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Examining the influence of out-of-school input on the lexical development of early-elementary students in a French-English dual immersion program

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Examining the influence of out-of-school input on the lexical development of early-elementary students in a French-English dual immersion program

A dissertation submitted in partial satisfaction of the requirements for the degree of

Doctor of Philosophy in Education

by

Ève Wendy Sophie Ryan

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ABSTRACT OF THE DISSERTATION

Examining the influence of out-of-school input on the lexical development of early-elementary students in a French-English dual immersion program

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Doctor of Philosophy in Education

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Professor Alison Bailey, Chair

The United States has witnessed a rise in dual language immersion (DLI) programs in recent years, with instruction delivered both in English, the majority language spoken in the wider society, and in another language, often referred to as the partner or minority language. But while accountability mandates have focused on students' performance in core subjects (language arts, math and science), scant attention has been paid to the development of both languages of instruction. The present dissertation seeks to fill this gap by focusing on the French and English lexical trajectories of early elementary school children attending a DLI program ($N = 39$), with special attention paid to the impact of linguistic support in French, or lack thereof, outside of school itself. Based on parental responses on surveys, information was gathered on the amount

and nature of the French language experience received outside of school. Next, using a multilevel model for change, the lexical trajectories of K-1 students in the DLI program is analyzed over one calendar year. Finally, relationships between French and English lexical outcomes are examined. Results suggest that participants' experiences with the French language remain limited outside of school, even for students coming from French-speaking households. In terms of French lexical trajectories, students from French-speaking households ($N = 15$) score higher at baseline compared to their peers from non-French-speaking households ($N = 24$), but they do not display growth over the calendar year; whereas students from non-French-speaking households display progress in their expressive French vocabulary (but not in their receptive vocabulary). In terms of English lexical trajectories, no differences emerged based on students' home language backgrounds. Participants displayed growth in their receptive English vocabulary, but not their expressive English vocabulary. Finally, results from correlations suggest that the relationship between French and English outcomes is stronger for students from French-speaking households than their peers from non-French-speaking households. This dissertation more fully elucidates the heretofore understudied relationship between out-of-school language experience and vocabulary development for students enrolled in a dual language program. Implications for research and practice with bilingual education are discussed, including the need to examine students' language development in other domains and to focus on vocabulary instruction.

The dissertation of Ève Wendy Sophie Ryan is approved.

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2019

Pour Tim, mon ‘ti zézèr.

Pour Zoé, Noémie et Fleur, mon bann’ marmay’.

Mi èm zot’ tout’ !

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SECTION 1: INTRODUCTION

In 2016, California voters overwhelmingly approved Proposition 58, the California Non-English Languages Allowed in Public Education Act. Major reversals were made to Proposition 227, a voter-approved initiative which, in 1998, placed broad restrictions on K-12 instruction in any language other than English (Mongeau, 2016). Though it is too early yet to fully account for the effects of Proposition 58 (which went into effect in July, 2017), one predicts a sharp rise in the number of bilingual programs offered in California public schools, such as dual language immersion (DLI) programs, which have become increasingly popular in the last few years (Bailey & Osipova, 2016). In such programs, instruction is delivered both in English, the *majority* language spoken in the larger U.S. society, and in an additional language, often referred to as the *partner* or *minority* language.

The growing interest in bilingual education may be partially attributed to research that has shown a "bilingual advantage" in areas as varied as socio-emotional development (e.g., Han, 2010) or cognitive development (e.g., Bialystok, Craik, Klein, & Viswanathan, 2004) (although see de Bruin, Treccani, & Sala, 2015, who warn against publication bias towards positive findings). In the field of education, scholars have highlighted the benefits of bilingual programs on children's academic achievement (e.g., Padilla, Fan, Xu, & Silva, 2013), as well as on their literacy and language development (e.g., Francis, Lesaux, & August, 2006)[1]. Yet, regarding the latter, a striking recurrent finding is the fact that "across these studies, therefore, the majority language of the community was mastered whether or not it was the primary language of instruction, but the minority language required environmental support to reach high proficiency levels" (Bialystok,

[1] Note that positive effects of bilingual programs compared to monolingual programs may not be initially apparent, and may take time to manifest themselves.

