between English-speaking and Spanish-speaking students. The focus of the present study is in the role parental home language use to support academic achievement from home. For this reason, this study carefully selected participants that were identified as bilinguals or language learners of Spanish-speaking backgrounds, avoiding the inclusion of English-speaking learners who came from monolingual households were the home language was exclusively English.

The findings of Bachman and colleagues speak about the complexity of investigating the academic trajectories of Latino children in connection to home language use. Although Bachman's study makes an important contribution to the field of early

childhood education by showing the inequalities of pre-kindergarten access among Latino children, it also may suggests that differences in academic trajectories among Latino children are because of the use of a non-English home language. Latino children as a group present great variability in terms of language background, socio-economical status, immigration experiences, and race, which are characteristics that conditions access to high quality education (Cabrera, Hennigar, Yumiseva-Lackenbacher & Galindo, 2019). In particular, Latino students from language-minority backgrounds as a group tends to come from immigrant families with lower levels of income or education. For this reason, this study exclusively focused on the group of Latino students who were identified as bilingual learners. In contrast to Bachman's study, which focuses on the pre-kindergarten experiences of monolingual and bilingual Latino children, this study seeks to make a contribution to the understanding of early childhood bilingualism and its implications for elementary school.

Conclusion: Limitations and Contributions

This literature review addresses the richness of the data collected by the ECLS program. An advantage of using ECLS data is that it is a nationally representative longitudinal data set. In the case of ECLS-K:2011, children were followed from kindergarten to the fifth grade and it includes data from school administrators, parents, teachers, early care and education providers, besides different types of children assessment data. This literature review shows that researchers have investigated a series of questions about bilingualism and family language practices using data from the ECLS. Although researchers have not asked questions about family language practices using ECLS explicitly, the literature review in this section shows that the data available in

ECLS is rich enough to investigate issues of family language practices that can be framed within FLP.

The studies reviewed in this section also speak about the limitations of working with secondary data. For instance, the ECLS program was not specifically designed to focus on bilingual students. For instance, assessment data that gauge the bilingual children's knowledge of the home language is missing. However, the ECLS-K:2011 gave an English language screening test to all the participants and, like the other ECLS data sets, includes parent and teacher data about non-English language use at home and at school. Despite these limitations, researchers like Han (2012) and Winsler et al. (2014) have operationalized the concept of bilingualism using the available information in ECLS to ask questions about the connections between being bilingual and academic trajectories.

As explained before, although FLP research has focused on questions about the motivations, ideology, and beliefs around the use of the home language or choice of a language program, these questions will remain unanswered in this study given the constraints of working with secondary data. However, this study makes an important contribution to FLP studies and research on the effectiveness of bilingual education by investigating often reported anomalous cases of bilingual students with rudimentary English skills who experience academic success in English-only classrooms in the apparent absence of home language support.

The literature reviewed conducted in this chapter shows the complexity of studying early childhood bilingualism in immigrant and language-minority families. The studies included in this section point to a series of social and economic factors (e.g., family income, parental level of education, immigrant status, parents' English

knowledge, type of school attended by children, availability of ESL services, etc.) that were included in the analyses of this study. They also show the variety of methodological approaches used to analyze longitudinal data like the ECLS-K:2011. Table 2.2 includes a summary of the main concepts and variables that were developed for this study drawing the studies reviewed for the conceptual framework and the empirical literature review. This study will contribute to the field of bilingual education a valuable overview of the family language practices among immigrant families using up-to-date methods in inferential statistics.

Gaps in the Research

The empirical literature review conducted in this chapter reveals contradictory evidence regarding the effects of language spoken at home on educational and cognitive outcomes (e.g., math achievement) and English language proficiency. For instance, Lahaie (2008) found that children of immigrants with both parents speaking a non-English language at home had a higher chance to be considered not proficient in English and had lower math scores than children of immigrants who have both parents speaking English at home. In contrast, Winsler et al. (2014) reported that the use of a home language at home may provide a "protective factor" for children of immigrant families since they found that being from an immigrant family who spoke exclusively English was linked with poorer early cognitive outcomes. However, according to Winsler et al. (2014), children with U.S.-born and those with foreign-born mothers were performing more similarly when other languages than English were spoken in the home.

Questions remain about the "protective role" that using a home language in the family has during early childhood for immigrant and language-minority students. Studies

in FLP revealed that home language use is complex and dynamic, and is intertwined with ideologies about language that influence the ways in which identities and family roles are constructed and enacted (King, 2013). Theories of bilingual education argue for the possibility of transfer of academic content knowledge in bilingual children (MacSwan & Rolstad, 2005). Providing an empirical evaluation of Krashen's cases of *de facto* bilingual education will further provide evidence in support of the effectiveness of bilingual education and the role of the home language to support academic development with no detriment to the acquisition of the majority language. This study is designed to investigate such cases of *de facto* bilingual education.

Relevance of the study

To conclude, this study has implications for transforming the pathways to achieving equal educational opportunity as we better inform policymakers and teachers of DLLs about the connections between family language practices, language development, and academic trajectories. It also carries implications for administrators and teachers who seek to encourage active participation of diverse multilingual families and create stronger school communities that support the language development and educational progress of all students. As schools in the U.S. grow increasingly linguistically and culturally diverse, we need more research to understand how to better support multilingual families to contribute to the quality and equity of our schools.

Table 2.1

Summary of the studies included in the empirical review section.

Main Topic	Author(s)	Dataset	Participants	Method	Conclusion
Bilingualism and Academic Achievement	Mouw and Xie (1999)	The 1988 National Educational Longitudinal Study (NELS:88)	892 first- and second-generation Asian American students with Asian parents. Study focused on students in 8th grade.	Multivariate regression analyses	Bilingualism is important for immigrant children's academic achievement only because it prevents a language gap from emerging between them and their parents. Once English proficiency is achieved in the family, the home language is not beneficial any more for academic achievement. Deficit perspective on bilingualism.
	Portes and Hao (2002)	The Children of Immigrants Longitudinal Study (CILS)	5,262 children across 49 schools. Participants were second-generation students in the 8th and 9th grades, who were followed until their high school graduation and later in adulthood.	Multivariate regression analyses	The authors concluded that "it is fluent bilingualism rather than English monolingualism that is associated with the more desirable results in terms of family relations and psycho-social adjustment" (p. 907)
	Han (2012)	Kindergarten Class of 1998-99 (ECLS-K)	16,380 bilingual and monolingual children. The study focused on students attending kindergarten to fifth grade.	Three-level growth-curve model analyses	The author found a positive relationship between bilingual fluency and academic achievement.

Main Topic	Author(s)	Dataset	Participants	Method	Conclusion
	Winsler, et al. (2014)	The Early Childhood Longitudinal Study, Birth Cohort 2001-2002 (ECLS-B)	9,250 children followed from 9 months to 5.4 years. Participants were divided in three groups: English only, heritage language only, and speakers of some combination of English and a heritage language used regularly at home	Two-level hierarchical linear model analyses	The authors concluded that "for early cognitive development and math skills upon school entry, there is some evidence…that use of the heritage language at home was a protective factor for children of immigrant families" (p. 760).
Parental Involvement, Home Language Use, and Academic Achievement	Lahaie (2008)	ECLS-K	13,078 bilingual and monolingual children. The sample included 2,678 children of immigrants. Study focused on the children's first months in kindergarten.	Ordinary Least Squares (OLS) logistic regression analyses	Children of immigrants with a mother and father speaking a non-English language at home had an 81 percent higher chance to be considered not proficient in English. Deficit perspective on parental home language use.
	Mancilla-Martinez, et al. (2010)	ECLS-K	1,538 children whose parents reported a language other than English spoken at home. The study compared parents' responses about home language use in kindergarten and 8th grade.	Mantel-Haenszel chi-square tests to compare proportions of change in responses	Patterns of language use in the home were found to be dynamic. Shifts towards less frequent use of the home language or more use of the home language were statistically significant among the participants.

Main Topic	Author(s)	Dataset	Participants	Method	Conclusion
	Galindo and Sheldon (2012)	ECLS-K	16,425 Latino students from 864 schools. The study focused on the kindergarten year	Two-level hierarchical linear model analyses	School outreach efforts had a positive association with family involvement at school, which suggested that school efforts to encourage families to participate in school activities were effective in terms of getting parents to interact with the school. However, the authors also found that family involvement at home was not significantly associated with reading or math gains.
	Bachman, et al. (2020)	Kindergarten Class of 2010-11 (ECLS-K:2011)	3,650 Spanish-speaking and English-speaking students. The study focused on students attending kindergarten to 3rd grade.	Latent growth curve model analyses	Latino children from English-speaking households attained higher scores in reading and math than children from Spanish-speaking families across public pre-k, Head Start, and no preschool groups upon kindergarten entry. These early home language differences greatly diminished by third grade.

Table 2.2

Main concepts or variables of interest developed in this study and its connections to the literature reviewed in Chapter 2.

Concept or Variable	Connection to Research	Definition in this Study
Family Language Practices	King (2013)	What families in the study do with English and the home language (i.e., Spanish) as they carry out their daily lives in their households.
Home Language	Zarate & Pineda (2014)	The language or languages spoken at the children's household, which in this study is Spanish.
Dual Language Learner (DLL)	Academies of Sciences, Engineering, & Medicine (2017)	DLL is a child learning two or more languages simultaneously within a bilingual or multilingual home environment. DLL is also a child learning a second language (L2) while continuing to develop the home language either because they attend a bilingual program or because they receive formal instruction in English but parents or close relatives use a non-English home language to communicate with them.
Bilingual Education Program	Wright & Baker (2017)	Bilingual education is a language instruction program at school where students receive content instruction in their home language in conjunction with English.
De facto Bilingual Education	Krashen (1999)	*De facto* bilingual education are infrequent but often reported cases in which bilingual students with low levels of English skills experience academic success in English-only classrooms in the apparent absence of home language support.

Chapter 3: Methods

Introduction

The purpose of this study is to examine patterns of family language practice across language-minority families and to investigate the extent to which family language practices are associated with English language proficiency and gains in mathematics in DLLs. Although there is abundant documentation of the positive effects of the use of the home language in the context of school through programs of bilingual education (e.g., Rolstad, Mahoney & Glass, 2005, and other studies that were discussed in the previous chapter), we know little about the effect of families using the home language as a resource to support the academic achievement of DLLs at home. This study will address this gap by investigating the research questions presented in the next section.

Research Questions and Hypotheses

RQ1. What are the patterns of family language practices among dual language learners (DLLs) from kindergarten to fifth grade?

Two different analyses were estimated to investigate parents and children language preferences separately and detect differences in language use among family members. RQ1 was divided in three subquestions:

RQ1.1. What are the family language preferences for using the home language?

RQ1.2. What is the growth rate of the family language preferences for using the home language from kindergarten to fifth grade?

RQ1.3. To what extent are parents and children's background characteristics accounting for variance in family language preferences for using the home language in kindergarten?

Building upon the work of Mancilla-Martinez and Kieffer (2010), and Kibler, Palacios and Simpson Baird (2014), this study investigates whether patterns of family language use are different across parents and children, immigration status, parental English language proficiency, and number of children a family has. Mancilla-Martinez and Kieffer (2010) investigate the proportion of reported home language use changes between kindergarten and eighth grade. This study contributes to Mancilla-Martinez and Kieffer's work by investigating the growth rate of family home language use from kindergarten to fifth grade. Based on Mancilla-Martinez and Kieffer's findings and ethnographic work in the field of family language policy (Fogle & King, 2013; King, 2013; Spolsky, 2012, among others) it is expected to observe a decline in the use of the home language between kindergarten and fifth grade.

Curdt-Christiansen (2009) also indicates that parents' immigration status may be an important factor influencing decisions around the use the home language. This study also explores what the patterns of family language use are among immigrant and non-immigrant families with different levels of education, English proficiency, and income using the inclusion of covariates. In addition, Kibler, et al. (2014) found that the number of siblings was a significant predictor of children's oral language production at home. This study includes a covariate to control for the number of siblings the focal child has. It is expected that immigration status, parental levels of education, English proficiency,

income, and number of children in the family will be associated with significant differences in the use of the home language.

RQ2. To what extent are identified family language practices accounting for variance in English language proficiency in DLLs upon entry to kindergarten?

Evidence from research on early childhood bilingualism suggests that learning two languages simultaneously does not jeopardize the development of language proficiency (Bialystok, 2017; Paradis, 2009). However, as discussed in the literature review, teachers and policymakers may still hold negative linguistic perceptions of bilingual students (Nava, 2009). Thus, it is important to examine whether children from families with equal preference for using English and the home language have lower or similar scores than other groups on English proficiency. We expect that we will not observe a significant difference in English language proficiency scores between children exposed to two languages at home and children exposed to only English.

RQ3. To what extent are identified family language practices accounting for variance in academic achievement or gains in mathematics in DLLs from kindergarten to fifth grade?

This question is divided in two subquestions.

RQ3.1. To what extent is parental academic help in the home language accounting for variance in kindergarten math scores for students with the lowest identified level of English and receiving a variety of language instruction in school?

RQ3.2. To what extent is parental academic help in the home language accounting for variance in growth rate in math from kindergarten to fifth grade for students with the lowest identified level of English and receiving a variety of language instruction in school?

The student English proficiency level was identified using the *preLAS* English language screener scores collected by the researchers. The identification of language proficiency groups will be discussed later in chapter. In addition, DLLs were divided in groups according to the type of language instruction they received in kindergarten to answer RQ3. Students received language instruction only in English (English as a second language or ESL group) or had language support in the home language (bilingual education group, which included the dual language instruction students). There was another group of DLLs who did not receive any language support during kindergarten although they received ESL instruction in later years. This group was identified as submersion students.

As mentioned before, prior research found that children of immigrants who have both parents speaking English at home had better academic outcomes (Lahaie, 2008). Others have found that using a home language may provide a "protective factor" for young children of immigrant families when compared to immigrant families using English only at home (Winsler et al., 2014). Questions remain about the effectiveness of using a home language for academic support at home, although there is ample evidence that language support in the home language in school is highly effective for linguistically diverse students (August & Hakuta, 1997; August & Shanahan, 2006; Genesee, et al., 2006; NASEM, 2017, Rolstad et al., 2005; among others).

The answer to RQ3 seeks to illuminate our understanding of cases in which bilingual students with emerging English skills appear to experience success or rapid academic gains in English-only classrooms in the apparent absence of home language support. The expected findings are that students with low level of English proficiency

will benefit the most from parental academic help in the home language compared with students with higher levels of English. In addition, students with low levels of English proficiency who receive language support only in English at school will also benefit more from parental help in the home language that students with similar levels of English but with home language support at school. The contribution of this study is to provide an empirical verification of what has been called “de facto” bilingual education (Krashen, 1999), a situation in which an emergent English learner succeeds in an English-only classroom due to parental academic support in the home language.

Data Sources

Data for the study come from the ECLS-K:2011, a nationally representative sample of elementary school learners attending kindergarten in 2010-11. Using a multi-stage sampling design, 18,174 kindergartners from 968 schools and their parents, teachers, school administrators, and caregivers participated in the study. The collected data focused on children's cognitive, social, emotional, and physical development. Data from parent interviews, self-administered questionnaires completed by teachers and school administrators, and one-on-one assessments of children were also collected (Tourangeau, et al., 2015). Data from the ECLS-K:2011 spans from fall 2010 (kindergarten) to spring 2016 (fifth grade) and allows the investigation of a wide range of family, school, community, and individual factors associated with school performance over time although some of the limitations of this dataset is that it was not originally collected for studying family language practices and important questions about home language use and proficiency were left unanswered in this study. The University of Maryland Institutional Review Board (IRB) reviewed the present project and determined

that this project is exempted from IRB review according to federal regulations on 08/14/18 (see Appendix for a copy of the letter).

Research Design and Sampling Strategy

A multi-stage probability sampling design was used to obtain a nationally representative sample of children attending kindergarten in 2010-2011. The sample was selected using a three-stage process. In the first stage of sampling, researchers divided the country into primary sampling units (PSUs), or geographic areas that are counties or groups of contiguous counties. The ECLS-K:2011 sampled 90 PSUs for inclusion in the study. In the second stage, samples of public and private schools with kindergarten programs or that educated children of kindergarten age (i.e., 5-year-old children) in ungraded settings were selected within the sampled PSUs. Both PSUs and schools were selected with probability proportional to measures of size (defined as the population size) that considered a desired oversampling of Asians, Native Hawaiians, and other Pacific Islanders (APIs). API children were oversampled as one group, not as three groups that were distinct from one another. Finally, researchers selected children enrolled in kindergarten and 5-year-olds in ungraded schools or classrooms within each sampled school in the third stage of sampling. This sampling procedure combines a clustered design that was helpful to minimize data collection costs, while still achieving an acceptable level of precision in the estimates produced with the data (Tourangeau, et al., 2015).

Instrumentation

The ECLS-K:2011 includes data from child assessments, parent interviews, school administrator questionnaire, teacher questionnaires, and before- and after-school care

provider questionnaires, as explained before. Data collection instruments employed during each wave of data collection for the ECLS-K:2011 included direct child assessments, parent interviews, teacher questionnaires, school administrator questionnaires, and before- and after-school caregiver questionnaires. The ECLS-K:2011 data were collected in nine waves over the course of seven years, from 2010 through 2016. This study uses all available data, from the first wave (kindergarten) to the 9th wave (fifth grade). Table 3.1 includes all the rounds and dates of data collection. Tourangeau et al. (2019) includes a summary of all the instruments used in ECLS-K:2011, including those that will not be used in this analysis. Next, descriptions of the instruments used to collect data on the variables selected for this study are provided.

Direct Child Cognitive Assessments

As Table 3.2 shows, direct child assessments were administered in all 9 waves of data collection, although not all assessments were administered in all waves. The direct cognitive assessments were designed to measure children's knowledge and skills at given points in time, as well as track their academic growth in different subject areas across time. Mathematics was assessed from the fall of 2010 (kindergarten) through the spring of 2016 (fifth grade). This study uses math scores to measure academic gains for DLLs during elementary school. In addition, in the kindergarten round of data collection, all children, regardless of home language, were administered an English language screener as the first component of the direct cognitive assessment.

The assessment frameworks for the ECLS-K:2011 were derived from national and state standards, including those of the National Assessment of Educational Progress (NAEP), the ECLS-K frameworks, and selected states' curriculum standards. The ECLS-

K:2011 assessments included items that were specifically created for the ECLS studies, items adapted from commercial assessments with copyright permission, and items from other NCES studies. The assessments were administered directly to the selected children on an individual basis by trained and certified child assessors and took about 60 minutes per child to administer all the cognitive assessments. Child responses were entered by the assessor into a computer-assisted interviewing (CAI) program.

Language Screener

The screener consisted of two tasks from the Preschool Language Assessment Scale (*preLAS 2000*, Duncan & De Avila, 1998). The "Simon Says" task required children to follow simple, direct instructions given by the assessor in English. The "Art Show" task was a picture vocabulary assessment that tested children's expressive vocabulary. Since all children were administered the language screener as the first component of the direct cognitive assessment, for children whose home language was English, the screener primarily served as a warm-up or practice for the rest of the assessment. For children who spoke a non-English language at home, the screener served as a warm-up, and it also determined whether the children understood English well enough to receive the full, direct child assessment in English.

Routing of Spanish-Speaking Children

Children had to achieve a score of 16 or higher in the *preLAS* language screener to be routed through all the assessments in English. Spanish-speaking children who did not achieve at least 16 points on the screener were administered a short reading assessment in Spanish that measured Spanish early reading skills (SERS), as well as the mathematics assessment that had been translated into Spanish. Children whose home language was

one other than English or Spanish and who did not achieve at least the minimum score on the screener were not administered any of the remaining cognitive assessments. In the first-grade collections, the language screener was administered only to children who spoke a language other than English at home who had not passed the screener in the most recent round in which they were assessed. By the spring of first grade, nearly all children (99.9 percent) were routed through the assessment in English; therefore, the language screener was not administered beyond the spring of first grade.

Mathematics: Two-Stage Assessment

Math included two-stage assessments. For each assessment, the first stage was a routing section that included items covering a broad range of difficulty. A child's performance on the routing section determined which one of three second-stage tests (low, middle, or high difficulty) the child was administered. The second-stage tests varied by level of difficulty so that a child would be administered questions appropriate to his or her demonstrated level of ability for each of these cognitive domains. The purpose of this adaptive assessment design was to maximize accuracy of measurement and minimize administration time. Assessors asked the children questions related to images or text that were presented on a small easel, such as words, short sentences, or items associated with passages for reading, and number problems for mathematics.

Assessment

The mathematics assessment was designed to measure skills in conceptual knowledge, procedural knowledge, and problem solving. The assessment consisted of questions on number sense, properties, and operations; measurement; geometry and spatial sense; data analysis, statistics, and probability; and patterns, algebra, and

functions. Most of the text was read to children to reduce the likelihood that their reading ability would affect their mathematics assessment performance. Children could also follow the text read and graphs on the easel pages. Paper and pencil were offered to children to use for the mathematics assessment, and children were periodically reminded of their availability as part of the assessment protocol. This assessment was conducted in two stages as explained. In the case of kindergarten, each of the second-stage mathematics assessment tests also contained several items for which wooden blocks were available for children to use in solving the problems. However, they were not required to the use blocks. Spanish-speaking children who did not pass the language screener completed the full mathematics assessment administered in Spanish until second grade.

Parent Interviews

Parent interviews conducted in the fall of kindergarten, the spring of first grade, the spring of third grade, and the spring of fifth grade were selected as main sources of information for determining the patterns of family language practices. These interviews included questions about primary language spoken in the home and preferences for language use. Other parent interviews were also included to collect background knowledge (e.g., family income, parent education, parent immigration status, etc.) as needed.

In kindergarten, the average length of the parent interview was approximately 45 minutes but interviews were shorter in later rounds (between 34 and 12 minutes) as topics changed. The parent interviews conducted in kindergarten addressed many important topics. Across the two waves of kindergarten data collection, parents provided information about parent involvement in the child's school; school practices; out-of-

school activities; children's nonparental care arrangements the year before kindergarten and during the kindergarten year; the home environment, including family practices such as rules and routines, food security, and discipline; parent and child health and well-being, including the child's level of physical activity and child disabilities; child behavior; household composition and family structure; child and parent characteristics, including the primary language spoken in the home, parent education, and parent employment; and the involvement of nonresident parents.

Interviews were conducted by telephone for most cases, and the respondent was usually a parent or guardian in the household who identified himself or herself as the person who knew the most about the child's care, education, and health. The researchers who collected the data conducted a bias analysis to determine if substantial bias was introduced as a result of the collection method or rate of nonresponse. A comparison between estimates for selected items from the base-year ECLS-K:2011 parent interviews and the 2007 National Household Education Surveys Program (NHES:2007) provided no indication that significant bias is present in the ECLS-K:2011 parent data.

After the first collection round, ECLS-K:2011 interviewers attempted to complete the parent interview with the same respondent who answered the parent interview in previous rounds, though another parent or guardian in the household who knew about the child's care, education, and health was selected if the previous respondent was not available. The parent interview was fully translated into Spanish before data collection began and could be administered by bilingual interviewers if parent respondents preferred to speak in Spanish. The interview was not translated into other languages because of the

cost. However, interviews could be completed with parents who spoke other languages by using an interpreter who translated from the English during the interview.

Teacher Questionnaires

The general classroom teachers of the children in the study completed two self-administered hard-copy questionnaires about themselves and their classrooms (teacher-level questionnaire) as well as a child-level questionnaire for each child in their classrooms who was participating in the ECLS-K:2011. The purpose of the teacher-level questionnaires was to collect information about the classroom environment and experiences that may relate to children's academic and social development. They included questions about the classroom and student characteristics, class materials, instructional practices and curricula, evaluation practices, parent involvement, teacher's background, teaching experience, staff development and support activities, and attitudes about teaching and the school climate. The teacher-level questionnaires used in kindergarten, first grade, second grade, and third grade were very similar in content.

The purpose of the child-level questionnaires was to collect information specifically about each study child's experiences and performance in the classroom. Teachers completed one questionnaire per participating child. Information was collected in the child-level questionnaires about the child's academic and cognitive abilities, behavior, social skills, executive function, specific programs and services received (e.g., ESL services), and achievement group placement in mathematics and reading, if applicable. Information about instruction for English language learners was only collected in kindergarten through third grade, which are the questionnaires that will be

the main source of information about children's participation in bilingual programs or ESL services in this study.

School Administrator Questionnaires

The school administrator questionnaires were hard-copy paper questionnaires completed by the school principal/administrator and/or his or her designee. The school administrator questionnaires were very similar in all the years, with the exception of a few topics that were added or removed over time. The school administrator questionnaires addressed the following topics: school characteristics; facilities and resources; school-family-community connections; school policies and practices; implementation of Response to Intervention programs and practices (omitted in kindergarten); school programs for particular populations (language-minority children and children with special needs); federal programs; staffing and teacher characteristics; and school administrator characteristics and background. Type of instruction for English language learners was omitted from the forth-grade questionnaire, although this topic was included in the child-level items of the reading teacher questionnaire in fourth grade, as part of the specialized programs and services provided to the child.

Sample

Students who were identified as Hispanic, had a non-English home language as reported by parents, and participated in an instructional program designed to teach English language skills at any moment between kindergarten and fifth grade were selected for this study. An initial sample of 2,428 bilingual students or DLLs from 438 schools was drawn from the original ECLS-K:2011 sample using the variables X_RACETH_R for the student ethnicity, X12LANGST for the child home language, and

TPRGES to identified students in English language skills programs between kindergarten and fifth grade.

X_RACETH_R is a composite variable created by the ECLS-K:2011 researchers from parent interview data. Parents were asked about the child's ethnicity, specifically, whether or not their child was Hispanic. X12LANGST is another composite variable already given in the ECLS-K:2011 dataset. This variable indicates whether English was a primary language spoken in the home or whether a non-English language was the primary language spoken. Only participants who reported using a non-English home language were included in the sample for this study. Families who reported that English was exclusively spoken in the child's household were excluded from the sample. Families who could not choose a primary language or reported using two languages equally were included in the sample. In these cases, the ECLS-K:2011 dataset does not include detailed information about the languages that these families used in their households.

The variable TPRGES comes from the child-level teacher questionnaires that were administered between kindergarten and fifth grade. A question asking the teacher whether the child participated in an instructional program designed to teach English language skills to children with limited English proficiency was included every academic year and collected under the variables T2PRGES, T4KPRGES, T4PRGES, T6PRGES, T7PRGES, G8PRGES, and G9PRGES. This set of variables was used to create the composite TPRGES and select Hispanic students with a home language other than English who received English language skills at any moment during elementary school.