2016, pp. 4–5). In other words, children who are enrolled in bilingual programs in the United States attain (or maintain) English fluency regardless of whether it is their primary language of instruction or not. Even for nonnative speakers of English, reaching or sustaining high levels of fluency in the partner language proves elusive through schooling in a bilingual program alone. Therefore, adequately accounting for children's input experience with the partner language outside of the school context is essential to obtaining a comprehensive picture of the language learning trajectory of students enrolled in a bilingual program.

French in the United States

The partner language of the current study is French. French is the fifth most spoken language in the United States, with over 1.3 million Americans over the age of five speaking it at home (Ryan, 2013). Some Francophone communities in the US date back to historical settlements as early as the 17th century. For example, Cajun French has been the dominant variety of French in Louisiana for over 200 years since the settlement of Acadian communities in various parts of the state. Following repressive language policies in the first half of the 20th century, efforts have been made to revitalize French as a heritage language in Louisiana, through initiatives such as the creation of a state agency (*The Council for the Development of French in Louisiana*) that advocates for the needs of French speakers in the state (Ross & Jaumont, 2014). Other Francophone communities formed more recently thanks to an ongoing flux of immigrants from Francophone countries. For instance, the 2010 earthquake in Haiti prompted a surge in Haitian immigration to the Southeastern United States (Ross & Jaumont, 2014). In sum, French speakers in the United States are a heterogeneous group, with diverse national origins, ethnicities, and socioeconomic statuses, which reflects the status of French as a global language (Ross & Jaumont, 2012, as cited in Ross & Jaumont, 2014).

There exist various educational programs that promote the learning or maintenance of French in the US, ranging from afterschool programs to full immersion schools that follow the curriculum set forth by the French Government (e.g., the Lycée Français de Los Angeles). There has been a surge in programs that promote French as a heritage language[2], such as the French Heritage Language Programs in New York, Florida, Maine and Boston (Lasserre, Lamplugh, & Liu, 2012). In addition, thanks to investment from the French government, the French dual language fund for bilingual education in US public schools was inaugurated in September 2017 (French Culture, 2017). In the Southwestern region of the US, where this study takes place, a rising number of French-English dual language programs have been launched in public elementary schools in the recent years, with seven schools currently serving approximately 500 students, and this trend is expected to continue (Charconnet, Ngo, & Sun, 2018).

Most of the research on the French language development of school-age children in North America focuses on the Canadian context, where both French and English are the official languages. For example, Chiang and Rvachew (2007) examined the relationship between phonological awareness and vocabulary for English-speaking Kindergarterners in French immersion programs and found that English phonological awareness significantly contributed to the development of phonological awareness in French, and that the latter was also partially explained by French expressive vocabulary size. In contrast, there is very little research on the French language development of elementary children in US schools where, while it does not have an official language status, English clearly has dominion over all other languages in US culture and society.

[2] The National Heritage Language Research Center provides the following definition: "individuals exposed to a language other than English at home but educated primarily in English are heritage speakers of the home language" (NHLRC, n.d.).

One exception is a study conducted on fifty-two children attending the United Nations International School in Manhattan, where French is taught as a foreign language. Wu, Temple, Herman, and Snow (1994) found that children provided better image descriptions in French in writing than in speaking, which reflected the limited opportunities to speak French in the classroom setting. Furthermore, the authors noted that "the home language environment of the children played a significant role in their French performance" (p. 158), with monolingual English students lagging behind their peers who spoke another language at home (i.e., children who spoke only French at home, children who spoke both French and English at home, and children who spoke languages other than French at home). It remains to be seen whether such findings could be generalizable to other school settings where French may have a different status (e.g., where it may be taught as a partner language as opposed to a foreign language). Clearly, more research needs to be conducted in the US context in a wider range of educational settings, including in bilingual programs where French is a partner language.

Dissertation goals

This dissertation contributes to the literature on bilingual students in DLI programs in the United States by examining their bilingual lexical development in French and English in light of their out-of-school language practices. This dissertation is divided into four sections. First, I introduce the literature review that informed the research questions for the current study. Second, I describe the participants, methods and plans for data analysis. Third, I present my findings before discussing their significance. Finally, in the last section, I close with concluding remarks about practical implications and future research.

SECTION 2: BACKGROUND

The present section begins with a segment on bilingual schooling where I describe the major characteristics and challenges of dual language immersion (DLI) programs. I then report findings on studies that have focused on the language outcomes for students enrolled in bilingual programs. Third, I review research on the home language practices of children enrolled in multilingual school settings. Next, I synthesize research findings vocabulary, highlighting some key considerations with regards to the lexical development of bilingual children. Finally, I describe the theoretical framework that guides the current research, before moving on to the research questions that my dissertation will answer.

Bilingual schooling

Research on bilingual children's language development ought to take into consideration their schooling context. Indeed, studies suggest that schooling context influences bilingual children's language acquisition patterns, both in the L1 and L2 (Bialystok, 2016). This section will first describe bilingual programs, including their characteristics and challenges, before examining the language outcomes that have been reported for students enrolled in such programs.

Dual language programs

The context of this study is that of a dual language program that involves two partner languages, which in the present case are French and English. DLI programs feature characteristics that are representative of full immersion programs (as identified by Johnson & Swain, 1997), such as the fact that: "the immersion curriculum parallels the local L1 curriculum," "the program aims for additive bilingualism," and "the classroom culture mirrors that of the community from which the students are drawn, not that of a community where the target language is spoken" (Walker & Tedick, 2000, p. 7). In the context of this study, the program advocates for proficiency in both

French and English and follows the curriculum set forth by the local school district, while its classroom culture mirrors that of the North American context (e.g., the students recite the Pledge of Allegiance at the beginning of the school day).

Furthermore, it is ideal for the student population of DLI programs to be equally balanced between L1 speakers of the majority language and L1 speakers of the second partner language, so that "students serve as native-speaking models for each other" (Bailey & Osipova, 2016, p. 181). In reality, the student population is often comprised of native speakers of the majority language, native speakers of the partner language, and proficient bilinguals. The main characteristic of DLI is that "in these programs, the partner language (e.g., Spanish, Mandarin, Korean) is used for a significant portion (from 50% to 90%) of the students' instructional day" (Lindholm-Leary, 2012, p. 256).

Bailey and Osipova (2016) identify pedagogical challenges that come with the practice of alternating languages as medium of instruction, including: the risk that students become disengaged when the content is covered in the L2 if it is also covered in the L1, and the risk that students lack academic lexical terms in both languages if some topics or subjects are solely covered in one language. This raises the possibility that, in certain content areas, students perform poorly on federally mandated assessments that are given in a language other than the language of instruction[3] (Bailey & Osipova, 2016) (e.g., being assessed in English about a math concept learned in French). As Lindholm-Leary (2012) warns, dual language programs are at a disadvantage when it comes to accountability, given that it often takes several years for students in such programs to catch up to their peers in monolingual programs on achievement tests

[3] Alternatively, this emphasis on English means that "even though DLI programs have a stated goal of biliteracy, there is often little accountability for demonstrating grade-level reading skills in the partner language" (Lindholm-Leary, 2012, p. 259).

(Umansky & Reardon, 2014). Additionally, Bailey and Osipova (2016) enumerate three further challenges, including administrative challenges that may arise when trying to program multiple strands within a single school site in order to arrange for different levels of exposure at different grade levels, challenges for DLI programs that operate within a larger school involving "the potential for isolation from the wider school community" (p.188), and finally, the fact that teachers have to contend with students' heterogeneous developmental trajectories in both languages, as well as their potential lack of motivation to use the partner language given the predominance of English in their everyday lives.

Language outcomes

Despite the aforementioned challenges, many families choose to enroll their children in bilingual programs. Research has documented the positive effects of bilingual education on academic outcomes. For example, thanks to data on lottery applicants, Steele et al. (2017) were able to determine that bilingual education had a positive effect on reading performance in fifth and eighth grade (though students' mathematics and science performance was not significantly different from their peers in traditional programs). In terms of language outcomes, bilingual education has a positive impact on children's L1 and L2 development (Bialystok, 2016). Burkhauser et al. (2016) found that by eighth grade, students enrolled in a dual language program "performed at least at the Intermediate Low sublevel, and often higher, on Standards-Based Measurement of Proficiency assessments of nearly all language skills tested (listening, reading, writing, and speaking)" (p. 416) (using the American Council on the Teaching of Foreign Languages (ACTFL) scale).