Missing Data

Given that the data used in this study come from a national longitudinal panel, missing data was handled using full information maximum likelihood (FIML) (Little & Rubin, 2002) to address potential bias from nonresponse or respondent attrition (Stapleton, Harring, & Lee, 2016). FIML is a data analytic technique that is often used in multilevel models to handle missing data that are hypothesized to be conditionally missing at random. FIML has the advantage of using all available data from each case for parameter estimation (Enders, 2001). It is recommended to use an inclusive analysis strategy that incorporates a number of auxiliary variables into the missing data handling procedure to address bias in regression analyses. Enders (2010) defines a useful auxiliary variable as a potential cause or correlate of missingness or a correlate of the incomplete variables in the analysis model. All the final analyses in this study include a set of auxiliary variables such as parental education, income and English proficiency levels. These variables are a potential cause of missingness given that parents with lower levels of socio-economical status were less likely to respond to the parent survey (Tourangeau et al., 2015). However, one of the disadvantages of using FIML to handle missing data is that this technique is affected by the proportion of missing data in the covariates. One of the limitations of this study is that the levels of non-response among parents were relatively high, in particular for the kindergarten year (e.g., 42 percent in the fall of kindergarten). Tables 3.3 and 3.4 include the response rates for parent interviews and child-level teacher questionnaires (kindergarten to third grade). In the case of the parent data, most of the variables come from waves 1, 4, 7, and 9, with response rates that range from 58 percent (fall 2010 of kindergarten) to 73 percent (spring 2011 of first grade). For

the child-level teacher questionnaires, response rates range from 41 percent (fall 2012 of second grade) to 84 percent (spring 2011 of kindergarten). Response rates for the reading, math, and science teacher in fourth and fifth grades were between 35 percent and 70 percent. In general, the level of nonresponse among parents and teachers in the sample selected from ECLS-K:2011 was moderate to high.

Table 3.5 shows selected patterns of data collection for the students of the initially selected sample of 2,428 families. A table with the percentages of math IRT scores that are missing in the selected sample was included in the Appendix. Missing rates go from 6 percent (spring 2011 of kindergarten) to 56 percent (fall 2012 of second grade). Missing rates are higher for fall first-grade and fall second-grade because the ECLS-K:2011 researchers collected data of a subsample of students from the full study sample using the three-step procedure described in the Data Sources section previously. This subsample was designed to be representative of the full sample. Regarding the *preLAS* English language screener scores, four percent of the *preLAS* scores were missing for the kindergarten year.

Key Variables in the Study

The key variables of the study are described in the next sections. Descriptive statistics is included when necessarily.

Students' English Language Proficiency Scores

As explained before, information on children's basic English language proficiency was collected with the *preLAS* 2000 (Duncan & De Avila, 1998) in kindergarten and first grade. In this study, the total scores from the "Simon Says" and "Art Show" subtests of

the *preLAS* from wave 1 and 2 corresponding to fall and spring of kindergarten were used (i.e., X1PLTOT, X2PLTOT). A raw number-right score, which are counts of the number of items a child answered correctly, is provided for children's performance on the set of 20 *preLAS* items, which were administered to all children regardless of their home language. The internal consistency of the scores (alpha coefficient) for the *preLAS* total raw number right scores in the fall and spring of kindergarten were 0.91 and 0.89, respectively (Tourangeau, et al., 2015).

In addition, levels of English language proficiency were created using a weighted version of the *preLAS* total raw number right scores for the kindergarten year. As explained before, the ECLS-K:2011 researchers used the publisher recommended cut score of 16 to route students through all of the assessments in English after weighting the scores from the "Simon Says" and "Art Show." A weighted total score of 15 or less corresponds to the proficiency level of Non-English Speaker (NES) for 4 year olds according to the publisher (Duncan & De Avila, 2000). Following the ECLS-K:2011 researchers' decision and the *preLAS* examiner's manual, a student who scored between 16 and 22 points was identified as Limited English Speaker (LES) and a student who scored between 23 and 30 points was identified as Fluent English Speaker (FES) after weighting the scores from the "Simon Says" and "Art Show" sections. The "Simon Says" section was weighted by tow and the "Art Show" was weighted by one. Table 3.6 includes a list of proficiency levels labels and a break-down of the scores that was created using the information from the ECLS-K:2011 researchers and the *preLAS* examiner's manual (Duncan & De Avila, 2000).

For the sample selected, it was found that 17 percent of the students were identified as NES, 20 percent were identified as LES, and 63 percent were labeled as FES. Table 3.7 shows descriptive statistics including weighted means for the *preLAS* scores for the kindergarten year. Another table with unweighted descriptive statistics can be found in the Appendix.

Students' Math IRT Scores

Since ECLS-K:2011 employed a two-stage assessment in mathematics in which children were administered a set of items appropriate for their demonstrated ability level, rather than all the items in the assessment, broad-based scores were calculated using item response theory (IRT) procedures (variables X1MSCALK5 to X9MSCALK5). IRT is a method that makes it possible to calculate an overall ability score for each domain measured for each child that can be compared to scores of other children regardless of which specific items a child was administered. IRT methods are also advantageous as they can be used to "link" scores from one year to the next (Raykov & Marcoulides, 2011). In this study IRT-based scores for math from kindergarten to fifth grade were used. The internal consistency of the scores (alpha coefficient) for math IRT-based assessments was between 0.94 and 0.92 for all the rounds of data collections between kindergarten and fifth grade (for more details, see Tourangeau, et al., 2018). Table 3.7 includes weighted means and other descriptive statistics for math scores from kindergarten to fifth grade. Another table with unweighted descriptive statistics can be found in the Appendix.

Family Language Practices

Parental use of the home language and Child use of the home language were two variables created to measure the language preferences of the families in the sample. These variables come from two questions that were included in the parent interview for the fall of 2010 (kindergarten), spring 2011 (first grade), fall 2012 (third grade), and spring 2014 (fifth grade). All questions were included in Table 3.8 and the full parent survey was publicly released by the U.S. Department of Education (National Center for Education Statistics [NCES], 2012). Parents were asked how often they used the home language when they spoke to the child ("How often do you use [the non-English language] in speaking to [your child]?" [NCES, 2012, p 8]). Responses were in the form of a scale with four points ranging from never to very often. Parental use of the home language is the average of both mother and father's responses created for each wave of data collection that included this question.

Parents were also asked how often the child used the home language when they spoke with the mother and the father ("How often does [your child] use [the non-English language] in speaking to [you]?" [NCES, 2012, p 9]). The same scale discussed before was offered to respond the question. Again, Child use of the home language is the average of both mother and father's responses created for each wave of data collection that included this question. Cronbach's alpha coefficients were calculated to inspect the interitem correlations and unidimensionality before creating the new variables. Alpha coefficients range between 0.57 and 0.79 for parental and child use of the home language variables. The Appendix includes a table with the interitem correlations for the composite family language practice variables created. In addition, Table 3.8 in this section includes

the questions for the parent interview that were used to create the variables Parental and Child use of the home language.

Parental academic support and Home language use for academic support were two other variables that come from the fall of kindergarten parent survey. As explained before, data for these variables come from home parental engagement questions that asked parents whether they told stories, sang songs, did art and crafts, did chores, played games or did puzzles, talked about nature or did science projects, built things together or played with construction toys, played sports, and practiced reading, writing or working with numbers with their children. Parents were also asked about how frequently they used the home language to engage children in the activities listed before. The data for these variables were only asked in the kindergarten parent interview for the fall of 2010 and all the questions used for creating Parental academic support and Home language use for academic support variables are included in Table 3.8. Parental academic support is the average of nine items that asked parents about their engagement with children at home (see questions or items in Table 3.8). A scale with four options was give to the parents. The options measured parental involvement with children at home on a weekly frequency ranging from not at all or never (1) to every day or always (4). Prior creating the composite, the alpha coefficient for the nine items was inspected and it was found to be 0.72. In addition, a factor analysis with unrotated factor loadings was conducted to explore how interrelated the nine items from the parent survey were. Three factors were extracted but an inspection of the eigenvalues associated suggested that only the first one was meaningful. All the items positively loaded on the first factor roughly equally. The Appendix includes two tables summarizing the factor analysis conducted.

Home language use for academic support was a single follow-up question after the nine items used to create the variable Parental academic support. This question asked parents how often they use the home language when they did any of the activities mentioned in the nine items. A similar scale with four options was given to parents. The scale ranged from always use the home language to never use the home language. To facilitate the interpretation of the estimates in the analyses, the scale was reversed to represent 1 = never use the home language and 4 = always use the home language. In addition, to facilitate the analyses and the creation of interaction terms to answer Research Question 3, home language use for academic support was converted into a dichotomous variable representing 1= *always* use the home language and 0 = any other frequency of use of the home language (never to most of the time). Table 3.8 includes the question and the scale from the parent survey. Table 3.9 shows descriptive statistics, including weighted means, for all the family language practice variables created for the study.

Type of Language Instruction for DLLs

All the students selected for this study received language instruction at school at any moment between kindergarten and fifth grade. Instruction focused on developing language skills only in English in English as a second language (ESL) programs or developing language skills in the student home language and English (i.e., bilingual education including dual language instruction). There was another small group of students (n = 91 in the kindergarten year) who received other types of language instruction but the ECLS-K:2011 researchers did not provide details about the language

used during the instruction. This group was dropped when the focus of the analysis was on the type of language instruction the students received because of lack of information.

For each student in the study, the general classroom teacher child-level questionnaires and the reading and language arts teacher questionnaire included questions about the language services a student received every year between kindergarten and fifth. The variables T2NSTNL, T4LNGINT, T6LNGINS, T7LNGINS, G8LNGINS, and G9LNGINS were used to identify the language program that the students attended each year. Table 3.10 shows the teacher questions used to identify students with language services and the type of language instruction received.

For this study, there was a special interest in the kindergarten year and the type of language instruction was included as a covariate in the analyses as time-invariant using the information from the kindergarten year. In kindergarten, 1,331 students received language instruction at school. 55 percent of kindergarten students received ESL instruction, 38 percent received bilingual education, and 7 percent received other types of language support. There were 669 students that did not received language instruction in kindergarten although they participated in an instructional program designed to teach English language skills to children with limited English proficiency in later years. These children were labeled as submersion students in this study. Table 3.11 shows the frequencies and percentages of students in kindergarten with language services and in submersion contexts.

Parent and Child Background Characteristics

Parent background characteristics that were included in this study are the following: level of education, level of English proficiency, income level, and whether

parents were immigrants or not. Children background characteristics selected in this study are whether the child was a male, age when he or she was given the first ECLS-K:2011 assessment battery, and number of siblings. Parent background variables and number of siblings come from the parent interviews administered between kindergarten and fifth grade. The questions used with parents are included in Table 3.12 and were made publicly available by the U.S. Department of Education (NCES, 2012). Child covariates such as gender and age when first assessed was provided by the ECLS-K:2011 researchers. The selection of these variables was based on the literature review of previous studies using large panel data and ethnographic studies investigating family language practices. In addition, averages were used to keep the number of covariates or background characteristics to the minimum given the complexity of the analyses in this study and the rate of attrition present in a panel data like ECLS-K:2011. In this study, special attention was given to the kindergarten year since this was the year when parents answered questions about academic help at home using the home language. Covariates such as parent level of education and income level were included as time-invariant using the information from the kindergarten year.

Parent level of education was created using a categorical variable (X12PAR1ED_I and X12PAR2ED_I) that ranges from 1 (8th grade or below) to 8 (Master's degree or higher). An average across mother and father level of education was created for the study. Parent level of English was collected only in the fall 2010 kindergarten interview (variables P1READE1, P1SPEAK1, P1UNDER1, P1WRITE1, P1READE2, P1SPEAK2, P1UNDER2, and P1WRITE2). Parents were asked to rate themselves on four aspects English communication (speaking, reading, writing, and

understanding) using a four-point scale that was reversed to facilitate the interpretation of the estimates in this study. The new scale for parent level of English ranges from 4 (very well) to 1 (not well at all). Table 3.12 includes the questions and the original scale that was given to the parents. An average across the four English communication items (speaking, reading, writing, and understanding) was first created for each parent. Next, average scores across parents were created for the analyses in this study. Prior to the creation of the parent level of English covariate, coefficient alphas were inspected (0.95 and 0.93 for the four variables measuring English communication for the mother and the father respectively).

Income level for the kindergarten year come from the categorical variable X2INCCAT_I, which goes from income level 1 (an income of $5,000 or less in the year before kindergarten) to income level 18 (an income of $200,001 or more in the year before kindergarten). An inspection of the unweighted descriptive statistics revealed heavy skewness in the distribution of income levels and the variable was transformed using the natural log to address non-normal distribution and skewness. Immigrant parents were identified using the variables P2PARCT1 and P2PARCT2. Parents were asked in what country they were born in the spring 2011 of kindergarten. In this sample, 91 and 93 percent of the primary and secondary caregivers were immigrants respectively. Most of the families in the sample spoke Spanish at home, except for 17 families (1.21 percent of the sample) who reported speaking other languages at home such as French or Portuguese.

Student covariates were provided by the ECLS-K:2011 researchers, who coded the child's gender under the variable X_CHSEX_R and the age in months when the child

was administered the ECLS-K:2011 battery (variable X1KAGE_R for the fall of kindergarten). The child age in months was also used to create the time variable used in Research Question 3. The child's number of siblings came from the parent interview. The variables X1NUMSIB to X9NUMSIB were used to include the number of siblings a child had in the analysis of Research Question 1. Table 3.13 shows the descriptive statistics, including weighted means, for the parental and child covariates created for the study.

Analytic Approaches

Sampling Weights

Descriptive statistics in this chapter was carried out using sampling weights for calculating means of variables of interest and covariates. Since the ECLS-K:2011 is a nationally representative data set, it is possible to generalize findings to the U.S. national population when using appropriate weighting. In addition, ECLS-K:2011 used a complex survey design with a multi-stage sampling design and data need to be weighted to account for differential probabilities of selection at each sampling stage. Using weights for descriptive statistics also allows for adjusting for the effect nonresponse can have on the variables and covariates (Heeringa, West, & Berglund, 2017).

Although a sample weight could be produced for use with data from every component of the study (e.g., data from the fourth-grade parent interview; the fourth-grade child assessment; etc.). ECLS-K:2011 researchers preferred to create sample weights that would maximize the number of sources of data included in the analyses. For this reason, when choosing sample weights for the descriptive analyses of this chapter, a weight that includes adjustments for more components than what was used in the analysis

was selected. When weighted means were provided, variance estimation of the variables and covariates was done using the paired jackknife replication method (JK2) (Tourangeau, et al., 2018) recommended by the ECLS-K:2011 researchers. The jackknife replication method (Tukey, 1958) considers the clustered, multistage sampling design and the use of differential sampling rates to oversample targeted subpopulations.

For the base year (kindergarten), weights were provided at the child and school levels. For all data collections after the kindergarten year, weights were provided only at the child level since the school sample was no longer nationally representative (Tourangeau, et al., 2018). The school sample was simply a set of schools attended by the children in the ECLS-K:2011 cohort after kindergarten.

Analyses

To answer Research Questions 1, 2, and 3, data was explored and analyzed using STATA 15.1 (StataCorp, 2017). All the research questions were answered using multilevel models with mixed effects (Fitzmaurice et al., 2011). Given the size of the sample and the large number of higher-order level units included in the study, Maximum Likelihood (ML) was selected to compute all models in this study because parameter estimates are considered consistent and asymptotically unbiased (Raudenbush & Bryk, 2002). To make the intercept interpretable, continuous covariates were centered at the grand mean since all the research questions involved person-level (child and parent) predictors (Enders & Tofighi, 2007). Dichotomous variables (e.g., child attends bilingual program) and continuous variables with a natural occurring zero in the scale (i.e., number of siblings) were not deemed it necessary to be centered.

Time Variables

Both time variables used in RQ1 and RQ2 encode time in terms of months since the onset of a specific event, which has the advantage of avoiding imposing an external time (researcher-generated) structure to the data and treating time in a more flexible and meaningful way (Singer & Willet, 2003). The time variable used in RQ1 is the number of months since the first parent interview in 2010. The time variable was centered at November 2010, the fall of kindergarten or the baseline year, when 60.76 percent of kindergarten parents had already been interviewed for the first time in order to make the regression intercept interpretable (Fitzmaurice et al., 2011). The number of months since the first parent interview was chosen as the time variable because it captures the chronological distance between occasions and provides more precise information about the family at the moment of the interview.

The time variable in RQ3 is the child's actual age (to the nearest month) on the day the assessments were administered. The child's age when he or she was assessed was chosen as the time variable because it captures the chronological distance between occasions and makes a meaningful contribution to the level-1 model as it takes into account the child's cognitive development at the moment of the test (Singer & Willet, 2003). Following Fitzmaurice et al. (2011), the time variable was centered at the mean age in months (= 66.84) when students were tested for the first time at the baseline in order to make the regression intercept interpretable. In addition, when covariates were included, the children's age when they were first tested (centered at 66.84 months) was added to control for the unbalanced design of the data panel.

Model Building

The multilevel models fitted for this study were built sequentially, following this order:

1. An unconditional means model: This is a model with no substantive predictors at any level used to describe and partition the variation in the outcome variable. The intraclass correlation coefficient (ICC), which measures the proportion of variance in the outcome variable that is between groups, was calculated using the unconditional means model. The ICC was calculated using formula (1) where τ_{00} is the level-2 variance component and σ^2 is the level-1 variance (Raudenbush & Bryk, 2002).

$$\rho = \tau_{00} / (\sigma^2 + \tau_{00}) \quad (1)$$

2. An unconditional growth model (only RQ1 and RQ3): This is a model that includes *time* as the only level-1 predictor and no other substantive predictors at level 2 are added. This model helps evaluate the baseline amount of change (Singer & Willett, 2003) before adding variables of interest. This model was also used to evaluate whether a linear or a quadratic term of *time* was needed after inspecting the shape of the growth trajectory. In addition, a proportional reduction in residual variance was calculated as predictors were added to the model building process. Following Raudenbush and Bryk (2002), for the unconditional growth model, the proportional reduction in residual variance was calculated as the difference between the unconditional means model residual variance and the unconditional growth model residual variance over the unconditional means model residual variance.
3. Conditional models: The first conditional model included only the variables of interest. The next conditional model included the addition of covariates or parent and

child background variables. RQ3 also included conditional growth models with variables of interests and covariates as predictors for the initial status and change. In the case of RQ3, conditional growth models with variables of interest were first fitted first for the initial status, and then for the growth rate. To compare the relative goodness-of-fit of the different models, the Akaike information criterion (AIC; Akaike, 1979) was used. The model with the smaller AIC was considered to fit better. To gauge the differences in AIC, Burnham and Anderson (2002) suggest that the relative AIC differences should be calculated and compared for each set of models. The model with the smallest AIC was selected and differences in AIC were calculated relative to this model for each series of models estimated. According to Burnham and Anderson (2002), difference in AIC of 1-10 were considered important, while differences in AIC larger than 10 were omitted from further consideration.

In addition, a four-way interaction term was created to answer RQ3. Following Rabe-Hesketh and Skrondal (2012), this interaction term was built in steps starting by the main effects, then adding the two-way interaction terms, next including the three-interaction terms, and finally creating the four-way interaction term of interest. To facilitate the interpretation of the interaction of interest, dichotomous variables were created from categorical variables (i.e., child English proficiency levels and levels of parental home language use). RQ3 required testing hypotheses regarding linear combinations of coefficients or, more specifically, a contrast (i.e., the difference between two coefficients is zero) (Rabe-Hesketh & Skrondal, 2012). To discuss the contrasts presented in RQ3, Wald tests with an asymptotic χ^2 (1) distribution for the

null hypotheses tested in RQ3 were computed and reported for each difference included in the findings.

Regarding the specification of fixed and random effects, only random-intercept models were fitted (i.e., only the level-1 model intercepts (β_{0j}) were set to random) following Galindo and Sheldon (2012). All other level-1 and level-2 coefficients were left constant (i.e., no random effect was modeled: a random-intercept model). Graphical representations of the analyses were included in chapter 4. Unstandardized regression coefficients with White-Huber (robust) standard errors (Huber, 1967; White, 1980) are reported in all the Tables. White-Huber (robust) standard errors were chosen because they have the advantage of not imposing any assumption on the structure of the error covariance matrix, providing consistent estimates of the covariance matrix for parameter estimates even when the fitted parametric model does not hold or there is heteroscedasticity in the error terms (Fitzmaurice, Davidian, Verbeke, & Molenberghs, 2008).

To indicate the relative magnitude of important differences or effect sizes, standardized estimates were provided in the finding sections using Hox, Moerbeek, and van de Schoot's (2010) formula:

(2)

$$\textit{standardized coefficient} = \frac{\textit{unstandardized coefficient} * \textit{SD of explanatory variable}}{\textit{SD of outcome variable}}$$

Model assumptions (normality and multicollinearity) were checked with graphs and correlations matrices for each research question after fitting the sequence of models. Equations for the three models corresponding to RQ1, RQ2, and RQ3 are included at

the end of the chapter showing the most exhaustive model that was fitted for each research question.

Table 3.1

Rounds and dates of ECLS-K:2011 data collection.

Wave	Round of data collection	Dates of data collection
1	Fall Kindergarten	August 2010 to December 2010
2	Spring Kindergarten	March 2011 to June 2011
3	Fall First Grade	August 2011 to December 2011
4	Spring First Grade	March 2012 to June 2012
5	Fall Second Grade	August 2012 to December 2012
6	Spring Second Grade	March 2013 to June 2013
7	Spring Third Grade	March 2014 to June 2014
8	Spring Fourth Grade	March 2015 to June 2015
9	Spring Fifth Grade	March 2016 to June 2016

Table 3.2

Percentages of response rate for parent interviews.

Wave	Round	Percentage
1	Fall Kindergarten	58
2	Spring Kindergarten	67
3	Fall First Grade	43
4	Spring First Grade	73
5	Fall Second Grade	39
6	Spring Second Grade	72
7	Spring Third Grade	65
8	Spring Fourth Grade	65
9	Spring Fifth Grade	63

Table 3.3

Percentages of response rate for child-level teacher questionnaires.

Wave	Round	Percentage
1	Fall Kindergarten	76
2	Spring Kindergarten	84
3	Fall First Grade	42
4	Spring First Grade	77
5	Fall Second Grade	41
6	Spring Second Grade	77
7	Spring Third Grade	74

Table 3.4

Selected patterns of data collection for the N = 2,428 students of the initially selected sample; X indicates observed.

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8	Wave 9	N
Pattern	Fall K	Spring K	Fall 1	Spring 1	Fall 2	Spring 2	Spring 3	Spring 4	Spring 5	
1	X	X	X	X	X	X	X	X	X	769
2	X	X		X		X	X	X	X	712
3	X	X		X		X	X	X		51
4	X	X		X		X	X			69
5	X	X		X		X				78
6	X	X		X						102
7	X	X								142
8	X									67
9		X		X		X	X	X		84
10		*other pattern without response in Fall K*								354

Table 3.5

Proficiency levels, labels, and break-down of the scores for preLAS language screener.

Proficiency level	Label	Total (Weighted) Raw Score	Equivalent in *preLAS* Oral Language Component (4-year-olds)
1	NES	0 to 15	0 to 50
2	LES	16 to 19	53.3 to 63.3
3	LES	20 to 22	66.6 to 73.3
4	FES	23 to 25	76.6 to 83.3
5	FES	26 to 30	86.6 to 100

Table 3.6

Descriptive statistics, including weighted means for students' English language proficiency (X1PLTOT and X2PLTOT) and math assessments (X1MSCALK5 to X9MSCALK5).

Round	Description	n	Range (scores)	Weighted mean	Standard deviation
1. Fall Kinder	*preLAS* Total Score	2,413	0 – 20	14.34	5.42
2. Spring Kinder	*preLAS* Total Score	2,347		16.83	4.03
1. Fall Kinder	Math IRT Scale Score	2,383	0–206	28.09	9.23
2. Spring Kinder	Math IRT Scale Score	3,341		42.36	11.38
3. Fall First Grade	Math IRT Scale Score	1,240		51.69	11.53
4. Spring 1st Grade	Math IRT Scale Score	2,417		64.2	12.97
5. Fall 2nd Grade	Math IRT Scale Score	1,239		68.77	13.06
6. Spring 2nd Grade	Math IRT Scale Score	2,419		80.82	15.7
7. Spring 3rd Grade	Math IRT Scale Score	2,413		95.06	16.69
8. Spring 4th Grade	Math IRT Scale Score	2,415		104.42	17
9. Spring 5th Grade	Math IRT Scale Score	2,417		111.83	17.44

Note: Fall kindergarten estimates (X1) and spring kindergarten estimates (X2) are weighted by W1C0. Fall first-grade estimates (X3) are weighted by W3CF3P_30, and spring first-grade estimates (X4) are weighted by W4CS4P_20. Fall second-grade estimates (X5) are weighted by W6CF6P_2A0, and spring second-grade estimates (X6) are weighted by W6CS6P_20. Spring third-grade estimates (X7) are weighted by W7C7P_20. Spring fourth-grade estimates (X8) are weighted by W8C8P_20. Spring fifth-grade estimates (X9) are weighted by W9C9P_20. The unweighted sample n indicates the number of cases with valid data regardless of the presence of a valid analytic weight.

Table 3.7

ECLS-K:2011 questions from the fall of 2010 parent interview (NCES, 2012) used for family language practices variables created for this study.

Variable	Source	Question
Parental use of the home language	P1RES_1 P1RES_2	How often do you use [the non-English language] in speaking to [your child]? Would you say never, sometimes, often, or very often?
Child use of the home language	P1CHL_1 P1CHL_2	How often does [your child] use [the non-English language] in speaking to [you]? Would you say never, sometimes, often, or very often?
Parental academic support	P1TELLST P1SINGSO P1HLPART P1CHORES P1GAMES P1NATURE P1BUILD P1SPORT P1NUMBRS	Now I'd like to talk with you about your child's activities with family members. In a typical week, how often do you or any other family members do the following things with the child? Tell stories to the child? Would you say not at all, once or twice a week, 3-6 times a week, or every day? Sing songs with the child? Help the child to do arts and crafts? Involve the child in household chores, like cooking, cleaning, setting the table, or caring for pets? Play games or do puzzles with the child? Talk about nature or do science projects with the child? Build something or play with construction toys with the child? Play a sport or exercise together? Practice reading, writing or working with numbers? Would you say not at all…once or twice a week…three to six times a week…or every day?
Home language use for academic support	P1NOENG	How often do you or other family members use the [primary language/a language other than English] when doing any of the activities we just talked about? Would you say always…most of the time… sometimes…or never?

Table 3.8

Descriptive statistics, including weighted means, for family language practice variables created for this study.

Variable	n	Range (scores)	Weighted mean	Stand. Dev.
Parental Home Language use	1,893	1-4	3.56	0.6
Child Home Language use	1,893		3.23	0.83
Parental academic support	1,893		2.69	0.53
Home language use for academic support	1,888		3.28	0.83

Note: Fall and spring kindergarten estimates from the parent interviews are weighted by W1_2P0.

Table 3.9

ECLS-K:2011 questions from the general classroom teacher child-level questionnaire (kindergarten spring 2011) used to identify students with language services and the type of language instruction received.

Variable	Question
T2PRGES	Does this child participate in an instructional program designed to teach English language skills to children with limited English proficiency?
T2NSTNL	Would you say the instruction this child receives is primarily…ESL? Bilingual education? Dual-language education? Some other type of instruction?

Table 3.10

Frequencies and percentage of students with language services in kindergarten (including students in submersion contexts).

Type of language instruction	Frequency	Percent	Cumulative Percent
English as a second language	735	36.75	36.75
Bilingual education	384	19.2	55.95
Bilingual education (Dual-language programs)	121	6.05	62
Other	91	4.55	66.55
Submersion students	669	33.45	100
Total	2,000	100	

Table 3.11

ECLS-K:2011 questions (NCES, 2012) from the parent interview (kindergarten year) used for parental background variables used in this study.