In particular, bilingual schooling positively impacts the language development of speakers of a minority language. For example, Lindholm-Leary (2014) examined the trajectory of 283 low-

SES Hispanic children and found that, even if the Kindergarteners in English-only instruction had higher language scores than their peers in bilingual programs originally, this trend reversed after two years, with children in bilingual instruction outperforming their peers in monolingual instruction on both English and Spanish measures. Similarly, in a study of oral narrative retells, Spanish-speaking first- and second-graders who were enrolled in dual language education displayed significantly better developed micro-level (e.g., vocabulary) and macro-level (e.g., narrative skills) abilities in both English and Spanish than their counterparts in English-only instruction (Lucero, 2015).

Despite the arguments put forth by detractors of bilingual education, who often favor schooling solely in the dominant language of society, receiving education in the partner language will not impede the acquisition of the language of larger society for emergent bilinguals (Francis et al., 2006). This point is illustrated by Pham and Kohnert's (2014) longitudinal study of elementary-school students in the US who spoke Vietnamese as their first language and who received 90 minutes per day of instruction in that language. Over the course of four years, the authors documented greater lexical progress in English (especially for expressive vocabulary), indicating a shift toward L2 dominance. Similarly, Steele et al. (2017) found that by sixth and seventh grade, English learners (ELs) in dual language education had a 3 to 4 percentage point lower probability of remaining classified as ELs than their peers in other programs. This trend was stronger for ELs whose home language matched the school partner language. This seems to hold true in international contexts as well. For example, Schwartz, Moin and Leikin (2012) found that for Russian-Hebrew bilingual preschoolers in Israel, a bilingual preschool context actually accelerated the lexical development of the majority language (Hebrew), while maintaining lexical knowledge in the first language (Russian).

On the other hand, bilingual education also contributes positively to the L1 and L2 development of children speaking a majority language at home and learning a partner language at school. Indeed, compared to their peers who learn a foreign language in a conventional L2 instruction setting (i.e., a foreign language class), students who learn a foreign language in an immersion setting have better L2 proficiency (e.g., Xu, Padilla, & Silva, 2015), all the while maintaining similar levels of proficiency in their L1 (Genesee, 2004). In fact, even though heritage students may initially have an advantage over their non-heritage peers since their home language matches the partner language taught at school, the gap seems to narrow down over time, and may disappear altogether (such as for students in a Mandarin-English DLI program examined by Padilla et al., 2013). For example, by fourth grade, non-Spanish heritage language students enrolled in a Spanish dual language program performed as well as Spanish heritage language students in the same program on reading and speaking measures in Spanish (though Spanish heritage language students still performed significantly better in listening and writing) (Burkhauser et al., 2016).

A major caveat when examining research on outcomes of bilingual education is that students are often artificially aggregated into groups, ignoring the variability that exists within and between such groups. For example, while students in dual language programs are usually classified as either a native speaker of English or a native speaker of the partner language, such categories are elusive (de Jong, 2016), and a more fine-grained categorization within each group may reveal different language development patterns. In the preschool context, Kim, Lambert and Burts (2018) found that dual language learners (N = 7,361) could be divided into three categories based on their different development and learning patterns: "(a) emergent bilingual children, who tended to speak primarily their native language but spoke some English at home and in the classroom; (b) bilingual children, who spoke predominantly English in the classroom and both languages at home; and (c)

heritage language speakers who tended to speak only their native language both at home and in the classroom". In another study, Babino (2017) indicated that students in two different TWI programs in the same city displayed different biliteracy trajectories in English and Spanish that could be explained by school of attendance and initial levels of English. In other words, differences in students' bilingual profiles (e.g., whether Spanish-speaking students learned English simultaneously or sequentially), as well as program characteristics (e.g., percentage of Latino teachers in the school) accounted for some of the variance in students' biliteracy trajectories.

In sum, bilingual education seems to benefit the L1 and L2 development, both for children speaking a minority language at home, as well as those speaking a majority language at home. However, it should be noted that students' language trajectories in a bilingual program may differ by individual and program characteristics.

Home language practices of children enrolled in multilingual school settings

Studies have shown that the language input that children receive at home influences their language development (Hart & Risley, 1995), and in the case of bilingual children, may account for individual differences in their proficiency in both languages (Place & Hoff, 2011). One should keep in mind that home language is a granular construct, and that details such as percentage of language use or specific contexts in which certain languages are used in the household, ought to be taken into account so as to provide a more comprehensive picture of bilingual children's language acquisition, especially with regards to the partner language. For example, Mori and Calder (2017) found that the English vocabulary performance of Japanese heritage students in US high schools could be predicted by parents' future residency plans (i.e., staying in the United States or returning to Japan), maternal English proficiency, and home language use, whereas significant predictors of Japanese vocabulary performance included: home language use, parents' goals for

their children's achievement in Japanese, reading for pleasure in Japanese and exposure to Japanese pop culture. In addition, as Golberg, Paradis, and Crago (2008) point out, the home language effect on the language acquisition of emergent bilinguals' may be "mitigated by other factors, such as SES, parental fluency in English, or community context" (p. 62).

Still, research on multilingual families' language policy (i.e., the "explicit and overt planning in relation to language use within the home among family members"; King, Fogle, & Logan-Terry, 2008, p. 907) has flourished, though there remains a dearth of studies on schooling choices made by parents who speak a partner language at home. Schwartz and colleagues (Schwartz, Moin, Leikin, & Breitkopf, 2010) found that among a group of 111 Russian young adult immigrants in Israel, when it came to language ideology, practice and management in the household, parents who chose to send their child to a bilingual Kindergarten (the bilingual group) differed on key characteristics from parents who elected a monolingual Kindergarten (the monolingual group). The bilingual group attributed more importance to bilingual education, and cited the child's well-being and language development as driving forces behind their schooling choice. In contrast, the monolingual group was more likely to cite convenience as a reason for sending their child to a specific Kindergarten. In addition, conversations between parents and children were less likely to be conducted in Russian in the monolingual group. The latter may have to do with the fact that some parents decide to switch to speaking in the majority language once their child begins school so as to maximize their child's exposure to the school language, often following the advice of educators or health professionals (Bailey & Osipova, 2016).

Within bilingual schools, differences also exist between parents based on their language background and practices. For example, in a survey of the 724 families with children enrolled in an English-Spanish dual-immersion program in the Southwest USA, Parkes (2008) found that

parents who reported speaking primarily in English to their child - the majority of whom rated themselves as bilinguals, as opposed to parents who regarded themselves as English-dominant or Spanish-dominant - were more likely to select "better able to relate to his/her heritage" as a reason for choosing bilingual education for their child. Thus, bilingual education may be a conduit for reviving a heritage language, especially for households where communication also occurs in the majority language.

In another study, Lao (2004) surveyed 86 parents who sent their child to a bilingual Chinese-English preschool in San Francisco and found that even if they all valued bilingualism, they held different expectations with regards to their child's proficiency in the partner language, with Chinese-dominant parents expecting their child to eventually reach a middle- to high-school level of literacy in Chinese, while English-dominant parents felt content with an elementary-school level of Chinese literacy for their child. Perhaps Lao's most striking finding is the fact that the children's Chinese language acquisition was not thoroughly supported in the home for both groups. Indeed, like their English-speaking counterparts, most of the Chinese-speaking parents admitted "never", "rarely" or "occasionally" reading to their children in Chinese (though 86.5% of them reported using at least some Chinese when speaking to their children). In addition, children's literacy development in Chinese was poorly supported in the home, as parents in both groups admitted owning only a few children's books in Chinese. This finding echoes Imbens-Bailey (2000), who discusses the greater parental investment needed when fostering literacy skills (compared to oral skills) among children learning a heritage language. Such studies highlight the issue that progress in the L2 may remain limited if such language is not supported in the home, which especially puts children who speak English as their primary language at a disadvantage. This is the rationale given by Hermanto, Moreno, and Bialystok (2012) to explain their findings

that despite full immersion in French at school since Kindergarten, English-dominant Canadian students in 2nd and 5th grade performed better in English than in French on vocabulary and grammatical knowledge tasks. Bailey and Osipova (2016) list a wide range of practices employed by parents of multilingual children to assist with their language development, such as: trips to the L2 country, teaching nursery rhymes in the L2, etc. However, in the case of children enrolled in TWI programs, parents with no proficiency in the partner language may have fewer strategies to resort to (e.g., technology) than parents who are native speakers. It is not clear how these differences in parents' strategies and practices impact the language trajectory of students enrolled in bilingual programs.