Variable	Source	Question
English Proficiency Level	P1SPEAK1 P1READE1 P1WRITE1 P1UNDER1	How well do you… speak English? Would you say very well, pretty well, not very well, or not well at all? Read English? Write English? Understand someone speaking English? [These questions were repeated for the father].
Income Level	X2INCCAT_I	In studies like this, households are sometimes grouped according to income. What was the total income of all persons in your household over the past year, including salaries or other earnings, interest, retirement, and so on for all household members? Was it…? [Interviewer reads scale].
Education Level	X12PAR1ED_I X12PAR2ED_I	What is the highest grade or year of school that you have completed? [Repeated for the father].
Immigration Status	P2PARCT1 P2PARCT2	Now I have a few questions about your country of birth. In what country were you born? [Repeated for the father].

Table 3.12

Descriptive statistics, including weighted means, for family language covariates used in this study (kindergarten year).

Variable	n	Range (scores)	Weighted mean	Stand. Dev.
Level of education (mother)	2,413	1-8	2.66	1.61
Level of education (father)	2,038		2.52	1.56
Level of English proficiency (mother)	1,894	1-4	2.25	0.98
Level of English proficiency (father)	1,594		2.46	0.91
Income level	2,109	1-18	5.72	3.92

Note: Fall and spring kindergarten estimates from the parent interviews are weighted by W1_2P0.

RQ1: What are the patterns of family language practices among dual language learners (DLLs) from kindergarten to fifth grade?

(3)

$$
\begin{aligned}
&(Family\ home\ language\ use)_i \\
&\quad = \beta_{0i} + \beta_{1i}(parent\ education\ level) + \beta_{2i}(parent\ English\ level) \\
&\quad + \beta_{3i}(parent\ income\ level) + \beta_{4i}(parents\ are\ immigrants) \\
&\quad + \beta_{5i}(child\ is\ in\ bilingual\ \ program) + \beta_{6i}(child\ number\ of\ \ siblings) \\
&\quad + \beta_{7i}(time\ in\ months) + e_i
\end{aligned}
$$

RQ2: To what extent are identified family language practices accounting for variance in English language proficiency in DLLs upon entry to kindergarten?

(4)

$$
\begin{aligned}
&(English\ \ proficiency\ scores\ in\ kindergarten)_{ij} \\
&\quad = \beta_{0j} + \beta_{1j}(family.home.language.use)_{ij} \\
&\quad + \beta_{2j}(child.English.proficiency.level)_{ij} \\
&\quad + \beta_{3j}\sum(family.covariates)_{ij} \\
&\quad + r_{ij}
\end{aligned}
$$

(4a)

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

(4b)

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30}$$

RQ3: To what extent are identified family language practices accounting for variance in academic achievement or gains in mathematics in DLLs from kindergarten to fifth grade?

(5)

$$(Math\ IRT scores)_{tij} = \pi_{0ij} + \pi_{1ij}(time.in.months) + e_{tij}$$

(5a)

$$\begin{aligned}\pi_{0ij} = {} & \beta_{00j} + \beta_{01j}(child.type.of.language.program)_{ij} + \beta_{02j}(child.English.proficiency.level)_{ij} \\ & + \beta_{03j}(parental.academic.support)_{ij} + \beta_{04j}(parental.home.language.use)_{ij} \\ & + \beta_{05j}(ch.type.of.lang.program * ch.English.level * par.acad.supp.* par.home.lang.use)_{ij} \\ & + \beta_{06j}\sum(2\text{-}way.interaction.terms)_{ij} \\ & + \beta_{07j}\sum(3\text{-}way.interaction.terms)_{ij} \\ & + \beta_{08j}\sum(family.covariates)_{ij} + r_{0ij}\end{aligned}$$

(5b)

$$\begin{aligned}\pi_{1ij} = {} & \beta_{10j} + \beta_{01j}(child.type.of.language.program)_{ij} + \beta_{12j}(child.English.proficiency.level)_{ij} \\ & + \beta_{13j}(parental.academic.support)_{ij} + \beta_{14j}(parental.home.language.use)_{ij} \\ & + \beta_{15j}(ch.type.of.lang.program * ch.English.level * par.acad.supp.* par.home.lang.use)_{ij} \\ & + \beta_{16j}\sum(2\text{-}way.interaction.terms)_{ij} \\ & + \beta_{17j}\sum(3\text{-}way.interaction.terms)_{ij} \\ & + \beta_{18j}\sum(family.covariates)_{ij} + r_{1ij}\end{aligned}$$

(5c)

$$\beta_{00j} = \gamma_{000} + u_{00j}$$

(5d)

$$\begin{aligned}\beta_{01j} &= \gamma_{010} \\ \beta_{02j} &= \gamma_{020} \\ \beta_{03j} &= \gamma_{030} \\ \beta_{04j} &= \gamma_{040} \\ \beta_{05j} &= \gamma_{040}\end{aligned}$$

(5e)

$$\beta_{10j} = \gamma_{100}$$

Chapter 4: Findings

Introduction

The purpose of this study was to investigate patterns of family language practice across language-minority families and to explore connections between family language practices, English language proficiency, and gains in academic achievement for math in DLLs. The focus of this chapter is on the findings from the analyses performed to explore the following research questions:

RQ1. What are the patterns of family language practices among dual language learners (DLLs) from kindergarten to fifth grade?

RQ2. To what extent are identified family language practices accounting for variance in English language proficiency in DLLs upon entry to kindergarten?

RQ3. To what extent are identified family language practices accounting for variance in academic achievement or gains in mathematics in DLLs from kindergarten to fifth grade?

Exploratory data analyses, multilevel analyses, and findings for each research question will be presented in the next three sections. Following Stapleton, et al. (2016), missing data was handled using information maximum likelihood (FIML) to address potential bias from nonresponse. Unstandardized regression coefficients with robust standard errors are reported in all the Tables. To indicate the relative magnitude of important differences or effect sizes, standardized estimates will be provided in the finding sections using Hox and colleagues' (2010) formula presented in the previous chapter.

Research Question 1 Results

To answer the first research question, a mean response profile analysis of the family language practices for parents and children were conducted using mixed models (Fitzmaurice et al., 2011). A series of two-level models with *time* (in months) representing the level-1 units (i.e., within-student effects), and students with their families representing the level-2 units (i.e., between-student) were fitted and reported in Tables 4.7 and 4.8 to explore parents and children's preferences about how frequently they used a home language other than English from kindergarten to fifth grade.

Tables 4.7 and 4.8 include the fixed and random parameter estimates and robust standard errors for three models. Each of the models focuses on a different aspect of RQ1. The outcome variables come from two questions that were included in the parents' interview during the fall of 2010 (kindergarten), spring 2011 (first grade), fall 2012 (third grade), and spring 2014 (fifth grade) as it was explained before. The sample for RQ1 includes 2,428 Hispanic students who spoke other language than English at home and received language support in English or the home language in any year between kindergarten and fifth grade. Response rates for the parent interviews about were between 73 percent (spring 2011) and 58 percent (fall 2010). Parents were interviewed every year for a period of 75 months. The models in Tables 4.7 and 4.8 are two-level models and do not include schools as a third level. Previous analysis of the data revealed that including a level-3 (school level) was not necessary because the level-3 variance was very close to zero for the parents and children's responses. The results for the three-level models were included in the Appendix for comparison.

Exploratory Data Analyses: Parental and Children Home Language Preferences

Table 4.1 displays the descriptive statistics for parents and children's scores for their preferences for using the home language from kindergarten to fifth grade Parents and children's preference for the home language are highly similar, ranging from 3.57 (parents) and 3.25 (children) in kindergarten to 3.41 (parents) and 3.11 (children) in third grade. The preference for the home language is very strong in this sample. Most of the families reported using the home language often (=3) and always or very often (=4). An inspection of the standard deviations shows that the children's scores have more variability (higher standard deviations) than the parents.

Table 4.2 shows the descriptive statistics for parents' background characteristics in the year of kindergarten. On average, parents in the sample had between 9th and 12th grade completed or had a high school diploma (= 2.67, SD =1.61 for the primary caregiver; 2.52, SD=1.56 for the secondary caregiver). The average level of English proficiency for the sample was between 2 (= not very well) and 3 (= pretty well) for both parents (2.75, SD =0.98 for the primary caregiver, 2.55, SD = 0.91 for the secondary caregiver). The average annual income level for the sample was between $20,001 and $30,000 (categories 5 and 6) for the kindergarten year (5.78, SD = 3.92). Children in the sample had an average of 1.65 siblings (SD = 1.19) in the year of kindergarten.

Table 4.3 includes the percentages of immigrant parents in the sample. About 91 percent of the primary caregivers were immigrant. About 93 percent of the secondary caregivers were immigrants. About 46 percent of the families in the sample had both parents as immigrants. Table 4.4 presents the frequencies and percentages of the types of language support the children received in kindergarten. About 55 percent of the sample

received English as a second language (ESL) and about 38 percent received language instruction in the home language in kindergarten, either as bilingual education or as dual language instruction. About 7 percent of the sample received other types of language support involving mostly English although the details about these other types of language support were not provided by the researchers.

All the variables except for the type of language support in school come from the parent interviews. Missing responses for the parent interviews ranged between 27 percent (spring 2011) and 42 percent (fall 2010). The information about the type of language support in school comes from the teacher questionnaire (student-level). The response rate for the teacher questionnaire in the kindergarten year was 88.2 percent for the child-level questionnaire.

Table 4.5 and Table 4.6 show the correlation matrix for the parental and child use of the home language scores from kindergarten to fifth grade. The correlations for the children's preferences are stronger than for the parents. For both parents and children, the four repeated measures of language preferences scores are reasonable correlated over time. Although this is a relatively short time series, the closer in time the measures are, the higher the correlation between them is, as expected. Correlations between the outcome variable and family background controls were also computed and included in the Appendix. The inspection of the matrices shows that all the variables included in the models are moderately correlated.

Figure 4.1 is a spaghetti plot or time plot of a random subset of 100 families created to examine the mean structure and the within-subject and between-subject variation in parental and child home language use. The time variable is months since the

first parent interview in the fall of 2010. The graphs show that, as time progresses, both parents and children expressed a preference for using more English than the home language. The trend of the growth rate is negative (downwards) and very mild, suggesting a switch to English as students became older. The graph also shows important variability among the families, especially for children's scores.

Table 4.1

Descriptive statistics for home language use (parents and children) from kindergarten to fifth grade (3 = often; 4 = always).

	Home Language use			
	Parents		Children	
	Mean	Std. Dev.	Mean	Std. Dev.
Fall of 2010 (kindergarten)	3.57	0.60	3.25	0.83
Spring 2011 (first grade)	3.48	0.65	3.16	0.83
Fall 2012 (third grade)	3.41	0.70	3.11	0.85
Spring 2014 (fifth grade)	3.49	0.65	3.12	0.88

Table 4.2

Descriptive statistics for parents' background characteristics in the year of kindergarten.

	Mean	Std. Dev.	Median	Range
Level of education (mother)	2.67	1.61	2	1-8
Level of education (father)	2.52	1.56	2	1-8
Level of English proficiency (mother)	2.75	0.98	3	1-4
Level of English proficiency (father)	2.55	0.91	2.75	1-4
Income level	5.78	3.92	5	1-18

Table 4.3

Percentage of immigrant parents (n = 2,428).

Percentage of immigrant parents	
Primary caregiver	91.27
Secondary caregiver	92.71
Both caregivers	46.25

Table 4.4

Frequencies and percentages of the types of language support in kindergarten.

Language support in kindergarten	Frequency	Percent
English as a second language (ESL)	735	55.22
Bilingual education	505	37.94
Other types of language support	91	6.84
Total	1331	100

Table 4.5

Correlation matrix for parental use of the home language scores from kinder to fifth grade (n=744).

		Parental use of the home language			
		1.	2.	3.	4.
1.	Fall of kindergarten	1.00			
2.	Spring of first grade	0.39	1.00		
3.	Fall of third grade	0.34	0.39	1.00	
4.	Spring of fifth grade	0.34	0.39	0.41	1.00

Table 4.6

Correlation matrix for child use of the home language scores from kinder to fifth grade (n=742).

		Child use of the home language			
		1.	2.	3.	4.
1.	Fall of kindergarten	1.00			
2.	Spring of first grade	0.45	1.00		
3.	Fall of third grade	0.39	0.48	1.00	
4.	Spring of fifth grade	0.41	0.48	0.53	1.00

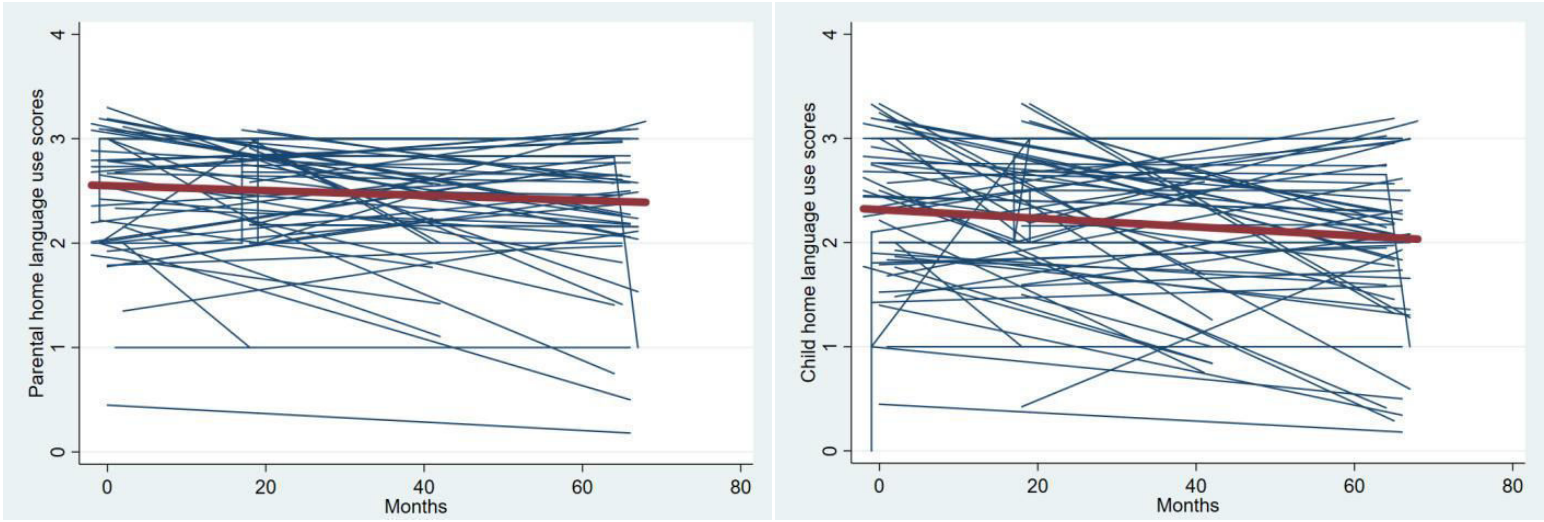


Figure 4.1. Spaghetti plots of a random sample of 100 families for home language use scores over months since the first parent interview (fall of 2010).

Findings for RQ1 (Parental Home Language Preferences)

To answer RQ1, this section focuses on three models (Baseline Model, Unconditional Growth Model and Conditional Model) reported in Table 4.7.

Model 1: Baseline Model

Table 4.7 includes Model 1 or the unconditional means model (Singer & Willet, 2003) that was used to answer the following question: RQ1.1. What are the parental preferences for using the home language?

It was found that the parents' average score for using the home language was 2.48 points (SE = 0.01, $p<0.001$) on a weekly frequency scale that ranged from 0 (never use the home language) to 3 (always use home language) from kindergarten to fifth grade across schools. In addition, Model 1 was used to calculate the intraclass correlation coefficient (ICC) to investigate the proportion of variance in scores for parental language preferences (the outcome) between students within schools (level-2 units) (Raudenbush & Bryk, 2002). It was found that 37.53 percent of the variance in scores for parental language preferences can be attributed to differences between students over time.

Model 2: Unconditional Growth Model

Model 2 is an unconditional growth model (Singer & Willet, 2003) with the addition of a linear effect of time in level-1. This model focuses on answering the following subquestion: RQ1.2. What is the growth rate of the parental preferences for using the home language from kindergarten to fifth grade?

As discussed in the previous chapter, the time variable is the number of months since the first parent interview in 2010 and was centered at November 2010, the fall of kindergarten or the baseline year, when 60.76 percent of kindergarten parents had already

been interviewed for the first time in order to make the regression intercept interpretable (Fitzmaurice et al., 2011).

The fixed effect parameters in Model 2 showed that the intercept or average score in parental home language preference in the fall of kindergarten was 2.52 points (SE = 0.01, $p<0.001$) on a weekly frequency scale that ranged from 0 (never use the home language) to 3 (always use home language). The growth rate or average monthly rate for the scores for parental home language preference was very close to zero and negative (-0.00, SE = 0.00, $p<0.001$), suggesting that parents may have a mild preference to use English at home over the period between kindergarten and fifth grade.

Although the growth rate for parental use of the home language was statistically significant, for practical purposes it is possible to conclude that there was no change in patterns of parental language preferences from kinder to fifth grade. This finding is in agreement with the visual inspection of a random sample of the parents' language preferences in Figure 4.1 and the exploratory data analysis included in the previous section.

An examination of the random effect parameters revealed that the levels of variance across level-1 (0.27, SE = 0.01, $p<0.001$), and level-2 (0.16, SE = 0.01, $p<0.001$) remained virtually unchanged. After the addition of the time variable, the model fit for Model 2 slightly improved (AIC = 11392.02) in contrast to the unconditional Model 1 (AIC = 11410.70).

Model 3: Conditional Model (Parent and Child Background Characteristics)

Model 3 focuses on the differences in scores for parental language preferences in the fall of kindergarten conditional on parent and child background characteristics. Since

the growth rate of the scores was estimated to be almost zero, kindergarten or the baseline year was selected to investigate how parent and child characteristics were related to patterns of family language practices. The research question that informs this model is the following: RQ1.3. To what extent are parents and children's background characteristics accounting for variance in parental preferences for using the home language in kindergarten?

Below there is a list of the parental characteristics that were included in Model 3. Categorical variables were centered to the value representing roughly half of the sample.

1. Level of education: the average level of education across the two parents when a child had two parents. This categorical variable goes from 1 = 8th grade or below, to 8 = master's degree or higher. It was centered at 2 (9th to 12th grade completed), which represented 56.06 percent of the sample.
2. Level of English proficiency: the average of four items from the fall kindergarten parent interview in which parents self-evaluated their reading, speaking, understanding, and writing in English. When a child had two parents, the level of English was average across parents. The scale ranges from 1 (not well at all) to 4 (very well). It was centered at 2.25 (2 = not very well; 3 = pretty well), which represented 53.20 percent of the sample.
3. Level of income: This is a categorical variable that ranges from 1 (an income level of $5,000 or less the year before the child attended kindergarten) to 18 (an annual income level of $200,001). The variable was transformed using the natural log to address non-normal distribution and skewness. It was centered to the income category

of 5 (an annual income of $20,001 to $25,000) which represented 63.09 percent of the sample.

4. Both parents are immigrants: This is a dichotomous variable (1= both parents are immigrant). 46.25 percent of the families had both parents as immigrant in the sample.

Children characteristics that were included in Model 3 are the following:

1. Bilingual instruction in kindergarten: This is a dichotomous variable (1= child received instruction in school in the home language). 25.25 percent of the students received bilingual instruction in kindergarten.
2. Number of siblings: This is a continuous variable that goes from 0 (no siblings) to 10 siblings. This variable was not centered.

Maximum likelihood revealed that the fixed effect for the intercept or the estimated score for parental language preferences in the fall of kindergarten was 2.45 points (SE = 0.04, $p<0.001$) for a family with the median level of education, English proficiency, and income, keeping constant the immigration background of the parents, the type of language support the child received at school, and the number of siblings the child had.

The estimated difference in parental language preferences scores for parents with higher levels of education than the median (at least 12th grade) was positive and significant for the intercept, holding everything constant. For one unit increase in the parents' level of education, parents' preference for using the home language increased by 0.04 (SE = 0.01, $\beta = 0.08$, $p<0.01$). In contrast, the estimated difference in parental language preferences scores for parents with higher levels of English proficiency than the

median (pretty well or very well) was negative and also significant for the intercept, holding everything constant. For one unit increase in the parents' level of English proficiency, parents' preference for using the home language decreased by -0.22 (SE = 0.02, β = -0.28, p<0.001).

When both parents in the family were immigrants, parents' preference for using the home language increased by 0.10 (SE = 0.03, β = 0.07, p<0.01), holding everything else constant. It was also found that when the child in the family received bilingual instruction or support in the home language in school during kindergarten, parents' preference for using the home language increased by 0.12 (SE = 0.03, β = 0.08, p<0.001), keeping everything else constant. The income level and the number of children at home (siblings of the focus child) were not statistically significant.

An examination of the variance components shows that level-1 residual variance decrease by 3.7 percent from model 2 (0.27, SE = 0.01, p<0.001) to model 3 (= 0.26, SE = 0.01, p<0.001). The level-1 residual variance summarizes the average scatter of a parent's observed score in family language preferences around his or her own true change trajectory. The level-2 variance also declined by 31.25 percent from model 2 (0.16, SE = 0.01, p<0.001) to model 3 (= 0.11, SE = 0.01, p<0.001). The level-2 variance components quantify the amount of unpredicted variation within schools, among students and families. Model fit for Model 3 (AIC = 5728.60) improved when compared to Model 2 (AIC = 11392.02).

Findings for RQ1 (Children Home Language Preferences)

This section is dedicated to the findings regarding the children's home language preferences and is divided in three parts, like the previous section. Each part parallels the

analysis of the parents' responses. The results are summarized in three Models included in Table 4.8.

Model 1: Baseline Model

Model 1 answers the following subquestion: RQ1.1. What are the children's preferences for using the home language? It was found that children's average score for using the home language was 2.15 points (SE = 0.02, p<0.001) on a weekly frequency scale that ranged from 0 (never use the home language) to 3 (always use home language) from kindergarten to fifth grade across schools. In addition, the ICC was calculated using Model 1 and it was found that 46.55 percent of the variance in scores for children's language preferences can be attributed to differences between students over time.

Model 2: Unconditional Growth Model

Model 2 is an unconditional growth model with the addition of a linear effect of time in level-1. This model focuses on the following question: RQ1.2. What is the growth rate of the children preferences for using the home language from kindergarten to fifth grade? The fixed effect parameters in Model 2 showed that the intercept or average score in children's home language preference in the fall of kindergarten was 2.21 points (SE = 0.02, p<0.001) on a weekly frequency scale that ranged from 0 (never use the home language) to 3 (always use home language).

The growth rate or average monthly rate for the scores for children's home language preference was very close to zero and negative (-0.00, SE = 0.00, p<0.001), suggesting that children may have a mild preference to use English at home over the period between kindergarten and fifth grade. Again, although the growth rate for children's use of the home language was statistically significant, for practical purposes it

is possible to conclude that there was no change in patterns of children's language preferences from kinder to fifth grade. This finding is in agreement with the visual inspection of a random sample of the children's language preferences in Figure 4.1 and the exploratory data analysis included in the previous section.

An examination of the random effect parameters revealed that the levels of variance across level-1 (0.39, SE = 0.01, $p<0.001$) and level-2 (0.34, SE = 0.02, $p<0.001$) remained virtually unchanged. After the addition of the time variable, the model fit for Model 2 improved (AIC = 14082.94) in contrast to the unconditional Model 1 (AIC = 14119.08).

Model 3: Conditional Model (Parent and Child Background Characteristics)

Model 3 focuses on the differences in scores for children's language preferences in the fall of kindergarten conditional on parent and child background characteristics. The research question that informs this model is the following: RQ1.3. To what extent are parents and children's background characteristics accounting for variance in children's preferences for using the home language in kindergarten?

The parents and children's background covariate are the same that were listed in the analysis of the parental data. Maximum likelihood (ML) revealed that the fixed effect for the intercept or the estimated score for children language preferences in the fall of kindergarten was 2.16 points (SE = 0.05, $p<0.001$) for a family with a median level of education, English proficiency, and income, keeping constant the immigration background of the parents, the type of language support the child received at school, and the number of siblings the child had.

The estimated difference in children's language preferences scores for a child with parents with higher levels of English proficiency than the median (pretty well or very well) was negative and significant for the intercept, holding everything constant. For one unit increase in the parents' level of English proficiency, children's preference for using the home language decreased by -0.33 (SE = 0.03, β= -0.33, p<0.001).

The estimated difference in children's language preferences scores for a child with parents with income levels higher than the median (an annual income level of at least $25,001) was also negative and significant for the intercept, holding everything constant. For one unit increase in the parents' income level (transformed using the natural log), children's preference for using the home language decreased by -0.09 (SE = 0.04, β= -0.06, p<0.05).

When both parents in the family were immigrants, children's preference for using the home language increased by 0.12 (SE = 0.04, β= 0.07, p<0.01), holding everything else constant. The parents' level of education was not significant for the intercept. It was also found that when the child received bilingual instruction or support in the home language in school during kindergarten, the child's preference for using the home language increased by 0.27 (SE = 0.04, β= 0.15, p<0.001), holding everything else constant. In contrast, the number of siblings a child was negative and significant for the intercept. For each additional sibling a child had between kindergarten and fifth grade, a child's preference for using the home language decreased by -0.03 (SE = 0.01, β= -0.04, p<0.001), holding everything else constant.

An examination of the variance components shows that level-1 residual variance increased by 2.63 percent from model 2 (0.38, SE = 0.01, p<0.001) to model 3 (= 0.39,

SE = 0.01, p<0.001). The level-2 variance decreased by 44.11 percent from model 2 (0.34, SE = 0.02, p<0.001) to model 3 (= 0.19, SE = 0.02, p<0.001). Model fit for Model 3 (AIC = 7073.08) improved when compared to Model 2(AIC = 14082.94).

Figure 4.2 displays the growth trajectory from the unconditional growth model (Model 2) for both parents and children's home language use preferences. The values plotted are the predicted estimates for parent and child home language use from a model with no substantive predictor at any level. Both groups show similar high values, which means that in this sample there was a strong preference for the use of the home language. The predicted lines also have mild negative slopes indicating that over time, parents and children preferences for using the home language diminished.

Table 4.7

Fixed and random estimates, including robust standard errors (in brackets), for parents' family language practices from kindergarten to 5th grade.

Fixed Effect Parameters	Model 1 n = 2,428	Model 2 n = 2,428	Model 3 n = 982
Parental use of the home language	2.48*** (0.01)	2.52*** (0.01)	2.45*** (0.04)
Control variables (parents)			
Level of education			0.04** (0.01)
Level of English proficiency			-0.22*** (0.02)
Income (categorical)			0.01 (0.03)
Both parents are immigrants			0.10** (0.03)
Control variables (child)			
Bilingual instruction in kindergarten			0.12*** (0.03)
Number of siblings			-0.01 (0.01)
Linear growth rate (in months)		-0.00*** (0.00)	-0.00*** (0.00)
Random Effect Parameters			
Level-2 variance	0.16*** (0.01)	0.16*** (0.01)	0.11*** (0.01)
Residual variance	0.27*** (0.01)	0.27*** (0.01)	0.26*** (0.01)
AIC	11410.70	11392.02	5728.60

* p<0.05; ** p<0.01; *** p<0.001

Table 4.8

Fixed and random estimates, including robust standard errors (in brackets), for children's family language practices from kindergarten to 5th grade.

Fixed Effect Parameters	Model 1 n = 2,428	Model 2 n = 2,428	Model 3 n = 982
Children use of the home language	2.15*** (0.02)	2.21*** (0.02)	2.16*** (0.05)
Control variables (parents)			
Level of education			0.02 (0.02)
Level of English proficiency			-0.33*** (0.03)
Income (categorical)			-0.09* (0.04)
Both parents are immigrants			0.12** (0.04)
Control variables (child)			
Bilingual instruction in kindergarten			0.27*** (0.04)
Number of siblings			-0.03* (0.01)
Linear growth rate (in months)		-0.00*** (0.00)	-0.00*** (0.00)
Random Effect Parameters			
Level-2 variance	0.34*** (0.02)	0.34*** (0.02)	0.19*** (0.02)
Residual variance	0.39*** (0.01)	0.38*** (0.01)	0.39*** (0.01)
AIC	14119.08	14082.94	7073.08

* p<0.05; ** p<0.01; *** p<0.001

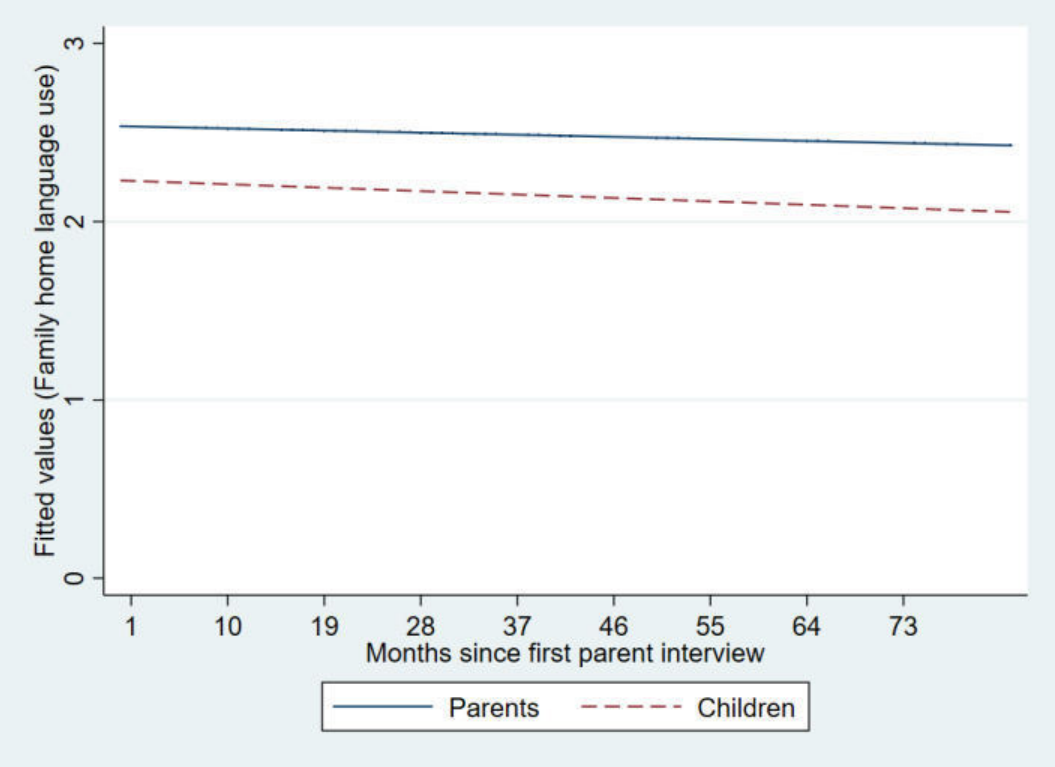


Figure 4.2. Prototypical trajectory from Model 2 (unconditional growth model) for parent and child home language preferences.

Research Question 2 Results

This section will address the following question: RQ2. To what extent are identified family language practices accounting for variance in English language proficiency in DLLs upon entry to kindergarten? Table 4.11 includes the fixed and random parameter estimates and robust standard errors for the unconditional or baseline model with the *preLAS* 2000 language screener score as outcome variable. The outcome variable selected is the raw number-right scores or the average of the "Simon Says" and the "Art Show" tasks the ECLS-K:2011 researchers selected as the student English language screener. 77 percent of scores used for RQ2 were collected in the fall of kindergarten. 19 percent of the scores were collected in the spring of kindergarten. For the kindergarten year, four percent of the *preLAS* scores were missing. The sample for RQ2 is composed of Hispanic students who spoke other language than English at home and received language instruction in school during kindergarten (n = 1,759 students). A series of two-level models with students representing the level-1 units (i.e., between-student effects), and students within schools representing the level-2 units (i.e., between-school) were fitted and reported in Table 4.11. All models were calculated using maximum likelihood.

Exploratory Data Analyses: Language Screener Scores

Table 4.9 shows the percentages and descriptive statistics for the *preLAS* language screener scores based on the total raw scores from the kindergarten year. 21 percent of the children were identified as non-English speakers (NES) according to the cutoff recommended by the publisher and used by the researchers. This cutoff was used to reroute Spanish-speaking students to the Spanish assessment when the children were

tested in math and reading, among other assessments. The raw score mean for the NES group was 4.55 (SD = 3.26). The group identified as limited English speakers (LES) represented 22 percent of the sample, and had a raw score mean of 12.75 (SD = 1.60). Finally, the group identified as fluent English speakers (FES) represented 57 percent of the sample, and had a raw score mean of 17.60 (SD = 1.68).

Table 4.10 shows the correlation matrix for the English language screener (total raw scores) and family use of the home language scores (parents and children) for the kindergarten year. The correlations are between -0.19 (between *preLAS* scores and parental language use) and 0.64 (between parental and child home language use). The Appendix also includes a correlation matrix for the English language screener and the family background characteristics that were included in final models. Both matrices show that the variables included in the analyses are moderately correlated.

Figure 4.3 is a scatter plot of the full sample created to examine the relation between the *preLAS scores* and family language use. The parents' plot shows that higher levels of parental home language use (3 and 4 in the language use scale) are associated with a wide of range identified English proficiency groups (NES, LES, FES). It also shows that a large proportion of the parents indicated that they use the home language very frequently (4 = very often or always), as it was discussed in the previous section. Parents who indicated using the home language less frequently (1 and 2 in the language use scale) are fewer and the patterns of association show that students' identified English language proficiency is varied, ranging from NES to FES. The children's home language use scatter plot is similar to the parents' one. The most remarkable difference between the children's and parents' graphs is that in the case of the child home language use, low

levels of home language use (1 in the language use scale) seem to be associated with a larger number of students identified as FES (fluent).

Table 4.9

Percentages and descriptive statistics for the preLAS language screener (total raw score) in kindergarten.

	Percent	Mean	SD
Non-English speaker (NES)	21	4.55	3.26
Limited English speaker (LES)	22	12.75	1.60
Fluent English speaker (FES)	57	17.60	1.68
Total	100	13.77	5.55

Table 4.10

Correlation matrix for the preLAS language screener (total raw score) and family language use (n=995).

	1.	2.	3.
1. Language screener scores	1.00		
2. Parental home language use	-0.19	1.00	
3. Child home language use	-0.28	0.64	1.00

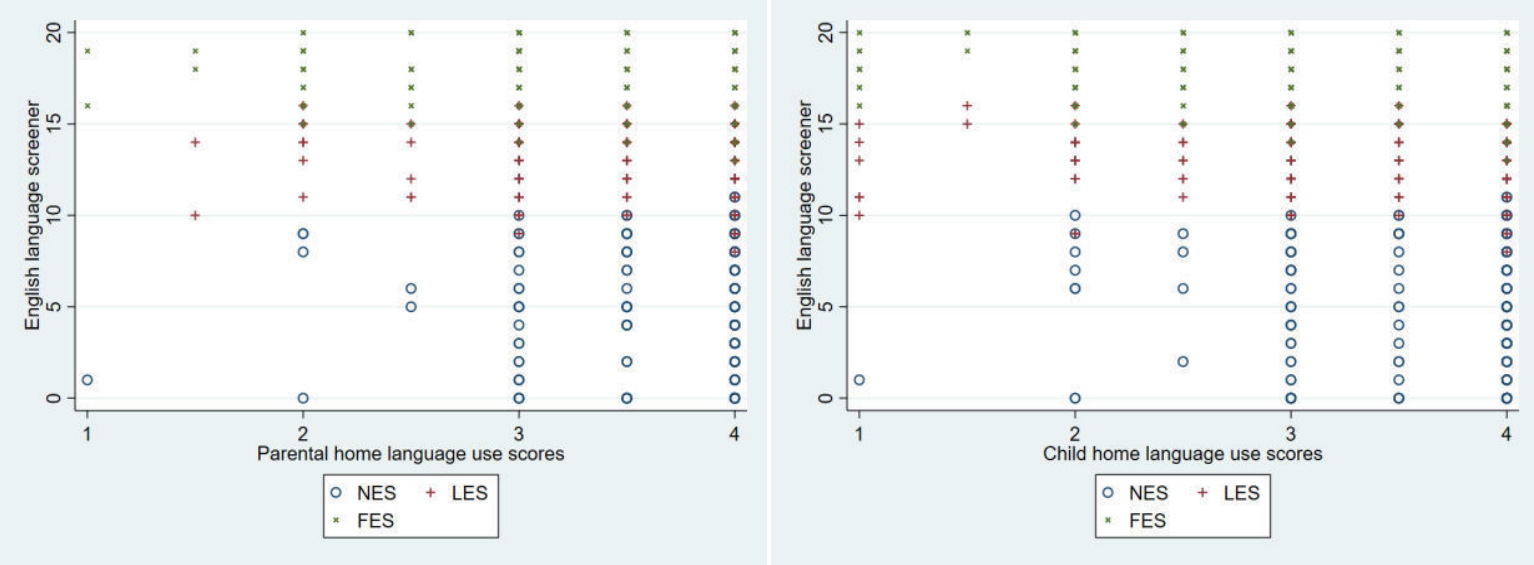


Figure 4.3. Scatter plots of English language screener scores and family home language use (parents on the left side, children on the right side) during kindergarten.

Findings for RQ2

Model 1: Baseline or Unconditional Means Model

Model 1 in Table 4.11 was used to calculate the ICC and investigate the proportion of variance in *preLAS* scores (the outcome) between schools (level-2 units). It was found that 17.02 percent of the variance in the *preLAS* scores can be attributed to differences between the schools the students attended.

Model 2: Conditional Model (Variables of Interest)

Model 2 in Table 4.11 focuses on the differences in *preLAS* scores upon entry to kindergarten conditional on the language preferences of parents and children. The main variables of interest, Parental use of the home language and Child use of the home language, are continuous variables that range from 0 (only English) to 3 (only the home language).

Maximum likelihood revealed that the fixed effect for the intercept or the estimated *preLAS* score at kindergarten entry was 18.18 points (SE = 0.77, $p<0.001$) for a student who preferred to use English at home, received language support in kindergarten, and had parents who also preferred to use English at home. A student with an average of 18 points in the total raw scores for the *preLAS* was identified as LES (limited English speaker) according to the researchers and *preLAS* publishers' recommended cutoff scores.

In the case of parental use of the home language, it was found that for each unit of parental preference for the home language, the estimated difference in *preLAS* scores in kindergarten was negative, very small, and not significant (=-0.25, SE = 0.36, β = -0.03, $p>0.05$), holding constant child use of the home language. Regarding child use of the

home language, for each unit of the child preference for the home language, the estimated difference in *preLAS* scores in kindergarten was negative and significant (=-1.66, SE = 0.24, β = -0.23, p<0.001), holding constant parental use of the home language.

An examination of the variance components shows that the residual variation or level-1 residual variance decrease by 4.04 percent from model 1 (=23.74, SE = 1.26, p <0.001) to model 2 (=22.78, SE = 1.42, p <0.001). Model fit for Model 2 (AIC = 6094.18) improved when compared to Model 1 (AIC = 9311.45).

Model 3: Conditional Model (Controls for Language Proficiency)

Model 3 in Table 4.11 builds upon Model 2 by adding controls for the English language proficiency of the students. The fixed effect for the *preLAS* score at kindergarten entry or intercept was 5.71 points (SE = 0.41, p<0.001) for a student who was identified as NES by the language screener, preferred to use English at home, received language support in kindergarten, and had parents who also preferred to use English at home.

Regarding family language preferences, it was found that for each unit of parental preference for the home language, the estimated difference in *preLAS* scores in kindergarten was positive but very small and not significant (=0.01, SE = 0.15, β = 0, p>0.05) for a child identified as NES, holding constant child use of the home language. In the case of child use of the home language, for each unit of the child preference for the home language, the estimated difference in *preLAS* scores in kindergarten for a child identified as NES was negative and significant (=-0.40, SE = 0.11, β = -0.06, p<0.001), holding constant parental use of the home language.

An examination of the variance components shows that the residual variation or level-1 residual variance decrease by 81.30 percent from model 2 (=22.78, SE = 1.42, $p<0.001$) to model 3 (=0.22, SE = 4.26, $p <0.001$). Model fit for Model 3 (AIC = 4323.48) improved when compared to Model 2 (AIC = 6094.18).

Another model was fitted and included in the Appendix. This last model (Model 4) adds other relevant covariates to Model 3 to control for child and parent characteristics. The covariates to control for child's characteristics were gender and age when first tested in kindergarten. Parents' characteristics were controlled using parental levels of education, English proficiency (self-reported), and income (also self-reported for the tax year when the child was attending kindergarten). Only the child's age when tested for the first time in kindergarten was significant. The fixed effect for the intercept (= 6.23, SE = 0.55, $p<0.001$) and estimated differential for parental (=0.05, SE = 0.16 $p>0.05$) and child uses of the home language were very similar to Model 3 (=-0.42, SE = 0.11 $p<0.001$), holding constant child and parents' characteristics. Correlations between the outcome variable and the included family background controls were also computed and included in the Appendix.

Figure 4.4 below is the prototypical trajectory for NES, LES, and FES students from a multilevel regression analysis with parental home language use scores as predictor and keeping constant children language preferences. In this case, children who were identified as using the home language "often" were selected (n=989). Parental home language use scores ranged from sometimes (=1) to always (=3) in this subsample as it can be observed in the graph. The predicted trajectories for the three levels of English

proficiency are parallel and there is virtually no slope which shows that parental home language use does not significantly explain the variation in the students' *preLAS* scores.

Table 4.11

Fixed and random estimates, including robust standard errors (in brackets) for the preLAS language screener (total raw score).

Fixed Effect Parameters	Model 1 n=1,759	Model 2 n=995	Model 3 n=995
Score at kindergarten entry	13.99***	18.18***	5.71***
	(0.21)	(0.77)	(0.41)
Parental use of the home language		-0.25	0.01
		(0.36)	(0.15)
Child use of the home language		-1.66***	-0.40***
		(0.24)	(0.11)
LES student			7.90***
			(0.26)
FES student			12.52***
			(0.26)
Random Effect Parameters			
Level-2 variance	6.79***	5.43***	0.22**
	(1.02)	(1.07)	(0.10)
Residual variance	23.74***	22.78***	4.26***
	(1.26)	(1.42)	(0.23)
AIC	9311.45	6094.18	4323.48

* p<0.05; ** p<0.01; *** p<0.001



Figure 4.4. Prototypical trajectory for NES, LES, and FES students from multilevel regression analyses with parental home language use scores as predictor and keeping constant children language preferences to *often* (=2).

Research Question 3 Results

This section will address the following question: RQ3. To what extent are identified family language practices accounting for variance in gains in mathematics in DLLs from kindergarten to fifth grade? There are three parts in this section. The first part presents results for baseline models to investigate the variance in math IRT scores within students, between students, and between schools before fitting a three-level hierarchical model with fixed and random effects. The second part shows the results for models comparing differences in variance in math IRT scores in students attending ESL programs versus bilingual programs. The third part includes results for models comparing differences in variance in math IRT scores in students in submersion classrooms (i.e., English language learners with no language support during the kindergarten year) versus students with language support in school in kinder.

In addition, RQ3 was divided in two subquestions to address first the initial status of the students' math scores upon entry to kindergarten (RQ3.1 and RQ3.3) and then the growth rate in math scores from kindergarten to fifth grade (RQ3.2 and RQ3.4). The models in Tables 4.16 and 4.17 are three-level models with *time* (in months) representing the level-1 units (i.e., within-student effects), students representing the level-2 units (i.e., between-student and within-school effects), and schools representing the level-3 units (i.e., between-school effects). All the estimates were calculated using maximum likelihood.

Exploratory Data Analyses: Math IRT Scores

Table 4.12 displays descriptive statistics for math scores from kindergarten to fifth grade. The means and standard deviations reported in Table 4.1 show that the children's math scores increased dramatically over a span of six years, going from an average of 28.41 points in kindergarten (SD = 9.23) to an average of 110.9 points in fifth grade (SD = 17.44). An examination of the standard deviations shows how the variability in math scores also increases over time.

Table 4.12 includes the descriptive statistics for the two variables of interest in this section: parental academic support (mean = 2.69, SD = 0.53) and home language use for academic support (mean = 3.3, SD = 0.83). These variables come from the fall 2010 kindergarten parent interview, which had a 58 percent response rate according to the researchers. Both variables of interest are on a weekly frequency scale that goes from 1 (never) to 4 (very often or always). As explained before, parental academic support is the average of nine items included in the section of the parent interview dealing with parental engagement. Home language use for academic support is the follow-up question after the nine items averaged. A table with descriptive statistics for all the items used for the variables of interest can be found in the Appendix.

Table 4.14 has the percentages of students with language services in kindergarten, including students who were in a submersion context during kindergarten. 39 percent of the students in the sample received language instruction in English or ESL services in kindergarten, while 26 percent attended bilingual programs that offered support in the home language. This later group also includes students attending dual language programs. Students who did not receive language instruction in kindergarten but later in

elementary school received language instruction in English (ESL services) were identified as submersion students. This group represents 35 percent of the sample. The table also displays the percentages of students with different English language proficiency according to the language screener given by the researchers. 17 percent of the students in the sample were identified as NES according to the *preLAS* screener. Most of the NES students received bilingual education. 20 percent of the students in the sample were identified as LES and almost half of them received ESL services. Identified FES students composed the rest of the sample, with roughly a third of them receiving ESL services. A table with student frequencies per group was included in the Appendix.

The correlation matrix in Table 4.15 shows that the nine repeated measures of math IRT scores are reasonable correlated over time. As it is expected, the closer in time the measures are, the higher the correlation between them is and when the measures become more spaced in time, the correlations between measures decreases. In addition, it was included in the Appendix a correlation matrix with the nine repeated measures and all family background characteristics that were included in the final models. The inspection of the matrix shows that the variables included in the model are moderately correlated with the outcome variable.

Figure 4.1 is a spaghetti plot or time plot of a random subset of 100 participants created to examine the mean structure and the within-subject and between-subject variation. The analysis conducted to answer RQ3 uses time as student age in months since the first assessment. Figure 4.1 shows that, as time progresses, students make gains in math scores. The trend of the growth rate is positive (upwards) with a slight curvature at the end of the collection period, suggesting that student learning decelerate when

students are older. The graph also shows important variability among the participants, which increases as students become older, giving the graph a slightly fan shape.

Table 4.12

Descriptive statistics for math IRT scores from kindergarten to fifth grade.

	Mean	S.D.	Min.	Max.
Fall 2010 kindergarten	28.41	9.23	11.96	74.23
Spring 2011 kindergarten	43.01	11.38	11.75	80.74
Fall 2011 1st grade	51.67	11.53	14.89	97.52
Spring 2012 1st grade	64.16	12.97	12.7	108.36
Fall 2012 2nd grade	68.52	13.06	14.21	117.36
Spring 2013 2nd grade	80.6	15.7	21.86	125.17
Spring 2014 3rd grade	94.69	16.69	43.45	136.32
Spring 2015 4th grade	103.89	17	31.24	146.41
Spring 2016 5th grade	110.9	17.44	26.76	147.28

Table 4.13

Descriptive statistics for parental academic support in kindergarten (weekly frequency ranging from 1 = never to 4 = always).

	Mean	S.D.
Parental academic support	2.69	0.53
Home language use for academic support	3.3	0.83

Table 4.14

Percentage of students with language services in kindergarten (including submersion contexts) (n = 1,903).

	NES	LES	FES	Total
English as a second language	5	9	25	39
Bilingual education	10	7	10	26
Submersion context	3	4	28	35
Total	17	20	63	100

Table 4.15

Correlation matrix for Math IRT scores from kindergarten to fifth grade (n=769).

		1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Fall 2010 kindergarten	1.00								
2.	Spring 2011 kindergarten	0.71	1.00							
3.	Fall 2011 1st grade	0.67	0.78	1.00						
4.	Spring 2012 1st grade	0.64	0.72	0.80	1.00					
5.	Fall 2012 2nd grade	0.62	0.70	0.76	0.84	1.00				
6.	Spring 2013 2nd grade	0.60	0.68	0.75	0.78	0.82	1.00			
7.	Spring 2014 3rd grade	0.59	0.68	0.70	0.73	0.75	0.83	1.00		
8.	Spring 2015 4th grade	0.57	0.64	0.68	0.71	0.74	0.81	0.86	1.00	
9.	Spring 2016 5th grade	0.55	0.64	0.68	0.70	0.72	0.78	0.83	0.87	1.00

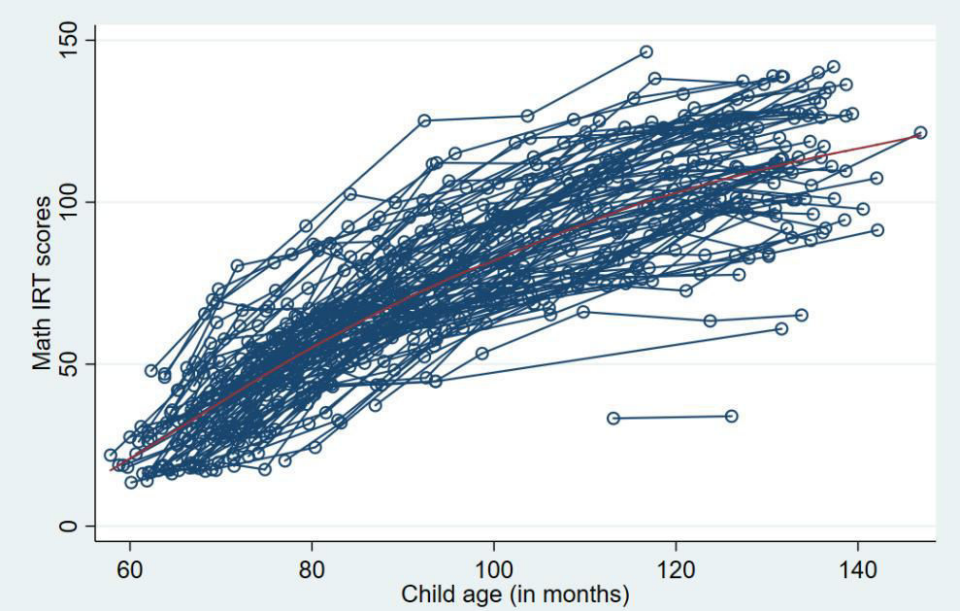


Figure 4.5. Spaghetti plot for math IRT scores over child age in months since the first assessment (loess superimposed).

Findings for RQ3

Results for Baseline Models for RQ3

Table 4.16 and 4.17 include the fixed and random parameter estimates and robust standard errors for the unconditional or baseline model with math IRT scores as outcome variable. Model 1 and 2 in Table 4.16 and 4.17 are discussed below. The sample for model 1 and 2 includes all the Hispanic students who reported speaking other language than English at home that were initially identified (N = 2,428 students).

Model 1: Unconditional Means Model

Model 1 or the unconditional means model was used to calculate the ICC and investigate the proportion of variance in math scores (the outcome) between students within schools (level-2 units) and between schools (level-3 units) (Raudenbush & Bryk, 2002). It was found that 32.65 percent of the variance in math scores can be attributed to differences between students over time while 22.14 percent can be attributed to the schools the students attended.

Model 2: Unconditional Quadratic Change Model

A visual inspection of a random sample (n=100) of the individual child math growth trajectories (Figure 4.1) indicates a nonlinear growth pattern with a decelerating curvature but increasing pattern. A sequence of models was fitted to model curvilinear change by adding first a linear effect of time, and then adding a quadratic term of time in level-1. The results for this sequence of models can be found in the Appendix.

Table 4.16 includes Model 2, a quadratic unconditional growth model that adds a linear term, *time,* and a quadratic term, $time^2$, to Model 1 to take into account the observed nonlinear growth pattern. As explained before, the time variable is the child's

actual age (to the nearest month) on the day he or she was assessed. The time variable was centered at the mean age in months (= 66.84) when students were tested for the first time in kindergarten to make the regression intercept interpretable. When covariates were included, the centered age when children were first tested at the baseline was added to control for the unbalanced design of the data panel.

The estimated score at kindergarten entry or intercept was 29.91 (SE = 0.32, p<0.001) for a child with the average age when students were tested for the first time. The instantaneous growth rate at the age of 66.84 months was 2.01 (SE = 0.02, p<0.001) points in math scores and the mean acceleration was -0.01 (SE = 0.00, p <0.001). This means that the trajectory of math scores initially increased but it did not persist and with each passing month, the magnitude of the outcome's raising values diminished. Figure 4.6 below includes a visual representation of the prototypical trajectory from this model.

The variance components were examined and reported in Table 4.17. The temporal variation or level-1 residual variance summarizes the average scatter of a child's observed math score around his or her own true change trajectory. There was an important decline of 92 per cent in the level-1 residual variance from model 1 (717.15, SE = 13.12, p<0.001) to model 2 (= 55.20, SE = 1.11, p<0.001), although some important within-person variation still remains at level-1.

The level-2 variance components quantify the amount of unpredicted variation within schools, among students and families. There was statistically significant variation in individual kindergarten math scores at 66.84 months (=157.86, SE=5.471, p <0.001). Similarly, the level-3 variance components, which quantify the amount of unpredicted variation between schools, showed that there was statistically significant variation in

school mean initial status or kindergarten math scores (=14.47, SE=4.54, p <0.001). Finally, the model fit of Model 2 was improved (AIC = 121809.3) in contrast to Model 1 (AIC = 157965.1).

Results for Models Comparing ESL Students versus Students in Bilingual Instruction

Table 4.16 and 4.17 include the fixed and random parameter estimates and robust standard errors for Model 3 and Model 4 comparing math IRT scores for students in ESL and bilingual language instruction groups. Regarding the sample used in this section, only students who received either ESL, bilingual or dual language education in the kindergarten year were selected to investigate RQ3.1 and RQ3.2 (n = 1,236 students) from the initial sample of Hispanic students who spoke other language than English at home (N = 2,428). Students identified by the teacher as receiving other types of language instruction were dropped because of lack of details about the language involved in the type of support these students received in school.