Such findings highlight the need to strengthen home and school connections, including for students in bilingual programs, who have to counter the dominance of English both inside and outside the classroom (Palmer & Martínez, 2013). Indeed, heritage speakers in dual language programs are often reluctant to use their home language at home and at school, instead favoring English (Babino & Stewart, 2017; Potowski, 2004) (also see Hamman, 2018, for examples of how translanguaging practices in a dual language classroom favor English over Spanish). Howard and Christian (2002) thus recommend that schools with dual language programs encourage similar levels of involvement from parents of both languages to send the message that both groups of students are valued. Another strategy put forth by some TWI programs is to offer language classes for parents (both in English and in the partner language) (Howard & Christian, 2002). Bailey and Osipova (2016) report that teachers acknowledged "the value in parents' learning the target L2 (whether the L2 was the majority or a minority language in society) as a signal to children of how important it was to know the language" (p. 230).

To summarize, parents' attitudes and decisions around language practices may influence the language development of multilingual children, an issue of particular salience for children enrolled in bilingual programs.

Vocabulary

This study focuses on vocabulary, which is a central element of the lexical domain. Unlike other language domains such as phonology or syntax, vocabulary is highly sensitive to language input. In other words, variability in children's vocabulary is mostly explained by their language exposure experience (Hart & Risley, 1995; Hoff, 2006), which, in the case of young learners, primarily concerns the school and home settings. For example, Duursma et al. (2007) found that English use in the home was not necessary to foster English vocabulary development among emergent bilinguals in fifth grade, whereas Spanish vocabulary development necessitated both instructional support at school and social support at home. Similarly, Pearson and colleagues (Pearson, Fernandez, Lewedeg, & Oller, 1997) find that a certain threshold of input (20% exposure) is necessary for young bilinguals to willingly or spontaneously produce utterances in a given language.

While acknowledging the importance for children to know words in depth (August, Carlo, Dressler, & Snow, 2005), language acquisition research has traditionally focused on vocabulary breadth, particularly as it relates to receptive skills, which are easier to measure than productive skills (David, 2008). Given the established relationship between vocabulary size, reading and academic achievement, educational researchers often rely upon vocabulary assessments that allow them "to understand variability across children in rate of language development and how such variability relates to later academic achievement" (Pan, 2012, p. 101). Indeed, research has shown

that vocabulary is predictive of performance in reading, discourse, narrative (Lucero, 2015), as well as performance on IQ tests (Wechsler, 1989, as cited in Huttenlocher, Levine, & Vevea, 1998).

The importance of vocabulary in the language acquisition process becomes salient in the case of emergent bilinguals, who have to perpetually try to catch up to their monolingual peers as they keep adding new words to their lexicons (Golberg et al., 2008). There is in fact no single pathway to vocabulary acquisition for bilingual children, given their wide range of profiles. For example, in the aforementioned Pham and Kohnert (2014) study, for Vietnamese-speaking elementary students in the United States, the shift to English dominance occurred at a faster pace in their receptive than their expressive lexical skills over a six-year period. In contrast, Golberg et al. (2008) report a different lexical growth pattern among English learners from various L1 backgrounds in Canada (N=19, mean age at outset = 5 years, 4 months). Over the course of two years, these children displayed continuous growth of their L2 receptive vocabulary whereas there was a plateau effect for their productive vocabulary. These results demonstrate that emergent bilinguals display "different growth patterns for the L1 and L2 during the school-age years due to varying levels of input and educational experience in each language" (Pham & Kohnert, 2014, p. 768). With regards to input, Hoff (2018) notes that it "is a slippery thing to capture—especially when input is provided in two languages, in different amounts, in different contexts, for different purposes, by different people" (p. 2) and that discussions of input should take into account current use, since it is also a strong predictor of language skill.