Model 3: Initial Status for ESL versus Bilingual Instruction

Model 3 focuses on the differences in math IRT scores upon entry to kindergarten among students with levels of English proficiency that included non-English speakers (NES), limited English speakers (LES), and fluent English speakers (FES), according to the language screener administered by the researchers. All students were receiving language support at school either only in English (ESL program) or in the home language (bilingual programs). The research question that guides this section is the following:

RQ3.1. To what extent is parental academic help in the home language accounting for variance in kindergarten math scores for students identified as NES receiving

school language support in English versus receiving support in the home language in school?

Model 3 in Table 4.16 includes the main effects of the variables of interested that were used to create interaction terms to compare the math outcome of students who were identified as NES and were attending an ESL program versus a bilingual program. To test whether parental academic help in the home language accounted for variance among NES students in ESL and bilingual programs, a four-way interaction term was created using the following variables:

1. ESL student (dichotomous variable)
2. NES (dichotomous variable)
3. Parental academic support (weekly frequency ranging from 0 = not at all to 3 = every day)
4. Home language use *always* for academic support (dichotomous variable)

Following Rabe-Hesketh and Skrondal (2012), a sequence of models were fitted to investigate the complexity of the interaction term of interest. All the models are reported in the Appendix. The order followed for the model building process was the following:

Model 1. Main effects, with only variables of interested included. This model was also reported in Table 4.16 and 4.17 and will be discussed in this section.

Model 2. Two-way interaction terms were created and added to Model 1.

Model 3. Three-way interaction terms were added to Model 2.

Model 4. Four-way interaction term was added to Model 3.

Model 5 and 6. Control variables for level-2 were added to Model 4. The results of Model 6 are partially reported in Table 4.18 in this section.

Tables 4.16 and 4.17 in this chapter displays the fixed and random parameter estimates for the first conditional model of the sequence reported in the Appendix. The variables included are the main effects that were later used to create the interaction term of interest.

Maximum likelihood showed that the fixed effects for the intercept or score at kindergarten entry (average initial status at 66.84 months) was 32.04 (SE = 1.45, $p<0.001$) for a student in a bilingual program who was identified as Fluent English speaker by the *preLAS* language screener, had no parental academic support and no help in the home language. Holding everything constant, the linear term of time or instantaneous rate of change at 66.84 months was 2.02 (SE = 0.02, $\beta = 1.43$, $p<0.001$) and the curvature parameter associated with the quadratic term of time was negative and close to zero (= -0.01, SE = 0.00, $p<0.001$). This indicates that, on average, math scores were initially increasing but over time the growth rate slowed down and slightly declined.

The fixed effect parameters also indicate that the estimated differential in initial math scores between children who attended an ESL program and children who attended a bilingual program was -2.72 (SE = 0.74, $\beta = -0.04$, $p<0.001$), controlling for English language proficiency, parental academic support and the use of the home language for academic support. In other words, students in ESL program had a lower performance level in math compared to the students in bilingual programs in kindergarten. The parameters in Model 3 also indicate that the estimated differential in initial math scores between children who were identified as NES and children identified as FES was -8.79 (SE = 0.86, $\beta = -0.12$, $p<0.001$), controlling for everything else. Children identified as

LES also performed lower in math like the NES students when compared to the FES group, although the estimated differential in initial math scores was smaller (=-4.44, β = -0.06, SE = 0.89, p<0.001).

Parental academic support and the use of the home language for academic support accounted for a very small portion of the variance in kindergarten math scores for FES students in bilingual programs and the differences in math scores were not significant. For a FES student in a bilingual program, the estimated differential in initial math scores between children who received parental academic support and children who did not was 0.30 (SE = 0.70, β = 0.01, p>0.05). When a FES student in a bilingual program received parental academic help always in the home language, the estimated differential in initial math scores was 1.26 (SE = 0.72, β = 0.02, p>0.05).

To explore how the combination of parental academic support and the use of the home language for academic support accounted for variance in kindergarten math scores among NES students attending ESL or bilingual programs, a four-way interaction term was created. The full model with the interaction term and controls for child and parents' characteristics can be found in the Appendix (Tables 10 and 11, Model 6). In the next section, the differences in math scores among NES students in different language programs will be discussed based on a reduced version of Model 6 included in Table 18 in the Appendix.

Finding for RQ3.1

Based on the results reported in Model 6 in Table 4.18, there is evidence that parental academic help is more beneficial for NES students in kindergarten attending ESL when the help is delivered in the home language, after controlling for child's age

and gender, and parental levels of use of the home language, education, English proficiency, and income.

The predicted math score for a kindergarten NES student in an ESL program who received parental academic support *always* in the home language was 51.82 points (31.48 [*score at kindergarten*] + 20.34 [estimated difference for a *NES* student in an *ESL* program with *parental academic help* and *home language support* at home *always*]). The predicted math score for a kindergarten NES student in an ESL program who received parental academic support but not in the home language was 21.99 points (31.48 – 9.50). These results indicate that, upon entry to kindergarten, a NES student in an ESL program who received parental academic support *always* in the home language had a positive and significant difference in math scores when compared to a NES student in an ESL program receiving parental academic help but not in the home language. The difference between the two groups was 29.84 points in math IRT scores (W= 6.04, df = 1, β= 0.48, $p < 0.05$).

There is also evidence that using the home language *always* for academic support is more beneficial for NES students attending ESL programs than bilingual programs at the beginning of kindergarten, keeping child and parent's characteristics constant. The predicted math score for a kindergarten NES student in a bilingual program who received parental academic support *always* in the home language was 9.81 points (31.48 – 21.67). The difference between a NES student in an ESL program and a NES student in a bilingual program both receiving parental academic support *always* in the home language was 42.01 points in math IRT scores (W= 13.71, df = 1, β= 1.08, $p < 0.001$).

Finally, it was found that using the home language *always* for academic support is more beneficial for NES students attending ESL programs than for students with higher levels of English also attending ESL programs upon entry to kindergarten, keeping child and parent's characteristics constant. The predicted math score for a student in an ESL program with higher levels of English proficiency (LES or FES) and who also received parental academic support *always* in the home language was 27.98 points (31.48 – 3.50) at the beginning of kindergarten. The difference between a NES student and a student with higher levels of English proficiency both in kindergarten, attending an ESL program, and receiving parental academic support *always* in the home language was 23.84 points in math IRT scores (W= 6.60, df = 1, β= 0.49, $p < 0.05$).

Model 4: Growth Rate for ESL versus Bilingual Instruction

Model 4 in Tables 4.16 and 4.17 is based on Model 3 with the inclusion of interaction terms between the main effects of interest and the linear term of *time* to investigate the instantaneous rate of change of math IRT scores upon entry to kindergarten conditional on the student level of English (NES, LES, FES), the type of language support students receive at school (ESL, bilingual), the weekly frequency of parental academic help, and whether parents used the home language always for academic support. The research question that guides this section is the following:

RQ3.2. To what extent is parental academic help in the home language accounting for variance in growth rate in math for students identified as NES receiving school language support in English versus receiving support in the home language in school?

Model 4 in Table 4.17 includes the main effects of the variables of interested plus the interactions of these variables with the linear term of time. Again, a series of models was fitted to investigate the interaction term of interest. The models were the same as discussed in RQ3.1 with the addition of the interactions with the linear term of time. Model 4 was the first model fitted in the sequence to investigate the main effects of the variables in question. All the models can be found in the Appendix. The results for RQ 3.2 are based on the same sample as RQ3.1 (i.e., 1,296 students receiving either ESL or bilingual education in kindergarten).

Compared to Model 3, maximum likelihood results in Model 4 in Table 4.16 showed similar estimates for the fixed effects for the score at kindergarten entry for a FES student in a bilingual program with no parental academic support and no help in the home language (30.39, SE = 1.43, $p<0.001$). Holding everything constant, the linear term of time was 2.07 (SE = 0.04, $\beta = 1.47$, $p<0.001$) and the curvature parameter associated with the quadratic term of time was negative and close to zero (= -0.01, SE = 0.00, $\beta = -0.56$, $p<0.001$). Again, math scores were initially increasing but over time the growth rate slowed down and slightly declined.

The estimated differential in initial math scores between children who attended an ESL program and children who attended a bilingual program was -1.61 (SE = 0.79, $\beta = -0.03$, $p<0.05$) for the intercept, and -0.04 (SE = 0.02, $p>0.05$) for the linear term of time, controlling for everything else. The instantaneous rate of growth for students in ESL program was not statistically different from the students in the bilingual program.

The estimated differential in initial math scores between NES children and FES children according to the *preLAS* was negative and significant for the intercept (= -3.89,

SE = 0.86, β = -0.10, p<0.001) and the linear term of time (= -0.05, SE = 0.02, p<0.05), controlling for everything else. Children identified as LES also performed lower in math like the NES students when compared to the FES group, although the estimated differential in initial math scores was small and not significant for the intercept (=0.71, β = -0.06, SE = 0.69, p>0.05) and linear term of time (-0.02, SE = 0.02, p>0.05).

Like in the case of Model 3, parental academic support and the use of the home language for academic support accounted for a very small portion of the variance in kindergarten math scores for FES students in bilingual programs and the differences in math scores were not significant for the intercept and the instantaneous rate of change upon entry to kindergarten. For a FES student in a bilingual program, the estimated differential in initial math scores between children who received parental academic support and children who did not was 0.72 (SE = 0.70, β = 0.01, p>0.05) for the intercept and -0.01 (SE = 0.02, p>0.05) for the linear term of time, controlling for everything else. When a FES student in a bilingual program received parental academic help always in the home language, the estimated differential in initial math scores was 0.99 (SE = 0.76, β = 0.02, p>0.05) for the intercept and 0.01 (SE = 0.01, p>0.05) for the linear term of time, controlling for everything else.

As explained before, a four-way interaction term was created to explore how the combination of parental academic support and the use of the home language for academic support accounted for variance in instantaneous rate of change of kindergarten math scores among NES students attending ESL or bilingual programs. The full model with the interaction term and controls for child and parents' characteristics can be found in the Appendix (Tables 12 and 13, Model 6). In the next section, the differences in

instantaneous rate of change in math scores among NES students in different language programs upon entry to kindergarten will be discussed based on a reduced version of Model 6 included in Table 4.19.

Finding for RQ3.2

Regarding the instantaneous rate of change in math scores upon entry to kindergarten, parental academic help was beneficial for NES students attending ESL when the help was delivered in the home language, although the difference was not statistically significant after controlling for child's age and gender, parental levels of use of the home language, education, English proficiency, and income according to the results reported in Model 6 in Table 4.19.

The predicted instantaneous rate of change in math scores for a kindergarten NES student in an ESL program who received parental academic support *always* in the home language was 2.15 points (1.94 + 0.21). The predicted math score for a kindergarten NES student in an ESL program who received parental academic support but not in the home language was 1.75 points (1.94 – 0.19). These results indicate that a NES student in an ESL program who received parental academic support *always* in the home language had a higher instantaneous rate of change in math score upon entry to kindergarten when compared to a NES student in an ESL program receiving parental academic help but not in the home language. However, the difference between the two groups was small and not significant (= 0.40, W= 1.60, df = 1, p > 0.05). Using the home language *always* for academic support was more beneficial but not significant for the instantaneous growth rate of NES students attending ESL programs than bilingual programs at the beginning of kindergarten, keeping child and parent's characteristics constant.

The instantaneous rate of change in math score for a kindergarten NES student in a bilingual program who received parental academic support *always* in the home language was 1.87 points (1.94 – 0.07). The difference between a NES student in an ESL program and a NES student in a bilingual program both receiving parental academic support *always* in the home language was 0.28 points in math IRT scores (W= 0.84, df = 1, p > 0.05).

Similarly, the use of the home language *always* for academic support was also beneficial but not significant for the growth rate of NES students attending ESL programs compared to students with higher levels of English also attending ESL programs upon entry to kindergarten, keeping child and parent's characteristics constant. The instantaneous rate of change in math score for a student in an ESL program with higher levels of English proficiency (LES or FES) and who also received parental academic support *always* in the home language was 1.97 points (1.94 – 0.07) upon entry to kindergarten. The difference in rate of change between a NES student and a student with higher levels of English proficiency both in kindergarten, attending an ESL program, and receiving parental academic support *always* in the home language was 0.19 points in math IRT scores (W= 0.58, df = 1, p > 0.05).

Results for Models Comparing Submersion Students versus Students with Language Support in School

Table 4.16 and 4.17 include the fixed and random parameter estimates and robust standard errors for Model 5 and Model 6 comparing math IRT scores for students in submersion context (i.e., DLLs with no language support at school) and students with language support at school (i.e., ESL and bilingual instruction groups). The sample for

model 5 and 6 includes 1,903 students that received either ESL or bilingual education or were in a submersion context during the year of kindergarten.

Model 5: Initial Status for Submersion versus Language Instruction Students

Model 5 focuses on the differences in math IRT scores upon entry to kindergarten among students in submersion contexts with a variety of English proficiency levels according to the *preLAS* language screener given by the researchers (i.e., NES, LES), and FES). The comparison group are all the students who were the focus of interest in RQ3.1 and RQ3.2 and were receiving language support at school either only in English (ESL program) or in the home language (bilingual programs). The research question that guides this section is the following:

RQ3.3. To what extent is parental academic help in the home language accounting for variance in kindergarten math scores for students identified as NES in submersion classrooms versus students identified as NES with language support in school?

Model 5 in Table 4.16 includes the main effects of the variables of interested that were used to create interaction terms to compare the math outcome of submersion students versus students with language instruction in school.

To test whether parental academic help in the home language accounted for variance among NES students in submersion contexts and in contexts with language support, a four-way interaction term was created using the following variables:

1. Submersion student (dichotomous variable)
2. NES (dichotomous variable)
3. Parental academic support (weekly frequency ranging from 0 = not at all to 3 = every day)

4. Home language use *always* for academic support (dichotomous variable)

Like in the case of the comparison between students in ESL and bilingual programs discussed before, a sequence of models was fitted and all models are reported in the Appendix.

Tables 4.16 and 4.17 in this chapter displays the fixed and random parameter estimates for the first conditional model of the sequence reported in the Appendix. The variables included are the main effects that were later used to create the interaction term of interest. Maximum likelihood showed that the fixed effects for the intercept or score at kindergarten entry was 28.36 (SE = 1.19, $p<0.001$) for a student with language support in school who was identified as Fluent English speaker by the *preLAS* language screener, had no parental academic support and no help in the home language.. Holding everything constant, the linear term of time or instantaneous rate of change at 66.84 months was 2.03 (SE = 0.02, $\beta = 1.42$, $p<0.001$) and the curvature parameter associated with the quadratic term of time was negative and close to zero (= -0.01, $\beta = -0.55$, SE = 0.00, $p<0.001$). Again, this indicates that, on average, math scores were initially increasing but over time the growth rate slowed down and slightly declined.

The fixed effect parameters also indicate that the estimated differential in initial math scores between children in submersion context and children with language support in school was 3.43 (SE = 0.68, $\beta = 0.05$, $p<0.001$), controlling for English language proficiency, parental academic support and the use of the home language for academic support. In other words, students in submersion classrooms had a higher performance in math compared to the students in language programs in kindergarten, possibly because

the majority of submersion students had enough English proficiency to be in a regular classroom.

The parameters in Model 5 also indicate that the estimated differential in initial math scores between children who were identified as NES and children identified as FES was -8.64 (SE = 0.82, β = -0.11, $p<0.001$), controlling for everything else. Children identified as LES also performed lower in math like the NES students when compared to the FES group, although the estimated differential in initial math scores was smaller (=-5.08, SE = 0.77, β = -0.07, $p<0.001$).

Parental academic support and the use of the home language for academic support accounted for a small portion of the variance in kindergarten math scores for FES students in bilingual programs. Only parental academic support was significant. For a FES student in a submersion context, the estimated differential in initial math scores between children who received parental academic support and children who did not was 1.53 (SE = 0.61, β = 0.03, $p<0.05$). When a FES student in a bilingual program received parental academic help always in the home language, the estimated differential in initial math scores was 0.93 (SE = 0.61, β = 0.01, $p>0.05$).

To explore how the combination of parental academic support and the use of the home language for academic support accounted for variance in kindergarten math scores among NES students in submersion contexts, a four-way interaction term was created. The full model with the interaction term and controls for child and parents' characteristics can be found in the Appendix (Tables 14 and 15, Model 6). In the next section, the differences in math scores among NES students in submersion classrooms

versus attending a language program will be discussed based on a reduced version of Model 6 included in Table 4.20.

Finding for RQ3.3

Based on the results reported in Model 6 in Table 4.20, there is evidence that parental academic help is more beneficial for NES students in kindergarten in submersion contexts when the help is delivered in the home language, after controlling for child's age and gender, and parental levels of use of the home language, education, English proficiency, and income. The predicted math score for a kindergarten NES student in a submersion classroom who received parental academic support *always* in the home language was 49.25 points (26.44 [*score at kindergarten*] + 22.81 [estimated difference for a *NES* student in *submersion* context with *parental academic help* and *home language support* at home *always*]). The predicted math score for a kindergarten NES student in a submersion classroom who received parental academic support but not in the home language was 9.92 points (26.44 – 16.52).

These results indicate that, upon entry to kindergarten, a NES student in a submersion classroom who received parental academic support *always* in the home language had a positive and significant difference in math scores when compared to a NES student in a submersion classroom receiving parental academic help but not in the home language. The difference between the two groups was 39.33 points in math IRT scores (W= 9.48, df = 1, β= 0.44, $p < 0.01$).

There is also evidence that using the home language *always* for academic support is more beneficial for NES students in submersion contexts than students attending language programs in school at the beginning of kindergarten, keeping child and parent's

characteristics constant. The predicted math score for a kindergarten NES student attending a language program who received parental academic support *always* in the home language was 14.52 points (26.44 – 11.92). The difference between a NES student in a submersion context and a NES student in a bilingual program both receiving parental academic support *always* in the home language was 34.73 points in math IRT scores (W= 12.37, df = 1, β= 0.63, $p < 0.001$).

Finally, it was found that using the home language *always* for academic support is more beneficial for NES students in submersion contexts than for students with higher levels of English also in submersion classrooms upon entry to kindergarten, keeping child and parent's characteristics constant. The predicted math score for a student in a submersion classroom with higher levels of English proficiency (LES or FES) and who also received parental academic support *always* in the home language was 21.99 points (26.44 – 4.45) at the beginning of kindergarten. The difference between a NES student and a student with higher levels of English proficiency both in kindergarten, in submersion contexts, and receiving parental academic support *always* in the home language was 27.26 points in math IRT scores (W= 9.43, df = 1, β= 0.40, $p < 0.01$).

Model 6: Growth Rate for Submersion versus Language Instruction Students

Model 6 is based on Model 5 with the inclusion of interaction terms between the main effects of interest and the linear term of *time* to investigate the instantaneous rate of change of math IRT scores upon entry to kindergarten conditional on the student level of English (NES, LES, FES), the type of language support students receive at school (ESL, bilingual), the weekly frequency of parental academic help, and whether parents used the

home language always for academic support. The research question that guides this section is the following:

RQ3.4. To what extent is parental academic help in the home language accounting for variance in growth rate in math scores for students identified as NES in submersion classrooms versus students identified as NES with language support in school?

Model 5 in Table 4.16 includes the main effects of the variables of interested plus the interactions of these variables with the linear term of time. Again, a series of models was fitted to investigate the interaction term of interest. The models were the same as discussed in RQ3.3 with the addition of the interactions with the linear term of time. Model 6 was the first model fitted in the sequence to investigate the main effects of the variables in question. All the models can be found in the Appendix. The results for RQ3.2 are based on the same sample as RQ3.1 (i.e., 1,885 students either in submersion context or receiving language instruction in school in kindergarten).

Maximum likelihood results in Model 6 in Table 4.20 showed that the estimates for the fixed effects for the score at kindergarten entry for a FES student attending a language program with no parental academic support and no help in the home language was very similar to Model 5 (= 28.10, SE = 1.22, $p<0.001$). Holding everything constant, the linear term of time was 2.04 (SE = 0.03, $\beta = 1.42$, $p<0.001$) and the curvature parameter associated with the quadratic term of time was negative and close to zero (= -0.01, SE = 0.00, $\beta = -0.55$, $p<0.001$). Again, math scores were initially increasing but over time the growth rate slowed down and slightly declined.

The estimated differential in initial math scores between children in submersion contexts and children who attended a language program was 2.51 (SE = 0.73, β = 0.04, p<0.001) for the intercept, and 0.03 (SE = 0.02, p>0.05) for the linear term of time, controlling for everything else. The instantaneous rate of growth for students in submersion classrooms was not statistically different from the students in language programs. The estimated differential in initial math scores between NES children and FES children according to the *preLAS* was negative and significant for the intercept (= -7.29, SE = 0.78, β = -0.09, p<0.001) and the linear term of time (= -0.04, SE = 0.02, p<0.05), controlling for everything else. Children identified as LES also performed lower in math like the NES students when compared to the FES group, although the estimated differential in initial math scores was smaller but significant for the intercept (=-4.06, SE = 0.75, β = -0.05, p<0.001) but not significant for linear term of time (-0.04, SE = 0.02, p>0.05).

FES students with language support and parental academic support had a positive and significant estimated differential in initial math scores of 1.60 (SE = 0.59, β = 0.03, p<0.01) for the intercept but not for the linear term of time (0.00, SE = 0.01, p>0.05). The use of the home language for academic support accounted for a very small portion of the variance in kindergarten math scores for FES students in bilingual programs and the differences in math scores were not significant for the intercept and the instantaneous rate of change upon entry to kindergarten.

As explained before, a four-way interaction term was created to explore how the combination of parental academic support and the use of the home language for academic support accounted for variance in instantaneous rate of change of kindergarten math

scores among NES students in submersion contexts compared to students attending language programs. The full model with the interaction term and controls for child and parents' characteristics can be found in the Appendix (Tables 16 and 17, Model 6). In the next section, the differences in instantaneous rate of change in math scores among NES students will be discussed based on a reduced version of Model 6 included in Table 4.21.

Finding for RQ3.4

Regarding the instantaneous rate of change in math scores upon entry to kindergarten, parental academic help was beneficial for NES students in submersion classrooms when the help was delivered in the home language. However, the difference was not statistically significant after controlling for child's age and gender, parental levels of use of the home language, education, English proficiency, and income according to the results reported in Model 6 in Table 4.21.

The predicted instantaneous rate of change in math scores for a kindergarten NES student in a submersion classroom who received parental academic support *always* in the home language was 2.15 points (1.95 [*linear term of time for the intercept*] + 0.20 [estimated difference for a *NES* student in *submersion* context with *parental academic help* and *home language support* at home *always*]). The predicted math score for a kindergarten NES student in a submersion context who received parental academic support but not in the home language was 1.82 points (1.95 – 0.13). These results indicate that a NES student in a submersion context who received parental academic support *always* in the home language had a higher instantaneous rate of change in math score upon entry to kindergarten when compared to a NES student in a language program

receiving parental academic help but not in the home language. However, the difference between the two groups was small and not significant (= 0.33, W= 1.10, df = 1, p > 0.05).

Using the home language *always* for academic support was more beneficial but not significant for the instantaneous growth rate of NES students in submersion classrooms than students receiving language instruction at the beginning of kindergarten, keeping child and parent's characteristics constant. The instantaneous rate of change in math score for a kindergarten NES student in a language program who received parental academic support *always* in the home language was 1.99 points (1.95 – 0.04). The difference between a NES student in a submersion classroom and a NES student in a language program both receiving parental academic support *always* in the home language was 0.16 points in math IRT scores (W= 0.37, df = 1, p > 0.05).

Similarly, the use of the home language *always* for academic support was also beneficial but not significant for the growth rate of NES students in submersion classrooms compared to students with higher levels of English also in submersion contexts upon entry to kindergarten, keeping child and parent's characteristics constant. The instantaneous rate of change in math score for a student in a submersion context with higher levels of English proficiency (LES or FES) and who also received parental academic support *always* in the home language was 1.88 points (1.95 – 0.07) upon entry to kindergarten. The difference in rate of change between a NES student and a student with higher levels of English proficiency both in a submersion context while in kindergarten, and receiving parental academic support *always* in the home language was 0.26 points in math IRT scores (W= 1.44, df = 1, p > 0.05).

Figure 4.6 displays the growth trajectory from the unconditional growth model for math IRT scores. This graph offers a visual representation of Model 2 in Table 4.16. It shows how math scores initially increased but the growth decelerated with each passing month. Figure 4.7 shows the prototypical trajectories for students identified as NES, LES and FES for math IRT scores. It illustrates the findings from Models 3 to 6 that show that NES students performed the lowest in math over the course of elementary school when compared to other groups with higher levels of English proficiency. Figure 4.8 focuses on the NES group and shows the prototypical trajectories for NES students with parental academic help using always the home language versus using sometimes English regardless whether the student receives language instruction in school or is in a submersion context. As it was found in RQ3.1 and RQ3.3, the initial status or the estimated math score upon entry to kindergarten for a NES student (i.e., a student with the lowest level of English proficiency according to the *preLAS* screener) was higher when the student received parental help in the home language always or very often in contrast to a NES student with parents who sometimes use English for academic help. This difference is captured by the gap between the two trajectories.

Table 4.16

Fixed estimates and robust standard errors (in brackets) for math IRT score.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effect Parameters	Baseline n = 2,428		ESL vs. Bilingual Instruction n = 1,296		Submersion vs. Language Instruction n = 1,993	
Score at kindergarten entry	77.77***	29.91***	32.04***	30.39***	28.36***	28.10***
	(0.60)	(0.32)	(1.45)	(1.43)	(1.19)	(1.22)
ESL student			-2.72***	-1.61*		
			(0.74)	(0.79)		
Submersion student					3.42***	2.51***
					(0.68)	(0.73)
Non-English speaker			-8.79***	-7.34***	-8.64***	-7.29***
			(0.86)	(0.88)	(0.82)	(0.78)
Limited English speaker			-4.44***	-3.89***	-5.08***	-4.06***
			(0.89)	(0.86)	(0.77)	(0.75)
Parental academic support			0.30	0.71	1.53*	1.60**
			(0.72)	(0.69)	(0.61)	(0.59)
Home language use *always* for academic support			1.26	0.99	0.93	0.75
			(0.72)	(0.76)	(0.61)	(0.62)
Rate of change						
Linear term		2.01***	2.02***	2.07***	2.03***	2.04***
		(0.02)	(0.02)	(0.04)	(0.02)	(0.03)
ESL student				-0.04		
				(0.02)		
Submersion student						0.03
						(0.02)
Non-English speaker				-0.05*		-0.04*
				(0.02)		(0.02)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effect Parameters	Baseline n = 2,428		ESL vs. Bilingual Instruction n = 1,296		Submersion vs. Language Instruction n = 1,993	
Limited English speaker				-0.02		-0.04
				(0.02)		(0.02)
Parental academic support				-0.01		-0.00
				(0.02)		(0.01)
Home language use for academic support				0.01		0.01
				(0.02)		(0.01)
Quadratic term		-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

* p<0.05; ** p<0.01; *** p<0.001

Table 4.17

Random estimates and robust standard errors (in brackets) for math IRT score.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Random Effect Parameters	Baseline n = 2,428		ESL vs. Bilingual Instruction n = 1,296		Submersion vs. Language Instruction n = 1,903	
Level-1 variance (within students)	717.15*** (13.12)	55.20*** (1.11)	55.26*** (1.76)	55.00*** (1.75)	54.16*** (1.39)	53.90*** (1.37)
Level-2 variance (between students)	111.88*** (7.48)	157.85*** (5.47)	139.71*** (7.95)	139.86*** (7.95)	143.40*** (6.63)	142.92*** (6.61)
Level 3- variance (between schools)	235.79*** (18.91)	14.47*** (4.54)	6.25** (4.38)	6.55** (4.44)	10.45*** (4.63)	10.58*** (4.67)
AIC	157965.1	121809.3	45553.3	45542.9	65153.8	65124.3

* p<0.05; ** p<0.01; *** p<0.001

Table 4.18

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.1. Initial status for ESL versus bilingual instruction).

Fixed Effect Parameters	Model 6 n=1,028
Score at kindergarten entry	31.48*** (3.99)
Parental academic support (PAS) x ESL x NES	-9.50 (5.77)
PAS x Home language use *always* for academic support (HLU *always*) x NES	-21.67*** (5.15)
PAS x HLU *always* x ESL	-3.50 (3.50)
PAS x HLU *always* x ESL x NES	20.34** (7.05)
Rate of change	
Linear term	2.02*** (0.03)
Quadratic term	-0.01*** (0.00)

Note: Full table with all interaction terms, covariates, and random effect parameters can be found in the Appendix (Tables 10 and 11).
* p<0.05; ** p<0.01; *** p<0.001

Table 4.19

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.2. Growth rate for ESL versus bilingual instruction).

Fixed Effect Parameters	Model 6 n=1,028
Score at kindergarten entry	34.64*** (3.60)
Parental academic support (PAS) x ESL x NES	-4.77 (4.95)
PAS x Home language use *always* for academic support (HLU *always*) x NES	-20.31*** (4.33)
PAS x HLU *always* x ESL	-3.99 (2.90)
PAS x HLU *always* x ESL x NES	15.30* (6.49)
Rate of change	
Linear term	1.94*** (0.08)
PAS x ESL x NES	-0.19 (0.15)
HLU *always* x ESL x NES	-0.42 (0.53)
PAS x HLU *always* x NES	-0.07 (0.14)
PAS x HLU *always* x ESL	0.03 (0.08)
PAS x HLU *always* x ESL x NES	0.21 (0.20)
Quadratic term	-0.01*** (0.00)

Note: Full table with all interaction terms, covariates, and random effect parameters can be found in the Appendix (Tables 12 and 13).
* p<0.05; ** p<0.01; *** p<0.001

Table 4.20

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.3. Initial status for submersion students versus students with language instruction).

Fixed Effect Parameters	Model 6 n=1,482
Score at kindergarten entry	26.44*** (3.20)
Parental academic support (PAS) x Submersion context (SUB) x NES	-16.52** (6.11)
PAS x Home language use *always* for academic support (HLU *always*) x NES	-11.92** (3.92)
PAS x HLU always x SUB	-4.45 (3.09)
PAS x HLU always x SUB x NES	22.81** (7.12)
Rate of change	
Linear term	2.03*** (0.02)
Quadratic term	-0.01*** (0.00)

Note: Full table with all interaction terms, covariates, and random effect parameters can be found in the Appendix (Tables 14 and 15).
* p<0.05; ** p<0.01; *** p<0.001

Table 4.21

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.4. Growth rate for submersion students versus students with language instruction).

Fixed Effect Parameters	Model 6 n=1,482
Score at kindergarten entry	30.67*** (2.72)
Parental academic support (PAS) x Submersion context (SUB) x NES	-12.65** (4.75)
PAS x Home language use *always* for academic support (HLU *always*) x NES	-13.49*** (3.12)
PAS x HLU *always* x SUB	-3.19 (2.78)
PAS x HLU *always* x SUB x NES	17.99** (5.57)
Rate of change	
Linear term	1.95*** (0.07)
PAS x SUB x NES	-0.13 (0.13)
PAS x HLU *always* x NES	0.04 (0.10)
PAS x HLU *always* x SUB	-0.07 (0.06)
PAS x HLU *always* x SUB x NES	0.20 (0.19)
Quadratic term	-0.01*** (0.00)

Note: Full table with all interaction terms, covariates, and random effect parameters can be found in the Appendix (Tables 16 and 17).
* p<0.05; ** p<0.01; *** p<0.001

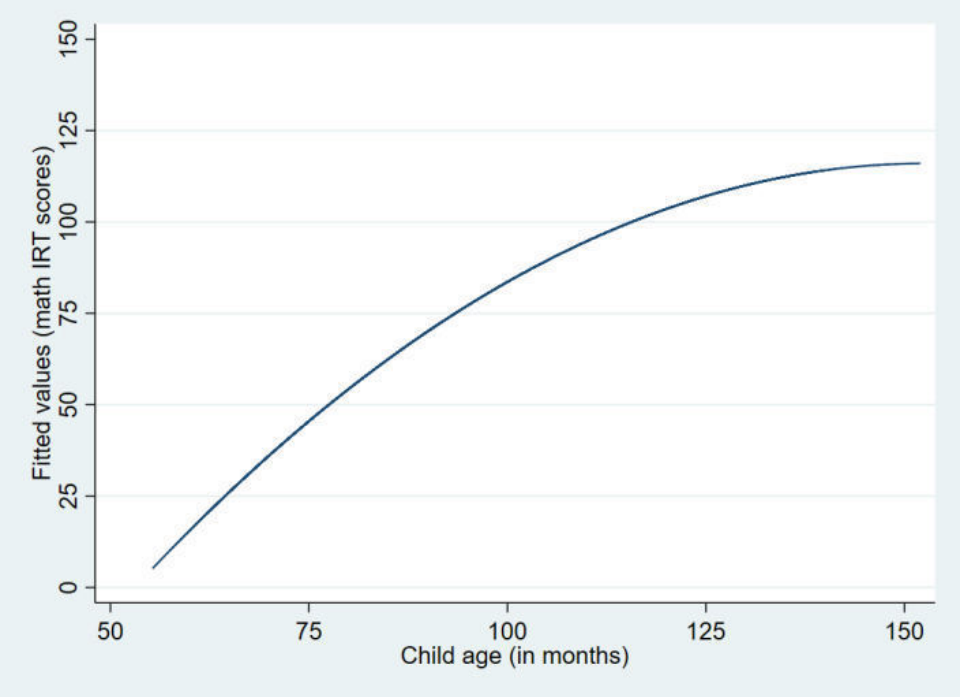


Figure 4.6. Prototypical trajectory from unconditional growth model for math IRT scores.

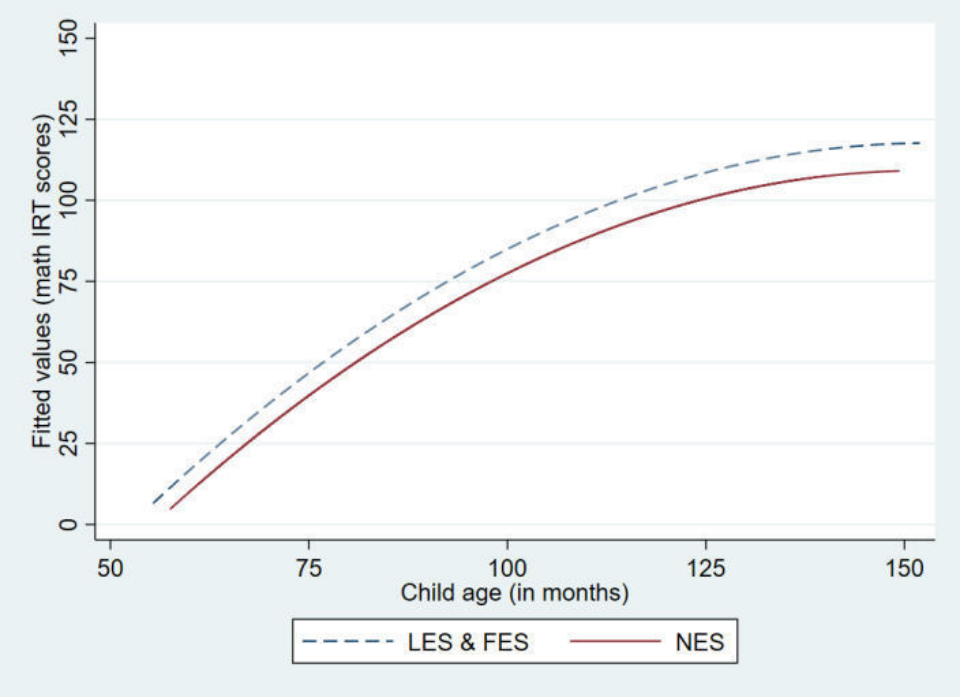


Figure 4.7. Prototypical trajectories for NES, LES and FES students from conditional growth model for math IRT scores.

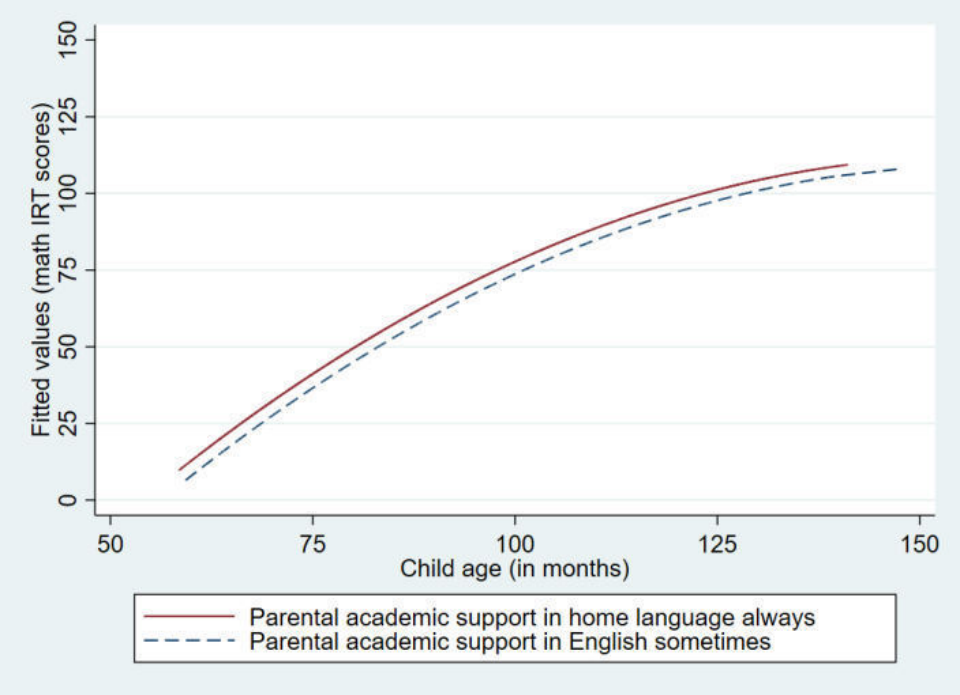


Figure 4.8. Prototypical trajectories for NES students (either in a language program or in a submersion classroom) who received parental academic help *always* in the home language versus *sometimes* in English from a conditional growth model.

Chapter 5: Discussion

For this dissertation, three research questions were created to shed light on the patterns of family language use among immigrant families with young learners in school, and illuminate our understanding of the role of parental use of the home language in the development of English proficiency in DLLs. This study was also designed to explain uncommon but often reported cases in which bilingual students with incipient English skills experience rapid academic gains in English-only classrooms in the apparent absence of home language support in schools. Findings for each research question are discussed separately and are presented as they relate to current research in family language policy and the education of bilingual learners. Sections about implication for research and practice, limitations, future research, and conclusion are also included at the end.

Research Question 1 Discussion: Family Language Practices of ECLS-K:2011 Immigrant Families

RQ1 was designed to investigate the patterns of family language practices among DLLs from kindergarten to fifth grade. A multilevel model with mixed effects was fitted to answer this question using a sample from ECLS-K:2011. The selection included 2,428 Hispanic students who spoke other language than English at home and received language support in English or the home language in any year between kindergarten and fifth grade. A series of two-level models with *time* (in months) representing the level-1 units (i.e., within-student effects), and students with their families representing the level-2 units (i.e., between-student) were fitted and results were presented in Chapter 4.

Patterns of Family Home Language Use and Growth Rate from Kindergarten to Fifth Grade

It was found that both parent and child had similar patterns of language use, marked with high preference for using the home language from Kindergarten to fifth grade. From the regression parameter estimates discussed in RQ1.1, parents' average score for using the home language was 2.48 points (SE = 0.01, $p<0.001$) and child's average score was 2.15 points (SE = 0.02, $p<0.001$) on a weekly frequency scale that ranged from 0 (never use the home language) to 3 (always use home language) from kindergarten to fifth grade across schools. This conclusion is supported by the descriptive analyses of the means and standard deviations for home language use of parents and children (Table 1 in Chapter 4).

Regarding the growth rate of family home language use from kindergarten to fifth grade, the regression parameter estimates for RQ1.2 suggest that there was very little change in the levels of preference for using the home language among the immigrant families of ECLS-K:2011 during the five years of elementary school the children attended. The growth rate or average monthly rate for the scores for both parents and children's home language preference was very close to zero (-0.00, SE = 0.00, $p<0.001$). This finding is supported by the inspection of the means and standard deviations of home language use of parents and children in Table 1 in Chapter 4. This finding is in contrast with Mancilla-Martinez and Kieffer's (2010) study, who found that patterns of language use in the home changed over time. A reason for the disparity in findings could be that Mancilla-Martinez and Kieffer conducted their analysis with a different data set than the version used in this study. Mancilla-Martinez and Kieffer drew their sample from the kindergarten class of 1998-99 cohort (ECLS-K) which followed students from

kindergarten through the eighth grade. As a consequence, Mancilla-Martinez and Kieffer had a longer time series to investigate language change. Another important difference between this study and Mancilla-Martinez and Kieffer's one is that their analysis was based on two data point (kindergarten and 8th grade) and involved a comparison of the proportions of parents that kept their kindergarten answers unchanged in contrast to parents who modified their kindergarten responses in eighth grade. The present study has the strength that uses all the responses that were collected between kindergarten and fifth grade and uses a methodology (multilevel models) to investigate growth rate over time.

Although the estimated growth rate for family language practices scores showed little variation and it was close to zero, it was also observed that the slope associated with the estimated growth rate for both parental and child home language use was negative, suggesting that there was a very mild decline in the preference for using the home language among the families in the sample over time. Visual inspections of the data for both parent and children support this trend. This finding is in agreement with Mancilla-Martinez and Kieffer (2010) who also found that one third of their sample shifted toward less frequent use of the home language. In addition, this finding is also in agreement with research in FLP involving language maintenance and parental attitudes that impact family language practices. Several scholars in FLP have shown that immigrant parents are vulnerable to public discourses and ideologies that depict bilingualism as potentially a threat to the acquisition of the majority language with the consequence of rapid language shifts within one generation of language-minority speakers (King, 2013; Piller & Gerber, 2018; Schecter & Bayley, 1997). In particular, Pérez Báez (2013) documented a rapid

language shift from a home language to more prestigious languages in a community of Zapotec speakers from Mexico residing in California.

Parent and Child Background Characteristics Explaining Differences in Family Use of the Home Language

Parent Characteristics

Parental and child background characteristics also explained an important amount of variation in family language practices. In the case of the parents' background, characteristics such as whether parents were immigrants, levels of education, self-reported English proficiency, and income were included in the models following the findings of Curdt-Christiansen (2009, 2013), Gallo and Hornberger (2019); King (2013), King and Lanza (2019) and Schecter and Bayley (1997). The empirical literature reviewed also included covariates for education, socioeconomical background, and immigration (e.g., Galindo & Sheldon, 2012; Mouw & Xie, 1999, Portes & Hao, 2002). These authors show that language proficiency, education, mobility, and socioeconomical status impact parents' family language practices and decisions.

It was found that parental levels of English proficiency and whether both parents were immigrants explained a significant amount of variation in both parental and child use of the home language. Consistent with research in FLP (i.e., Gallo & Hornberger, 2019; King 2013) and also the studies reviewed for the empirical literature section (Mouw & Xie, 1999; Portes & Hao, 2002), factors that indicate how comfortable parents could have been using the majority language at home were associated with higher levels of preference for English. For instance, in the case of parents, it was found that for one unit increase in the parents' level of English proficiency, parents' preference for using the

home language decreased by -0.22, the equivalent of 0.28 standard deviation units (SE = 0.02, β = -0.28, p<0.001). Conversely, when both parents in the family were immigrants, parents' preference for using the home language increased by 0.10, the equivalent of 0.07 units of standard deviations (SE = 0.03, β = 0.07, p<0.01).

It was also found that parental levels of education and income explained a significant amount of variation in parental and child use of the home language in different patterns. For example, in the case of the parents, for one unit increase in the parents' level of education, parents' preference for using the home language increased by 0.04 or the equivalent of 0.08 units of standard deviations (SE = 0.01, β = 0.08, p<0.01). Education level was not a significant predictor of home language use for the children. However, income level was found to be significant for the children's language preferences. For one unit increase in the parents' income level (transformed using the natural log), children's preference for using the home language decreased by -0.09, the equivalent of 0.06 units of standard deviations (SE = 0.04, β= -0.06, p<0.05). Level of income was not a significant predictor of home language preferences for the parents.

More contextual information is needed to fully understand these results. In terms of the role of family income in the level of preference for using the home language, Schecter and Bayley (1997) documented how an immigrant family from Mexico moved swiftly from using Spanish to English at home once the child started attending school in the United States. This shift was particularly acute for the family who had moved most fully into the middle class compared to the other Mexican families in the sample. In addition, Piller and Gerber (2018) but also King and Fogle (2006) and Curdt-Christiansen (2009, 2013) documented how middle class parents with relatively high levels of

education have pursued bilingualism at home when raising DLLs. In particular, King and Fogle (2006) and Curdt-Christiansen (2009, 2013) showed how parents can device a family language policy to teach and maintain the use of the home language among the younger members of the family. Piller and Gerber (2018) discussed the contradictory views on maintaining a family language that middle class parents held in an online forum. Parents were enthusiastic about individual bilingualism but fearful that speaking a home language would jeopardize their children's English acquisition. The findings of this study seem to speak about these different and contradictory perspectives on maintaining a home language among immigrant families. The findings of this study also highlight the complexities of working with a sample of mostly immigrant families of Spanish-speaking backgrounds. As it was noted in Chapter 1 and Chapter 3, the sample of this study is diverse and includes a range of parental educational levels and incomes, although levels of income and education were in general low across the sample.

Child Characteristics

In the case of children's background characteristics, whether a child attended a bilingual education program or not was included as a control variable given that Farrugio (2010) and Schwartz and Moin (2012) found that when parents were afforded the opportunity to choose an instructional language program for their children, they did it on the bases of their beliefs and expectations regarding the use of the home language. It was found that attending a bilingual education program explained an important amount of variation in family language practices for both parents and children.

In the case of the parents, it was found that when the child received bilingual instruction in kindergarten, parents' preference for using the home language increased by

0.12, the equivalent of 0.08 units of standard deviations (SE = 0.03, β = 0.08, p<0.001). In the case of the children, attending a bilingual program was connected to higher preference for using the home language by 0.27, the equivalent of 0.15 units of standard deviations (SE = 0.04, β= 0.15, p<0.001). These results suggest that bilingual education support the maintenance of a home language among immigrant families (Farrugio, 2010; Schwartz & Moin, 2012). In the case of parents who indicated that they had low levels of English proficiency, these results also suggest that bilingual education facilitates intergenerational communication among language-minority families (Portes & Hao, 2002) with potential psychological, emotional, and social benefits for DLLs (Bialystok, 2017; Portes & Hao, 2002; Zarate & Pineda, 2014).

The number of siblings was included as a control variable when analyzing the children's patterns of family language use, following the findings of King (2013), Kibler, Palacios and Simpson Baird (2014), Shin (2002), and Wong Fillmore (1991). These authors found that the presence of siblings was connected with specific language preference among bilingual children. This study found that for each additional sibling a child had, a child's preference for using the home language decreased by -0.03, the equivalent of 0.04 units of standard deviation (SE = 0.01, β= -0.04, p<0.001). The results are consistent with the findings of Kibler, et al. (2014), who found that the number of older siblings of a child was a significant predictor of the child's oral language production toward other children in the home. Wong Fillmore (1991) and Shin (2002) found that the presence of older siblings in immigrant families tended to introduce the majority language to younger siblings at home more quickly once the children attended school. More information is needed to understand the role of siblings in this study.

Limitations and Contributions to FLP Research

More information is needed to understand the patterns of language change among the bilingual families in this study. One of the limitations of this study is that the ECLS-K:2011 data were not originally collected for investigating family language practices. As a consequence, questions about the motivations and attitudes of the parents in this sample are left unanswered. FLP researchers have extensively investigated issues of language power dynamics or maintenance of the heritage language, which this study has left unaddressed given the constraints of working with secondary data. In addition, minority groups tend to have lower response rates than other groups as the ECLS-K:2011 researchers indicate (Tourangeau, et al., 2015). The response rate for the parent interviews were on the lower end of the spectrum in particular for the fall of kindergarten. However, this study also provides an updated insight of the patterns of language use among a large sample of immigrant families in the Unites States, complementing and expanding the work of Mancilla-Martinez and Kieffer (2010). This study also adds to the evidence already documented by researchers in the field of FLP, such as the role of the number of siblings in the children's language preferences. This study also contributes the operationalization of concepts such as family language practices using inferential statistics.

Another limitation of this study is the complexity of the population that was sampled for this study. As Cabrera and colleagues (2019) indicate, Hispanics or Latinos in the United States are often seen as a single racial and ethnic group. Families from Spanish-speaking backgrounds are a diverse group in terms of country of origin, immigration status, language, race, and socioeconomic status. According to Cabrera et al.

(2019), approximately 30% of Latino children live in poverty. However, 22 percent of Latinos in the United States were classified as middle class in 2017. As Cabrera and her colleagues indicate, researchers have focused most of their attention to understanding Latino children living in poverty and we know less about those who grow up in better economic circumstances. Future research using the ECLS-K:2011 data could investigate with more depth the intersection of income, education and in connection to family language practices and academic achievement of DLLs.

Research Question 2 Discussion: Family Language Practices and English Proficiency in Immigrant Families

RQ2 was designed to investigate the extent identified family language practices accounted for variance in English language proficiency in DLLs upon entry to kindergarten. Another multilevel model with mixed effects was fitted to answer this question. Only students who received language instruction in school during the kindergarten year were selected to answer RQ2 (n = 1,759 Hispanic students who spoke other language than English at home). A series of two-level models with students representing the level-1 units (i.e., between-student effects), and students within schools representing the level-2 units (i.e., between-school) were fitted and results were presented in Chapter 4. The outcome variable used was the raw number-right scores or the average of the *preLAS* 2000 tasks that were administered as a language screener in the ECLS-K:2011 study.

Parental Home Language Use Does not Affect English Language Proficiency

The findings for RQ2 show that there is no significant difference in English language proficiency scores between children whose parents prefer to use a home language and children whose parents prefer to use English at home. For example, when only family language practices (parents and children) were included as predictors for the children's English proficiency scores in kindergarten, it was found that for one unit increase in the parental preference for using the home language, the change in the child's *preLAS* score was close to zero and not a significant (=-0.25, SE = 0.36, β = -0.03, p>0.05; Model 2), keeping constant the language preferences of the children.

This study also investigated whether parental home language use had a different role when a child's English proficiency level was the lowest according to the *preLAS* screener (i.e., whether a student was identified as a NES by the test, a non-English speaker). Again, it was found that higher levels of parental home language use did not significantly explained the estimated difference in *preLAS* scores for a NES student (=0.01, SE = 0.15, β = 0, p>0.05; Model 3), keeping constant the language preferences of the children.

Other relevant background variables where also included in the model to take into account the socio-economical differences of the families in the sample. Parents' characteristics that were controlled were levels of education, English proficiency (self-reported), and annual income. Background variables to take into account child's characteristics were also included, such as gender and age when the child was first tested in kindergarten. The findings regarding the role of parental home language use were the same like in the previous model. In this sample, it was found that there was no connection

between higher levels of parental home language use and English language proficiency as identified by the *preLAS* screener.

These findings are in agreement with evidence from research on early childhood bilingualism (Bialystok, 2017; Oliver & Azkarai, 2017) and the effectiveness of bilingual education (Bialystok, 2018; MacSwan et al., 2017), which has shown that learning two languages simultaneously does not jeopardize the development of language proficiency. MacSwan, et al., (2020) arrived to the same conclusion after evaluating how home language practices pertaining to code-switching affected successful multilingual acquisition. The authors' conclusion was that "no language-related differences [were detected] between children raised in codeswitching homes and those raised in non-codeswitching homes" (p. 157).

This study also found that children higher preference for using English to answer parents was associated with significant positive differences in *preLAS* score. An explanation for this finding is that children with higher preference for using English at home maybe more comfortable using the majority language rather than the home language. In contrast to MacSwan et al. (2020), this study is limited by the scarce information available about the children's levels of proficiency in the home language. MacSwan et al. (2020) included measures of children's language proficiency in both English and Spanish, while this study only includes information about the children's English proficiency. This study expands MacSwan and colleagues' study by analyzing a larger sample although with the limitation that little is known about the levels of proficiency in the home language were among the children ECLS-K:2011 study.

Limitations and Contributions to the Field of Early Childhood Bilingualism

One of the limitations of this study that was already discussed is that this study could not incorporate information about the children's home language proficiency like MacSwan et al. (2020) did. Related to this point, questions remain about how the home language was used in the family among the youngest members of the family. Future research involving data collection of family language practices could include the voices of the children by interviewing them and asking them about their language preferences. As it was already discussed, this study would also benefit from collecting a measure of the home language proficiency among the DLLs.

Another limitation of this study is related to the assessment employed to measure English proficiency. This study uses the English version of *preLAS* 2000 to determine the English level proficiency of the students. MacSwan and Rolstad (2006) found that an earlier version of the Language Assessment Scales–Oral-Español (LAS–O Español; De Avila & Duncan, 1994) potentially identified language-minority students as non-speakers of their first language. In a sample of 145 Spanish-English bilingual students, MacSwan and Rolstad found that 74 percent of the children they evaluated were identified as limited speakers of their home language, whereas a natural language measure identified only two percent of participants.

Although this study uses a newer version of the Language Assessment Scales (LAS) test, an important difference with MacSwan and Rolstad's study is that the test was used to evaluate English proficiency rather than the participants' language skills in the home language. As the exploratory descriptive analyses conducted in Chapter 4 showed, the *preLAS* scores for English proficiency were rather high in the ECLS-K:2011

study in contrast to MacSwan and Rolstad's data on the participants' home language skills. In the particular sample selected for this study, only 21 percent of the DLLs were identified as non-English speakers (NES) according to the guidelines given by the publisher (Duncan & De Avila, 2000).

This study makes an important contribution to our understanding of early childhood language development by dispelling misconceptions about the role of home language use on the child development of the majority language. As the literature reviewed in Chapter 2 revealed, teachers, policymakers, and parents may still hold negative linguistic perceptions of bilingual learners or bilingual education (King, 2013; Farrugio, 2010; Lewis & Davies, 2018; Pettit, 2011; Piller & Gerber, 2018). This study shows that there were no detectable significant differences in the language development of the majority language among the participants. More research is needed to understand the benefits of bilingualism in particular among language-minority immigrant populations.

Research Question 3 Discussion: De Facto Bilingual Education

RQ3 was designed to investigate the extent identified family language practices accounted for variance in mathematics achievement in DLLs in kindergarten and over the five years of elementary school. This question was investigated in two educational contexts. One of them involved the comparison of DLLs who received language support in English-only versus DLLs who attended bilingual education programs (n = 1,236 students). The other context involved DLLs who received any language support (either English-only or bilingual education) versus DLLs in submersion classrooms (i.e., DLLs who did not receive language support in kindergarten but attended a language program

aimed at improving English skills in later years) (n = 1,903 students). Again, several multilevel models with mixed effects were fitted to answer this question. A series of two-level models with *time* (in months) representing the level-1 units (i.e., within-student effects), students representing the level-2 units (i.e., between-student and within-school effects), and schools representing the level-3 units (i.e., between-school effects) were estimated and results can be found in Chapter 4. The outcome variable used was the students' math IRT scores from kindergarten to fifth grade.

Bilingual Students in English-Only Programs, Bilingual Education, and Submersion Classrooms

Research on bilingual education programs found considerable evidence in favor of the effectiveness of bilingual programs for all learners including DLLs (August & Hakuta, 1997; August & Shanahan, 2006; Bialystok, 2018; Genesee et al., 2006; NASEM, 2017; Rolstad et al., 2005). However, two reports by Baker and de Kanter (1981) and Rossell and Baker (1996) reported that there was weak research evidence for bilingual education and have remained highly influential among advocates of English-intensive programs. Critical perspectives on bilingual education, bilingualism and immigration are still current in the broader social context of the United States, as Lewis and Davies (2018) documented. Cases in which bilingual students with emerging English skills appear to experience success in English-only classrooms in the apparent absence of language support in schools are often cited by English-only instruction advocates as evidence against bilingual education (Krashen, 1999). This study was designed to illuminate our understanding of cases of *de facto* bilingual education (Krashen, 1999) by

investigating the academic support that immigrant parents give to their children using the home language as a means to explain content.

Drawing from theories of bilingual education (MacSwan et al., 2017) to interpret the findings of this study, it was hypothesized that DLLs with the lowest level of English would benefit more from parental academic support in the home language in situations where the school offered language support only in the majority language or no language support at all. According to MacSwan and Rolstad (2005) and also MacSwan et al. (2017), language and conceptual understanding of school subject are distinctly separately and academic subject knowledge gained in any language the child happens to know will be accessible and available to the child. In this sense, academic knowledge that immigrant parents can teach to their children in the home language will help DLLs develop a network of contextual clues that allows them to be successful in English-only environments in the same way as home language support contributes to children's success in bilingual programs.

This study found that parental academic help is more beneficial for NES students in kindergarten attending ESL compared to a NES student in bilingual education when the help is delivered in the home language, after controlling for child's age and gender, and parental levels of use of the home language, education, English proficiency, and income. The difference between a NES student in an ESL program and a NES student in a bilingual program both receiving parental academic support *always* in the home language was 42.01 points in math IRT scores, the equivalent of 1.08 standard deviations (W= 13.71, df = 1, β= 1.08, $p < 0.001$).

In addition, it was also found that students with the lowest level of English proficiency benefited the most from parental help in the home language within the ESL program. The difference between a NES student and a student with higher levels of English proficiency both in kindergarten, attending an ESL program, and receiving parental academic support *always* in the home language was 23.84 points in math IRT scores, the equivalent of almost half standard deviation (W= 6.60, df = 1, β= 0.49, p < 0.05).

Crucially, this study found that students with the lowest level of English benefitted the most when the parental academic help was delivered in the home language rather than English. The difference between a NES student in an ESL program who received parental academic support *always* in the home language compared to a NES student in the same language program and also receiving parental academic help but English rather that in the home language was 29.84 points in math IRT scores, the equivalent of almost half standard deviation (W= 6.04, df = 1, β= 0.48, p < 0.05).

These findings were replicated when DLLs in a submersion context were compared to DLLs in a language program (either English-only or bilingual education) during the kindergarten year. DLLs in a submersion context with the lowest level of English proficiency benefitted the most from parental academic help in the home language compared to DLLs attending a language program, or DLLs in submersion contexts but with higher levels of English proficiency. Again, DLLs with the lowest levels of English proficiency in submersion classroom crucially benefited the most from parental academic help when the help was delivered in the home language rather than English.

Limitations and Contributions to the Research on the Effectiveness of Bilingual Education, Early Childhood Bilingualism and Family Language Policy

Although this study was also set to investigate the growth rate of math scores in connection to parental home language use for academic help, no significant difference was found in the use of the home language over the growth rate from kindergarten to fifth grade. One of the limitations of this study is that parental academic support in the home language was limited to the kindergarten year. Although the ECLS-K:2011 dataset includes questions about parental engagement and academic support in later years after kindergarten, only the kindergarten year included a follow-up question regarding the use of the home language for involving the child in school-type activities at home. It is expected that parental academic support as it was conceptualized in this study would look differently in later years of elementary school, such the inclusion of parental homework support. Although the ECLS-K:2011 dataset includes questions about the frequency of the home language use among parents and children in later years such as 1st, 3rd, and 5th grade, questions remain about the use of the home language for academic support in later years as students learn more complex content at school.

Another limitation of this study is related to the size of the sample. As it was explained before, cases of *de facto* bilingual education are uncommon given that current and past regulation specify that DLLs need to receive some form of language instruction (ESSA, 2015; NCLB, 2001), which makes the study of these cases difficult. The NES group or the group with the lowest level of English proficiency had the smallest number of participants in sample. When NES students were divided in groups according to the type of language instruction they received in school, the sample was further reduced (see Appendix, Table 5, for frequencies of DLLs according to English level and type of

language instruction). In addition, the sample size was affected by high rates of non-responses among parents (e.g., 42% in fall of kindergarten), which affected the covariates and the use of FIML to address missing data. Despite these limitations, this study identified a sample of 333 DLLs with the lowest level of English proficiency, offering an explanation and verification of cases of *de facto* bilingual education in early childhood education.

This study makes an important contribution to the evidence of the effectiveness of bilingual education since it connects parental home language support with math achievement in DLLs of Spanish-speaking background attending elementary school. The finding of this study support the evidence in favor of the effectiveness of bilingual education (e.g., Bialystok, 2018; Genesee et al., 2006; NASEM, 2017) by investigating the role of parental home language support in math achievement upon entry to kindergarten and in later years in elementary school. This study draws from the transfer theory in bilingual education (MacSwan et al., 2017) to interpret the differences in math scores observed among DLLs with the lowest level of English proficiency across different school language programs and contexts. This study argues that the parental support in the home language that DLLs receive when attending kindergarten provides them with background knowledge (Ramos & Krashen, 2013) or a network of contextual clues that allows them to make significant gains in math in English-only environments upon entry to kindergarten in the same way as first language or home language support contributes to children's success in bilingual and dual language programs.

This study also contributes to the understanding of early childhood bilingualism in relation to academic achievement and English language development among DLLs of

Spanish-speaking background. Findings of this study showed that parents' preference for using a home language did not harm the English language development of DLLs upon entry to kindergarten. In addition, regarding the empirical literature that guided the design of this study, the findings of this study support the results reported by Winsler and colleagues (2014) who investigate learning and language use among immigrant families with four-year-old children. Winsler and colleagues (2014) found that children from immigrant families who spoke exclusively English in the home, performed poorer in early cognitive outcomes. However, when the family spoke other languages than English at home, children with U.S.-born and those with foreign-born mothers performed more similarly.

A limitation of this study is that it only investigated parental academic support in the home language only in connection with math achievement. Other researchers like Galindo and Sheldon (2012) and Bachman et al. (2020) have investigated academic achievement in connection with reading. This study focused exclusively in mathematics achievement because reading was tested in English and the sample selected in this study included students with the lowest level of English proficiency. In contrast to Lahaie (2008) and Bachman et al. (2020), this study found a positive effect associated to the use of the home language by parents of Spanish-speaking background. By carefully selecting a sample of bilingual students who were identified as speakers of a non-English language at home, this study found that parental home language use does not affect English language proficiency and, in the case of DLLs with the lowest level of English proficiency, parental support in the home language has academic benefits since it provides DLLs with background knowledge or contextual information to keep up with

classroom instruction while they learn English when no support in the home language is provided at school. These findings are of great significance to teachers, parents, policymakers, and researchers who seek to promote a language as a resource perspective on bilingualism and strive for equitable educational practices that support the inclusion of all children in schools.

Using ethnographic methods, Curdt-Christiansen (2009, 2013) and Gallo and Hornberger (2019) documented how immigrant parents were involved in supporting the academic development of their children. In particular, Gallo and Hornberger (2019) presented the case of a Mexican family residing in the Unites States and planning to return to Mexico because of the deportation of the father. The mother and daughter of this family resisted monoglossic language ideologies in the US and the Mexican school system by negotiating opportunities for the daughter to become bilingual and bilateral as they engaged in literacy events at home. Although this study is limited by the use of secondary data, in particular in connection to the type of academic support and use of the home language by parents in the years after kindergarten, the findings of this study contributes to the research in FLP by documenting the involvement of immigrant parents in their children's education. Questions about the motivations and attitudes of the parents and children in this sample are left unanswered. However, this study also offers a unique overview of the language practices of a large number of immigrant families of Spanish-speaking backgrounds in the United States.

Conclusion: Implications and Future Research

This study was designed to illuminate our understanding of anomalous cases in which bilingual students with emerging English skills experience academic success or

rapid math gains in English-only classrooms in the apparent absence of home language support in schools. Using a sample of 2,428 bilingual students in 438 schools from the ECLS-K:2011, this study examined the patterns of language use among immigrant bilingual families and shed light on the role of family language practices on the English language development of language-minority students.

Past and current research in family language policy has asked questions about the interplay between family language preferences, immigration, and the larger political and social context (King & Lanza, 2019; Piller & Gerber, 2018). However, there is a dearth of quantitative studies using nationally representative data sets that seek to investigate patterns of home language use and the English language development of DLLs. This study addresses this gap by using data from the ECLS-K:2011 study and employing up-to-date longitudinal quantitative methods to investigate home language use among immigrant families with young children. This study further adds to the literature by considering how parental use of the home language supports the educational attainment of young bilingual learners.

Moreover, although there is extensive research on the effectiveness of bilingual education programs (e.g., NASEM, 2017; Rolstad et al., 2005) including empirical evaluations of theoretical models for educating bilingual learners (MacSwan, et al., 2017), little is known about the role of the home language in supporting academic achievement in other contexts than the classroom. This study makes an important contribution to the field of bilingual education by offering an empirical verification of Krashen's (1999) conjecture regarding "de facto" bilingual education upon entry to kindergarten. The conclusion of this study is that there is no evidence that bilingualism in

early childhood or bilingual education ("de facto" or in school) jeopardize the acquisition of the majority language or academic achievement among DLLs. Moreover, parental use of a home language to support the academic development of bilingual learners is beneficial in particular in situations when home language support at school is lacking or no language support is provided to DLLs.

As the prior discussion of the limitations of this study indicated, more research is necessary to better understand the patterns of language use among immigrant families. A study that could bring the strengths of using inferential statistics combined with ethnographic observations of the language practices and attitudes would provide answers to some of the questions left unanswered in this study. For example, more data about the motivations for using the home language and perceptions about the use of the home language and English could be collected. Measures of the home language proficiency among DLLs could also be included. Finally, surveys involving children could be included to investigate the children's motivations and language perceptions regarding the home language and the majority language.

In addition, this study did not explore the possible connections between parental involvement, family language practices and school efforts to engage immigrant parents. Future research using the ECLS-K:2011 study involving family language practices could focus attention to the role of schools in supporting bilingual families. This study also did not explore the possible connections between parental levels of education and income and preferences for language use at home. As explained before, the complexity of the population that was sampled for this study was not fully investigated. Future research using the ECLS-K:2011 data could interrogate the diversity of educational and

economical backgrounds among Latino families in connection to family language practices and academic achievement of DLLs.

This study offers implications for policymakers, teachers and parents. An implication for policymakers is that more programs offering support in the student home language at school are needed. The findings of this study support the evidence in favor of the effectiveness of bilingual education, in particular for students who speak a minority language at home. This study also offers implications for teachers working with students coming from immigrant families. Findings from this study show that parental home language use was not linked to development of English language proficiency in young bilingual learners. Teachers who work with students from minority language backgrounds should not discourage parents from pursuing bilingual parenting at home or encourage family language practices at the expense of the home language. Finally, this study hopes to encourage parents who desire to raise bi-/multilingual children to pursue family language practices that celebrate the complexities and joys of growing up with a multilingual repertoire.

Appendix

Table 1

Correlation matrix for parental use of the home language scores (n=569). (RQ1).

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.	PAR HL use kinder*	1.00									
2.	PAR HL use 1st grade	0.38	1.00								
3.	PAR HL use 3rd grade	0.35	0.39	1.00							
4.	PAR HL use 5th grade	0.36	0.40	0.40	1.00						
5.	PAR education	-0.09	0.00	-0.02	-0.13	1.00					
6.	PAR English proficiency	0.32	0.17	0.19	0.30	-0.50	1.00				
7.	PAR income	-0.06	0.00	-0.04	-0.04	0.27	-0.29	1.00			
8.	Both PAR immigrants	0.07	0.06	0.14	0.20	-0.14	0.28	0.09	1.00		
9.	CHL bilingual education	0.10	0.17	0.11	0.07	-0.11	0.16	-0.11	-0.05	1.00	
10.	CHL number of siblings	-0.01	0.07	0.07	0.06	-0.21	0.15	-0.01	0.09	0.11	1.00

*PAR = parents; CHL = Child; HL = home language.

Table 2

Correlation matrix for child use of the home language scores (n=569). (RQ1).

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. CHL HL use kinder*	1.00									
2. CHL HL use 1st grade	0.43	1.00								
3. CHL HL use 3rd grade	0.40	0.45	1.00							
4. CHL HL use 5th grade	0.42	0.47	0.52	1.00						
5. PAR education	-0.21	-0.12	-0.10	-0.22	1.00					
6. PAR English proficiency	0.38	0.31	0.28	0.42	-0.50	1.00				
7. PAR income	-0.15	-0.14	-0.10	-0.11	0.27	-0.29	1.00			
8. Both PAR immigrants	0.12	0.05	0.13	0.18	-0.14	0.28	0.09	1.00		
9. CHL bilingual education	0.23	0.29	0.16	0.15	-0.11	0.16	-0.11	-0.05	1.00	
10. CHL number of siblings	-0.01	0.07	0.10	0.11	-0.21	0.15	-0.01	0.09	0.11	1.00

*PAR = parents; CHL = Child; HL = home language.

Table 3

Correlation matrix for English language screener scores and family background characteristics during kindergarten (n=787). (RQ2).

		1.	2.	3.	4.	5.	6.	7.
1.	*preLAS* scores	1.00						
2.	PAR HL use*	-0.18	1.00					
3.	CHL HL use	-0.27	0.64	1.00				
4.	CHL male	0.01	-0.05	-0.05	1.00			
5.	PAR education	0.19	-0.09	-0.15	0.03	1.00		
6.	PAR English level	-0.26	0.35	0.35	-0.04	-0.47	1.00	
7.	PAR income	0.12	-0.05	-0.14	0.04	0.21	-0.22	1.00

*PAR = parents; CHL = Child; HL = home language

Table 4

Descriptive statistics for parental academic support in kindergarten (weekly frequency ranging from 1 = never to 4 = always) (RQ3).

Items from fall 2010 parent interview	Mean	S.D.
How often PAR tell stories*	2.65	0.9
How often PAR & CHL sing songs	2.84	1.01
How often PAR help CHL do art	2.75	0.98
How often CHL does chores	2.88	1.07
How often PAR & CHL play games	2.64	0.93
How often PAR talk about nature	2.05	0.95
How often PAR & CHL all build things	2.28	0.95
How often PAR & CHL do sports	2.72	0.95
How often CHL practice numbers	3.37	0.81
Parental academic support (average)	2.69	0.53
Home language use for academic support	3.3	0.83

*PAR = parents; CHL = Child

Table 5

Frequency of students with language services in kindergarten (including submersion contexts). (RQ3).

	NES	LES	FES	Total
English as a second language	93	172	469	734
Bilingual education	185	125	192	502
Submersion context	55	79	533	667
Total	333	376	1,194	1,903

Table 6

Correlation matrix for Math IRT scores and family background characteristics from kindergarten (2010-11) to fifth grade (2016) (n= (n=470). (RQ3).

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.
1.	MAT fall 2010*	1.00																
2.	MAT spring 2011	0.72	1.00															
3.	MAT fall 2011	0.66	0.77	1.00														
4.	MAT spring 2012	0.63	0.70	0.79	1.00													
5.	MAT fall 2012	0.61	0.69	0.75	0.84	1.00												
6.	MAT spring 2013	0.61	0.66	0.75	0.78	0.82	1.00											
7.	MAT spring 2014	0.60	0.67	0.70	0.73	0.75	0.82	1.00										
8.	MAT spring 2015	0.59	0.64	0.68	0.70	0.75	0.81	0.85	1.00									
9.	MAT spring 2016	0.54	0.62	0.68	0.69	0.73	0.78	0.83	0.87	1.00								
10.	PAR academic support	0.04	0.02	0.07	0.07	0.08	0.09	0.10	0.06	0.04	1.00							
11.	PAR HL for academic support	-0.05	0.00	0.03	-0.06	-0.03	-0.05	-0.01	0.02	0.02	-0.03	1.00						
12.	CHL *preLAS* K scores	0.33	0.32	0.32	0.34	0.34	0.32	0.24	0.22	0.18	0.05	-0.23	1.00					
13.	CHL male	0.10	0.08	0.01	0.01	0.04	0.10	0.11	0.11	0.08	0.06	-0.02	0.02	1.00				
14.	PAR HL use in K	-0.02	0.01	0.01	0.01	0.01	0.03	0.03	0.05	0.04	-0.10	0.36	-0.18	-0.05	1.00			
15.	PAR education	0.21	0.20	0.14	0.18	0.16	0.12	0.17	0.16	0.18	0.17	-0.13	0.16	0.05	-0.12	1.00		
16.	PAR English proficiency	-0.19	-0.16	-0.12	-0.14	-0.13	-0.10	-0.12	-0.13	-0.12	-0.17	0.29	-0.30	-0.05	0.31	-0.52	1.00	
17.	PAR income	0.08	0.07	0.11	0.13	0.10	0.12	0.11	0.09	0.13	0.02	-0.11	0.14	0.05	-0.04	0.28	-0.26	1.00

*MAT = math IRT scores; PAR = parents; CHL = Child; HL = home language; K = kindergarten.

Table 7

Three-level model with robust standard errors (in brackets) for parents' family language practices from kindergarten to 5th grade. (RQ1).

Fixed Effect Parameters	Model 1 n = 2,428	Model 2 n = 2,428	Model 3 n = 1,450
Parental use of the home language	2.48*** (0.01)	2.52*** (0.01)	2.43*** (0.04)
Control variables (parents)			
Level of education			0.04** (0.01)
Level of English proficiency			-0.22*** (0.02)
Income (categorical)			0.01 (0.03)
Both parents are immigrants			0.10** (0.03)
Control variables (child)			
Bilingual instruction in kindergarten			0.12*** (0.03)
Number of siblings			-0.00 (0.01)
Linear growth rate (in months)		-0.00*** (0.00)	-0.00*** (0.00)
Random Effect Parameters			
Level-3 variance	0.00*** (0.00)	0.00*** (0.00)	0.01*** (0.01)
Level-2 variance	0.16*** (0.01)	0.16*** (0.01)	0.11*** (0.01)
Residual variance	0.27*** (0.01)	0.27*** (0.01)	0.26*** (0.01)
AIC	11629.41	11616.00	5790.68

* p<0.05; ** p<0.01; *** p<0.001

Table 8

Three-level models with robust standard errors (in brackets) for children's family language practices from kindergarten to 5th grade. (RQ1).

Fixed Effect Parameters	Model 1 n = 2,428	Model 2 n = 2,428	Model 3 n = 1,450
Children's use of the home language	2.13*** (0.02)	2.20*** (0.02)	2.14*** (0.05)
Control variables (parents)			
Level of education			0.01 (0.02)
Level of English proficiency			-0.32*** (0.02)
Income (categorical)			-0.08* (0.04)
Both parents are immigrants			0.13*** (0.04)
Control variables (child)			
Bilingual instruction in kindergarten			0.27*** (0.04)
Number of siblings			-0.03* (0.01)
Linear growth rate (in months)		-0.00*** (0.00)	-0.00*** (0.00)
Random Effect Parameters			
Level-3 variance	0.04*** (0.01)	0.04*** (0.01)	0.01*** (0.01)
Level-2 variance	0.31*** (0.02)	0.31*** (0.02)	0.18*** (0.02)
Residual variance	0.38*** (0.01)	0.38*** (0.01)	0.39*** (0.02)
AIC	14394.80	14367.84	7183.50

* p<0.05; ** p<0.01; *** p<0.001

Table 9

Fixed and random estimates, including robust standard errors (in brackets) for the preLAS language screener (total raw score) (RQ2. Initial status for preLAS language screener).

Fixed Effect Parameters	Model 1 n=1,331	Model 2 n=995	Model 3 n=995	Model 4 n=768
Score at kindergarten entry	13.99***	18.18***	5.71***	6.23***
	(0.21)	(0.77)	(0.41)	(0.55)
Parental use of the home language		-0.25	0.01	0.05
		(0.36)	(0.15)	(0.16)
Child use of the home language		-1.66***	-0.40***	-0.42***
		(0.24)	(0.11)	(0.11)
LES student			7.90***	7.64***
			(0.26)	(0.31)
FES student			12.52***	12.00***
			(0.26)	(0.31)
Control variables (child)				
Age in kindergarten				0.05*
				(0.02)
Male				-0.12
				(0.16)
Control variables (parents)				
Level of education				0.05
				(0.07)
Level of English proficiency				0.19
				(0.13)
Income (categorical)				-0.25
				(0.13)
Random Effect Parameters				
Level-2 variance	6.79***	5.43***	0.22**	0.39**
	(1.02)	(1.07)	(0.10)	(0.12)
Residual variance	23.74***	22.78***	4.26***	4.03***
	(1.26)	(1.42)	(0.23)	(0.25)
AIC	9311.45	6094.18	4323.48	3334.06

* p<0.05; ** p<0.01; *** p<0.001

Table 10

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.1. Initial status for ESL versus bilingual instruction).

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Score at kindergarten entry	32.04*** (1.45)	33.26*** (2.85)	35.46*** (3.61)	36.97*** (3.95)	33.16*** (4.38)	31.48*** (3.99)
ESL student	-2.72*** (0.74)	-4.95 (2.96)	-3.92 (4.77)	-6.56 (5.48)	-3.02 (6.00)	-4.78 (5.23)
NES student	-8.79*** (0.86)	-7.73* (3.28)	-16.27** (5.45)	-21.96*** (6.44)	-29.95*** (7.39)	-27.11*** (7.31)
LES student	-4.44*** (0.89)	-3.25 (3.32)	-7.12 (5.90)	-8.53 (6.95)	-13.53* (6.64)	
Parental academic support (PAS)	0.30 (0.72)	-0.70 (1.62)	-2.16 (2.10)	-3.10 (2.31)	-5.78** (2.10)	-4.48* (1.94)
Home language use *always* for academic support (HLU *always*)	1.26 (0.72)	0.55 (4.01)	-9.84 (7.51)	-14.90 (9.00)	-19.45* (7.92)	-17.20** (6.47)
2-way interactions						
ESL x NES		-0.05 (1.70)	-11.11 (6.18)	1.94 (9.61)	6.75 (9.65)	8.62 (9.12)
ESL x LES		-3.48 (1.83)	-2.59 (6.63)	-0.11 (10.41)	2.38 (11.37)	
PAS x NES		-1.27 (1.75)	5.20 (3.32)	8.83* (3.96)	15.11** (4.63)	13.81** (4.63)
PAS x LES		0.76 (1.61)	2.58 (3.21)	3.47 (3.85)	6.74 (4.02)	
HLU *always* x NES		1.96 (1.93)	29.34** (10.16)	43.22** (13.39)	55.34*** (14.04)	53.56*** (13.02)
HLU *always* x LES		-0.61 (1.81)	10.22 (9.38)	15.07 (13.43)	17.32 (13.32)	

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
PAS x ESL		1.76 (1.57)	1.48 (2.64)	3.06 (3.07)	1.91 (3.29)	2.06 (2.92)
HLU *always* x ESL		0.46 (1.43)	3.78 (8.43)	11.87 (11.42)	4.00 (11.68)	5.55 (9.63)
PAS x HLU *always*		0.12 (1.47)	4.16 (2.81)	6.09 (3.38)	8.43** (3.00)	7.27** (2.43)
3-way interactions						
PAS x ESL x NES			3.68 (3.55)	-4.39 (5.76)	-9.40 (5.97)	-9.50 (5.77)
PAS x ESL x LES			0.29 (3.44)	-1.19 (5.83)	-4.29 (6.42)	
HLU *always* x ESL x NES			6.65 (3.51)	-25.37 (19.46)	-41.38* (19.49)	-42.81* (17.89)
HLU *always* x ESL x LES			-2.71 (3.60)	-10.45 (18.97)	-10.89 (20.93)	
PAS x HLU *always* x NES			-11.34** (3.84)	-16.67** (5.13)	-22.74*** (5.49)	-21.67*** (5.15)
PAS x HLU *always* x LES			-3.46 (3.45)	-5.31 (5.01)	-7.12 (5.06)	
PAS x HLU *always* x ESL			-1.55 (3.05)	-4.57 (4.19)	-3.19 (4.29)	-3.50 (3.50)
4-way interactions						
PAS x HLU *always* x ESL x NES				12.30 (7.43)	20.17** (7.59)	20.34** (7.05)
PAS x HLU *always* x ESL x LES				2.90 (7.04)	4.67 (7.71)	
Control variables (child)						
Age in kindergarten					-1.10*** (0.09)	-1.03*** (0.09)

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Male					-0.29 (0.76)	-0.32 (0.78)
Control variables (parents)						
Use of home language					1.73* (0.68)	1.24 (0.67)
Level of education					0.80* (0.39)	0.78 (0.40)
Level of English proficiency					-0.15 (0.66)	-0.02 (0.68)
Income (categorical)					1.71* (0.78)	1.68* (0.80)
Rate of change						
Linear term	2.02*** (0.02)	2.02*** (0.02)	2.02*** (0.02)	2.02*** (0.02)	2.02*** (0.03)	2.02*** (0.03)
Quadratic term	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)

* p<0.05; ** p<0.01; *** p<0.001

Table 11

Random estimates, robust standard errors (in brackets) and model fit for math IRT score. (RQ3.1. Initial status for ESL versus bilingual instruction).

Random Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Level-3 Variance	6.25** (4.38)	6.20** (4.31)	6.14* (4.39)	6.27** (4.45)	9.99** (6.99)	14.67*** (7.44)
Level-2 Variance	139.71*** (7.95)	138.79*** (7.84)	137.22*** (7.66)	136.86*** (7.70)	119.83*** (8.90)	121.43*** (9.04)
Residual Variance	55.26*** (1.76)	55.24*** (1.76)	55.23*** (1.76)	55.23*** (1.76)	54.95*** (1.88)	54.94*** (1.88)
AIC	45553.32	45562.16	45562.20	45563.90	36934.78	36955.76

* p<0.05; ** p<0.01; *** p<0.001

Table 12

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.2. Growth Rate for ESL versus bilingual instruction).

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Score at kindergarten entry	30.39***	31.91***	33.52***	35.50***	36.24***	34.64***
	(1.43)	(2.81)	(3.84)	(4.31)	(4.08)	(3.60)
ESL student	-1.61*	-5.32	-4.43	-7.90	-1.89	-4.60
	(0.79)	(2.88)	(4.70)	(5.62)	(5.34)	(4.15)
NES student	-7.34***	-3.38	-11.19*	-17.15**	-23.93***	-21.38***
	(0.88)	(3.09)	(5.35)	(6.44)	(6.63)	(6.29)
LES student	-3.89***	-0.62	0.23	-2.74	-11.71*	
	(0.85)	(3.18)	(5.43)	(6.34)	(4.67)	
Parental academic support (PAS)	0.71	-0.17	-1.06	-2.29	-5.07**	-4.31**
	(0.69)	(1.51)	(2.10)	(2.40)	(1.81)	(1.61)
Home language use *always* for academic support	0.99	-3.11	-16.48*	-23.32*	-28.01***	-22.10***

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
(HLU *always*)						
	(0.76)	(3.68)	(8.07)	(9.88)	(7.89)	(5.70)
2-way interactions						
ESL x NES		0.83	-10.80	2.62	0.16	2.96
		(1.78)	(6.07)	(8.50)	(9.54)	(8.73)
ESL x LES		-2.78	-6.50	-1.08	-1.49	
		(1.73)	(6.27)	(9.23)	(8.04)	
PAS x NES		-3.64*	1.82	5.61	10.50**	9.75**
		(1.68)	(3.24)	(3.88)	(3.88)	(3.73)
PAS x LES		-0.69	-2.01	-0.18	4.37	
		(1.68)	(2.96)	(3.55)	(2.97)	
HLU *always* x NES		3.05	33.57***	48.80***	58.08***	52.56***
		(1.84)	(9.35)	(13.06)	(13.05)	(11.43)
HLU *always* x LES		-0.67	5.97	15.54	22.82*	
		(1.72)	(9.40)	(13.89)	(10.46)	
PAS x ESL		2.19	1.65	3.70	1.05	2.17
		(1.46)	(2.44)	(3.00)	(2.82)	(2.27)
HLU *always* x ESL		1.09	11.59	22.42	10.43	8.26
		(1.56)	(8.31)	(11.80)	(10.61)	(7.89)
PAS x HLU *always*		1.18	6.04*	8.62*	11.03***	8.59***

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
		(1.34)	(2.99)	(3.69)	(2.96)	(2.16)
3-way interactions						
PAS x ESL x NES			5.55	-2.74	-3.71	-4.77
			(3.44)	(4.91)	(5.33)	(4.95)
PAS x ESL x LES			3.54	0.30	-0.41	
			(3.45)	(5.37)	(4.72)	
HLU *always* x ESL x NES			2.29	-31.32	-36.99	-34.51*
			(3.56)	(17.92)	(19.19)	(17.41)
HLU *always* x ESL x LES			-4.46	-20.35	-14.99	
			(3.57)	(18.17)	(15.65)	
PAS x HLU *always* x NES			-11.88***	-17.72***	-22.69***	-20.31***
			(3.46)	(4.89)	(4.91)	(4.33)
PAS x HLU *always* x LES			-1.49	-5.14	-8.73*	
			(3.53)	(5.31)	(4.06)	
PAS x HLU *always* x ESL			-3.74	-7.78	-5.03	-3.99

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
			(2.98)	(4.31)	(3.90)	(2.90)
4-way interactions						
PAS x HLU *always* x ESL x NES				12.87	16.53*	15.30*
				(6.74)	(7.14)	(6.49)
PAS x HLU *always* x ESL x LES				5.96	5.84	
				(6.90)	(5.90)	
Control variables (child)						
Age in kindergarten					-1.67***	-1.59***
					(0.11)	(0.10)
Male					-1.39*	-1.44*
					(0.61)	(0.63)
Control variables (parents)						
Use of home language					1.23*	0.79
					(0.58)	(0.57)
Level of education					0.26	0.25

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
					(0.34)	(0.36)
Level of English proficiency					-0.49	-0.39
					(0.59)	(0.61)
Income (categorical)					0.83	0.89
					(0.68)	(0.71)
Rate of change						
Linear term	2.07***	2.06***	2.08***	2.07***	1.95***	1.94***
	(0.04)	(0.06)	(0.07)	(0.08)	(0.08)	(0.08)
ESL student	-0.04	0.02	0.03	0.05	-0.02	0.01
	(0.02)	(0.06)	(0.10)	(0.12)	(0.13)	(0.12)
NES student	-0.05*	-0.15	-0.17	-0.17	-0.23	-0.22
	(0.02)	(0.08)	(0.12)	(0.14)	(0.19)	(0.19)
LES student	-0.02	-0.08	-0.26*	-0.22	-0.10	
	(0.02)	(0.08)	(0.12)	(0.14)	(0.17)	
Parental academic support (PAS)	-0.01	-0.02	-0.03	-0.03	-0.02	-0.00
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.03)
Home language use *always* for	0.01	0.12	0.22	0.26	0.22	0.15

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
academic support (HLU) *always*)						
	(0.02)	(0.08)	(0.14)	(0.15)	(0.15)	(0.12)
2-way interactions						
ESL x NES		-0.03	-0.01	0.00	0.30	0.26
		(0.04)	(0.16)	(0.21)	(0.25)	(0.24)
ESL x LES		-0.03	0.13	0.06	0.19	
		(0.05)	(0.17)	(0.28)	(0.32)	
PAS x NES		0.08	0.11	0.12	0.17	0.15
		(0.04)	(0.07)	(0.08)	(0.12)	(0.12)
PAS x LES		0.05	0.16**	0.14	0.10	
		(0.04)	(0.06)	(0.07)	(0.08)	
HLU *always* x NES		-0.04	-0.13	-0.14	0.04	0.10
		(0.04)	(0.23)	(0.28)	(0.36)	(0.35)
HLU *always* x LES		0.00	0.17	0.05	-0.03	
		(0.04)	(0.22)	(0.31)	(0.31)	
PAS x ESL		-0.02	-0.01	-0.02	0.02	-0.02
		(0.03)	(0.06)	(0.07)	(0.07)	(0.07)
HLU *always* x ESL		-0.02	-0.28	-0.34	-0.18	-0.12
		(0.04)	(0.18)	(0.23)	(0.25)	(0.22)

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
PAS x HLU *always*		-0.04	-0.06	-0.08	-0.06	-0.04
		(0.03)	(0.05)	(0.06)	(0.05)	(0.05)
3-way interactions						
PAS x ESL x NES			-0.06	-0.07	-0.23	-0.19
			(0.09)	(0.12)	(0.15)	(0.15)
PAS x ESL x LES			-0.11	-0.07	-0.17	
			(0.09)	(0.15)	(0.17)	
HLU *always* x ESL x NES			0.14	0.14	-0.36	-0.42
			(0.08)	(0.45)	(0.55)	(0.53)
HLU *always* x ESL x LES			0.06	0.27	-0.08	
			(0.08)	(0.50)	(0.57)	
PAS x HLU *always* x NES			0.01	0.02	-0.05	-0.07
			(0.08)	(0.10)	(0.14)	(0.14)
PAS x HLU *always* x LES			-0.08	-0.03	-0.01	
			(0.08)	(0.11)	(0.11)	
PAS x HLU			0.08	0.10	0.05	0.03

	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Fixed Effect Parameters						
always x ESL						
			(0.07)	(0.08)	(0.09)	(0.08)
4-way interactions						
PAS x HLU *always* x ESL x NES				0.00	0.19	0.21
				(0.17)	(0.20)	(0.20)
PAS x HLU *always* x ESL x LES				-0.08	0.04	
				(0.18)	(0.20)	
Control variables (child)						
Age in kindergarten					0.02***	0.02***
					(0.00)	(0.00)
Male					0.04*	0.04*
					(0.02)	(0.02)
Control variables (parents)						
Use of home language					0.02	0.02
					(0.02)	(0.02)

Fixed Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Level of education					0.02* (0.01)	0.02* (0.01)
Level of English proficiency					0.01 (0.01)	0.01 (0.01)
Income (categorical)					0.04 (0.02)	0.03 (0.02)
Rate of change						
Quadratic term	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)

* p<0.05; ** p<0.01; *** p<0.001

Table 13

Random estimates, robust standard errors (in brackets) and model fit for math IRT score. (RQ3.2. Growth rate for ESL versus bilingual instruction).

Random Effect Parameters	Model 1 n=1296	Model 2 n=1296	Model 3 n=1296	Model 4 n=1296	Model 5 n=1028	Model 6 n=1028
Level-3 Variance	6.55** (4.44)	6.72** (4.42)	6.90** (4.54)	6.94** (4.59)	11.69*** (7.33)	16.61*** (7.60)
Level-2 Variance	139.86*** (7.96)	139.12*** (7.89)	137.46*** (7.73)	137.17*** (7.77)	118.03*** (8.95)	119.64*** (8.98)
Residual Variance	55.00*** (1.75)	54.74*** (1.74)	54.54*** (1.73)	54.53*** (1.73)	51.93*** (1.67)	52.11*** (1.69)

* p<0.05; ** p<0.01; *** p<0.001

Table 14

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3.3. Initial status for submersion students versus students with language instruction).

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
Score at kindergarten entry	28.36*** (1.19)	30.31*** (2.06)	31.81*** (2.65)	32.92*** (2.74)	35.39*** (3.60)	26.44*** (3.20)
Submersion student (SUB)	3.42*** (0.68)	-2.49 (2.33)	-2.93 (3.51)	-5.09 (3.72)	-11.36** (4.24)	-8.80* (3.95)
NES student	-8.64*** (0.82)	-8.10** (2.59)	-14.80** (4.51)	-19.32*** (5.20)	-21.80*** (6.13)	-18.97*** (5.61)
LES student	-5.08*** (0.77)	-5.00 (2.80)	-7.65 (4.59)	-9.33 (4.90)	-12.49* (5.43)	
Parental academic support (PAS)	1.53* (0.61)	0.14 (1.11)	-0.82 (1.45)	-1.46 (1.50)	-4.47** (1.58)	-3.35* (1.44)
Home language use *always* for academic support	0.93	0.33	-4.55	-7.79	-16.22**	-12.55**

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
(HLU *always*)						
	(0.61)	(3.34)	(4.98)	(5.33)	(5.70)	(4.70)
2-way interactions						
SUB x NES		-3.17	-8.76	7.32	27.09*	24.09*
		(2.36)	(6.05)	(9.33)	(12.30)	(11.37)
SUB x LES		-3.25	-0.96	4.58	7.37	
		(1.87)	(7.15)	(8.39)	(9.00)	
PAS x NES		4.35***	4.79*	6.05**	8.37***	7.06**
		(1.24)	(1.88)	(2.01)	(2.34)	(2.18)
PAS x LES		-1.40	-1.10	7.49	21.81*	12.33
		(1.30)	(7.21)	(8.71)	(8.73)	(8.58)
HLU *always* x NES		-0.97	3.37	6.16	8.28*	7.59*
		(1.41)	(2.68)	(3.16)	(3.75)	(3.51)
HLU *always* x LES		0.41	2.23	3.21	4.40	
		(1.46)	(2.55)	(2.75)	(3.07)	
PAS x ESL		2.39	20.85**	31.50**	34.05**	32.13**
		(1.73)	(7.97)	(9.83)	(11.11)	(10.02)
HLU *always* x ESL		0.15	6.42	11.00	13.95	
		(1.60)	(8.05)	(9.02)	(10.03)	
PAS x HLU *always*		0.20	2.13	3.33	6.26**	4.79**

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
		(1.20)	(1.82)	(1.95)	(2.10)	(1.71)
3-way interactions						
PAS x SUB x NES			2.29	-7.09	-18.13**	-16.52**
			(3.03)	(5.38)	(6.19)	(6.11)
PAS x SUB x LES			-2.45	-5.75	-6.61	
			(3.84)	(4.58)	(4.84)	
HLU *always* x SUB x NES			2.96	-37.10*	-67.74***	-58.95**
			(4.54)	(17.46)	(19.99)	(19.69)
HLU *always* x SUB x LES			3.47	-12.99	-23.91	
			(3.82)	(19.31)	(19.47)	
PAS x HLU *always* x NES			-7.24*	-11.30**	-12.84**	-11.92**
			(3.05)	(3.78)	(4.25)	(3.92)
PAS x HLU *always* x LES			-2.63	-4.34	-5.17	
			(2.97)	(3.34)	(3.69)	
PAS x HLU *always* x SUB			-0.42	-3.59	-7.76*	-4.45
			(2.58)	(3.15)	(3.20)	(3.09)
4-way interactions						

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
PAS x HLU *always* x SUB x NES				14.76* (6.47)	25.93*** (7.12)	22.81** (7.12)
PAS x HLU *always* x SUB x LES				6.13 (7.11)	8.78 (7.07)	
Control variables (child)						
Age in kindergarten					-1.08*** (0.08)	-1.01*** (0.08)
Male					0.33 (0.63)	-0.11 (0.63)
Control variables (parents)						
Use of home language					1.48** (0.54)	1.44** (0.53)
Level of education					0.37 (0.31)	0.37 (0.31)
Level of					0.36	0.83

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
English proficiency						
					(0.53)	(0.53)
Income (categorical)					2.07**	1.96**
					(0.70)	(0.69)
Rate of change						
Linear term	2.03***	2.03***	2.03***	2.03***	1.28***	2.03***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Quadratic term	-0.01***	-0.01***	-0.01***	-0.01***		-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)

* p<0.05; ** p<0.01; *** p<0.001

Table 15

Random estimates and robust standard errors (in brackets) for math IRT score. (RQ3.3. Initial status for submersion students versus students with language instruction).

Random Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
Level-3 Variance	10.45*** (4.63)	10.22*** (4.66)	10.58*** (4.79)	10.33*** (4.84)	20.39*** (7.37)	17.75*** (6.69)
Level-2 Variance	143.40*** (6.63)	141.56*** (6.73)	140.63*** (6.74)	140.51*** (6.76)	111.12*** (7.62)	122.11*** (7.58)
Residual Variance	54.16*** (1.39)	54.16*** (1.39)	54.16*** (1.39)	54.16*** (1.39)	83.02*** (2.33)	54.65*** (1.50)
AIC	65153.82	65148.50	65155.36	65155.29	54599.41	52234.88

* p<0.05; ** p<0.01; *** p<0.001

Table 16

Fixed estimates and robust standard errors (in brackets) for math IRT score. (RQ3. Growth rate for submersion students versus students with language instruction).

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
Score at kindergarten entry	28.10*** (1.22)	30.06*** (2.08)	30.64*** (2.62)	31.53*** (2.70)	34.11*** (3.14)	30.67*** (2.72)
Submersion student (SUB)	2.51*** (0.73)	-2.01 (2.53)	-0.14 (3.53)	-1.41 (3.73)	-9.27* (3.69)	-7.07* (3.30)
NES student	-7.29*** (0.78)	-3.26 (2.49)	-11.62** (4.09)	-15.21*** (4.52)	-20.99*** (4.85)	-17.36*** (4.47)
LES student	-4.06*** (0.75)	-4.06 (2.74)	-3.65 (4.43)	-4.98 (4.69)	-11.64* (4.86)	
Parental academic support (PAS)	1.60** (0.59)	0.48 (1.07)	-0.05 (1.38)	-0.56 (1.43)	-4.31** (1.39)	-3.22** (1.14)
Home language use always for academic	0.75	-4.62	-8.14	-10.69*	-18.93***	-16.14***

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
support (HLU) *always*)						
	(0.62)	(3.36)	(4.97)	(5.30)	(5.14)	(3.81)
2-way interactions						
SUB x NES		-2.22	-8.73	3.62	16.60	13.56
		(1.76)	(5.86)	(8.11)	(8.68)	(8.48)
SUB x LES		-0.18	-6.66	-6.38	0.32	
		(1.92)	(7.66)	(8.75)	(8.03)	
PAS x NES		3.07*	2.39	3.15	6.76***	5.85**
		(1.32)	(1.87)	(1.99)	(2.00)	(1.80)
PAS x LES		-0.96	-5.08	-0.13	12.87	7.83
		(1.34)	(7.80)	(9.39)	(8.04)	(7.75)
HLU *always* x NES		-3.80**	1.82	4.05	7.73**	6.62*
		(1.35)	(2.40)	(2.67)	(2.81)	(2.62)
HLU *always* x LES		-0.07	0.15	0.93	3.69	
		(1.49)	(2.52)	(2.69)	(2.76)	
PAS x ESL		3.91*	26.11***	34.50***	39.25***	36.72***
		(1.61)	(7.43)	(8.73)	(9.20)	(8.30)
HLU *always* x ESL		0.79	3.27	6.90	11.81	
		(1.54)	(8.35)	(9.17)	(9.87)	
PAS x HLU *always*		1.77	3.33	4.27*	7.14***	5.95***

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
		(1.22)	(1.80)	(1.92)	(1.88)	(1.38)
3-way interactions						
PAS x SUB x NES			1.78	-5.42	-14.13**	-12.65**
			(3.20)	(4.91)	(4.89)	(4.75)
PAS x SUB x LES			1.74	1.46	-1.65	
			(4.23)	(4.97)	(4.35)	
HLU *always* x SUB x NES			5.72	-24.36	-47.86**	-41.04**
			(3.45)	(15.87)	(15.62)	(15.17)
HLU *always* x SUB x LES			6.74	5.30	-7.66	
			(3.95)	(20.68)	(18.00)	
PAS x HLU *always* x NES			-8.94**	-12.14***	-14.64***	-13.49***
			(2.81)	(3.30)	(3.45)	(3.12)
PAS x HLU *always* x LES			-1.49	-2.85	-4.42	
			(3.09)	(3.40)	(3.62)	
PAS x HLU *always* x SUB			0.87	-0.96	-5.13	-3.19
			(2.78)	(3.37)	(2.92)	(2.78)
4-way interactions						

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
PAS x HLU *always* x SUB x NES				11.04 (5.92)	20.54*** (5.82)	17.99** (5.57)
PAS x HLU *always* x SUB x LES				0.61 (7.76)	3.81 (6.63)	
Control variables (child)						
Age in kindergarten					-1.70*** (0.09)	-1.63*** (0.09)
Male					-1.01 (0.56)	-1.20* (0.57)
Control variables (parents)						
Use of home language					0.89 (0.46)	0.77 (0.46)
Level of education					0.14 (0.29)	0.13 (0.29)
Level of English					0.14	0.45

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
proficiency						
					(0.49)	(0.49)
Income (categorical)					0.95	0.94
					(0.60)	(0.63)
Rate of change						
Linear term	2.04***	2.03***	2.07***	2.08***	1.95***	1.95***
	(0.03)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)
Submersion student (SUB)	0.03	-0.01	-0.10	-0.13	-0.07	-0.06
	(0.02)	(0.06)	(0.08)	(0.09)	(0.09)	(0.08)
NES student	-0.04*	-0.16*	-0.11	-0.14	-0.07	-0.08
	(0.02)	(0.07)	(0.11)	(0.12)	(0.14)	(0.13)
LES student	-0.04	-0.03	-0.14	-0.16*	-0.05	-0.04*
	(0.02)	(0.07)	(0.08)	(0.08)	(0.08)	(0.02)
Parental academic support (PAS)	-0.00	-0.01	-0.03	-0.03	-0.01	-0.01
	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Home language use always for academic support (HLU) *always*)	0.01	0.17*	0.12	0.10	0.06	0.09
	(0.01)	(0.07)	(0.09)	(0.09)	(0.10)	(0.09)
2-way						

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
interactions						
SUB x NES		-0.03	-0.03	0.09	0.37	0.36
		(0.06)	(0.17)	(0.25)	(0.24)	(0.24)
SUB x LES		-0.11**	0.25	0.44*	0.32	
		(0.04)	(0.15)	(0.17)	(0.19)	
PAS x NES		0.04	0.09*	0.10*	0.06	0.04
		(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
PAS x LES		-0.02	0.16	0.28	0.31	0.22
		(0.03)	(0.16)	(0.19)	(0.19)	(0.17)
HLU *always* x NES		0.10**	0.06	0.07	0.04	0.04
		(0.04)	(0.06)	(0.07)	(0.09)	(0.08)
HLU *always* x LES		0.01	0.14*	0.16*	0.11	
		(0.04)	(0.06)	(0.07)	(0.07)	
PAS x ESL		-0.06	-0.16	-0.09	-0.09	-0.11
		(0.04)	(0.19)	(0.22)	(0.26)	(0.26)
HLU *always* x ESL		-0.02	0.08	0.10	0.07	
		(0.03)	(0.06)	(0.06)	(0.06)	
PAS x HLU *always*		-0.05*	-0.04	-0.03	-0.02	-0.03
		(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
3-way interactions						
PAS x SUB x			0.04	-0.03	-0.15	-0.13

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
NES						
			(0.08)	(0.13)	(0.14)	(0.13)
PAS x SUB x LES			-0.19*	-0.30**	-0.25*	
			(0.09)	(0.10)	(0.11)	
HLU *always* x SUB x NES			-0.11	-0.44	-0.78	-0.68
			(0.11)	(0.48)	(0.52)	(0.51)
HLU *always* x SUB x LES			-0.13	-0.68	-0.72*	
			(0.08)	(0.39)	(0.36)	
PAS x HLU *always* x NES			0.05	0.03	0.03	0.04
			(0.07)	(0.08)	(0.10)	(0.10)
PAS x HLU *always* x LES			-0.04	-0.04*	-0.04	
			(0.02)	(0.02)	(0.02)	
PAS x HLU *always* x SUB			-0.05	-0.10	-0.10	-0.07
			(0.06)	(0.07)	(0.07)	(0.06)
4-way interactions						
PAS x HLU *always* x SUB x NES				0.12	0.23	0.20
				(0.18)	(0.19)	(0.19)

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
PAS x HLU *always* x SUB x LES				0.21 (0.15)	0.25 (0.13)	
Control variables (child)						
Age in kindergarten					0.02*** (0.00)	0.02*** (0.00)
Male					0.04** (0.01)	0.04** (0.01)
Control variables (parents)						
Use of home language					0.02 (0.01)	0.02 (0.01)
Level of education					0.01 (0.01)	0.01 (0.01)
Level of English proficiency					0.01 (0.01)	0.01 (0.01)
Income (categorical)					0.04*	0.04*

Fixed Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
					(0.02)	(0.02)
Quadratic term	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)

* p<0.05; ** p<0.01; *** p<0.001

Table 17

Random estimates and robust standard errors (in brackets) for math IRT score. (RQ3.4. Growth rate for submersion students versus students with language instruction).

Random Effect Parameters	Model 1 n=1,885	Model 2 n=1,885	Model 3 n=1,885	Model 4 n=1,885	Model 5 n=1,482	Model 6 n=1,482
Level-3 Variance	10.58*** (4.67)	10.86*** (4.80)	11.15*** (4.95)	11.00*** (5.00)	18.88*** (6.75)	19.84*** (6.67)
Level-2 Variance	142.92*** (6.61)	141.48*** (6.71)	140.98*** (6.80)	140.67*** (6.82)	115.03*** (7.33)	118.12*** (7.36)
Residual Variance	53.90*** (1.37)	53.38*** (1.36)	53.12*** (1.36)	53.09*** (1.36)	51.12*** (1.34)	51.41*** (1.35)
AIC	65124.26	65078.25	65067.55	65066.38	51858.19	51900.04

* p<0.05; ** p<0.01; *** p<0.001

Table 18

Descriptive statistics for students' English language proficiency (X1PLTOT and X2PLTOT) and math assessments (X1MSCALK5 to X9MSCALK5). (Chapter 3).

Round	Description	n	Mean	Stand. Dev.	Min.	Max.
1. Fall Kinder	*preLAS* Total Score	2032	14.26	5.42	0	74.23
2. Spring Kinder	*preLAS* Total Score	2302	16.68	4.03	0	80.74
1. Fall Kinder	Math IRT Scale Score	1990	28.41	9.23	11.96	97.52
2. Spring Kinder	Math IRT Scale Score	2291	43.01	11.38	11.75	108.36
3. Fall First Grade	Math IRT Scale Score	1122	51.67	11.53	14.89	117.36
4. Spring 1st Grade	Math IRT Scale Score	2174	64.16	12.97	12.7	125.17
5. Fall 2nd Grade	Math IRT Scale Score	1075	68.52	13.06	14.21	136.32
6. Spring 2nd Grade	Math IRT Scale Score	2071	80.6	15.7	21.86	146.41
7. Spring 3rd Grade	Math IRT Scale Score	1975	94.69	16.69	43.45	147.28
8. Spring 4th Grade	Math IRT Scale Score	1909	103.89	17	31.24	20
9. Spring 5th Grade	Math IRT Scale Score	1861	110.9	17.44	26.76	20

Table 19

Cronbach's alpha coefficients for family language practices variables. (Chapter 3).

Variable	ECLS-K:2011 Variable	Number of items	1. Fall Kinder	4. Spring 1st Grade	7. Spring 3rd Grade	9. Spring 5th Grade
PAR use of the home language	P1RES_1 P1RES_2	2	0.57	0.62	0.60	0.57
CHL use of the home language	P1CHL_1 P1CHL_2	2	0.79	0.82	0.76	0.79
PAR academic support	P1TELLST P1SINGSO P1HLPART P1CHORES P1GAMES P1NATURE P1BUILD P1SPORT P1NUMBRS	9	0.72			
PAR English level (mother)	P1READE1 P1SPEAK1 P1UNDER1 P1WRITE1	4	0.95			
PAR English level (father)	P1READE2 P1SPEAK2 P1UNDER2 P1WRITE2	4	0.93			

Table 20

Factor analysis with unrotated loading for 9 items used to create the Parental academic support variable.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	1.97	1.85	1.27	1.27
Factor 2	0.12	0.08	0.08	1.35
Factor 3	0.04	0.03	0.03	1.38

Table 21

Factor loadings and unique variances for 9 items used to create the Parental academic support variable.

Variable	Factor 1	Factor 2	Factor 3	Uniqueness
P1TELLST	0.49	0.13	-0.06	0.74
P1SINGSO	0.48	0.06	0.04	0.77
P1HLPART	0.48	0.06	-0.09	0.76
P1CHORES	0.37	0.02	0.11	0.85
P1GAMES	0.49	-0.12	0.06	0.74
P1NATURE	0.52	-0.16	-0.05	0.70
P1BUILD	0.52	-0.15	-0.04	0.70
P1SPORT	0.39	0.02	0.10	0.84
P1NUMBRS	0.45	0.19	0.00	0.76

Table 22

Percentages of missing score for child math IRT assessments (n= 2,428).

Wave	Round	Percentage
1	Fall Kindergarten	18
2	Spring Kindergarten	6
3	Fall First Grade	54
4	Spring First Grade	10
5	Fall Second Grade	56
6	Spring Second Grade	15
7	Spring Third Grade	19
8	Spring Fourth Grade	21
9	Spring Fifth Grade	23

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