In sum, vocabulary research is all the more crucial given the relationship between vocabulary knowledge and academic achievement. With regards to studies on bilingual children's lexical development, results ought to be interpreted in light of their schooling

experience (e.g., being enrolled in a bilingual program), as well as the input they receive (e.g., home language background).

Summary

This background section started by reviewing characteristics of dual language programs. Research has generally focused on outcomes of such programs, especially to compare how students fare academically compared to their counterparts enrolled in monolingual programs. However, few studies examine students' language development at a more micro-level, especially with regards to the partner language.

On the other hand, research has shown that schooling alone is not responsible for children's language development, and that home language practices play a significant role, especially in the case of bilingual children. Children's L1 and L2 development is strongly influenced by parents' attitudes and decisions surrounding language practices, and parents who decide to enroll their child in a bilingual program may support to various degrees the development of the partner language at home. More research needs to be conducted to examine the effect of the home language environment on the development of the partner language for children enrolled in bilingual programs given that input at home may account for differences in language trajectories.

Finally, this section highlighted the importance of vocabulary in the field of education, and acknowledged bilingual children's unique lexical development pathways based on the input they receive, both in the school and out-of-school contexts. The present study thus proposes to focus on children's lexical development in both English and a partner language (French), taking into consideration the impact of their schooling experience (i.e., their lexical trajectory during the

school year), as well as their levels of input outside of school (i.e., the amount of French they are exposed to at home).

Theoretical framework

This research is guided by a dynamic systems approach to language development, which posits that individual language systems result from the complex synergy between experiences, social interactions and cognitive processes (Beckner et al., 2009). Dynamic systems theory has been popularized in the field of second language acquisition (De Bot, 2008), but is also relevant to first language development (Geert, 2008). According to this perspective, language development is a dynamic process that evolves over time, and variation is expected both within and across individuals (De Bot, Lowie, & Verspoor, 2007; Larsen-Freeman, 2011). Initial conditions play an important role (e.g., phonological awareness is a predictor for reading acquisition), and subsequent language development is expected to happen in a nonlinear fashion (De Bot et al., 2007). Language development is viewed as a self-organizing process in which a complex multifaceted system is in constant interaction with the environment. The dynamic systems approach seems relevant for the present research given its emphasis on the role played by the environment on the development of language (as seen in the study's focus on out-of-school language practices), as well as on the fluidity of language (within and between individuals, across time, etc.). Indeed, this study aims to examine the lexical trajectories of students, acknowledging the variation that may exist among and across individuals, as well as over time.

Research questions

French exposure

The first part of my dissertation is concerned with the amount and nature of French language exposure outside of school, specifically in the household and over the summer for early-elementary students enrolled in a DLI program. More specifically, the first part of my study aims to answer the following questions:

RQ1 – For early-elementary children enrolled in a French-English dual language program, on average, how much exposure to French do they get outside of school both during the school year and summer in terms of: amounts of input and output and type of print/media exposure?

RQ1a – Are there significant differences between children from French-speaking vs. non-French-speaking households?

RQ1b – For children from French-speaking and non-French-speaking households, are there significant differences both during the school year and summer in terms of: French input vs. output, and French vs. English print/media exposure?

I hypothesize that the exposure to French outside of school will be greater for children from French-speaking households than non-French-speaking households. Also, since research has shown that students in bilingual programs favor English language use at home (and in school), I expect that children from French-speaking households will experience greater input than output, whereas there might not be significant differences between French input and output for children from non-French-speaking households. Finally, based on the literature cited above, I hypothesize that for both groups of students, print and media exposure will be significantly greater in English than in French.

French lexical trajectories

The second part of my dissertation examines the range of vocabulary trajectories in French of students in a DLI program over a one calendar-year period. Students' trajectories are

examined separately based on whether or not French is spoken in the home. More specifically, the second part of my study aims to answer the following questions:

RQ2 – What are the French vocabulary growth trajectories over a one-year period for early-elementary children who are enrolled in a French-English dual language program and who come from households where French is spoken?

RQ2a – What are their receptive French vocabulary growth trajectories?

RQ2b – What are their expressive French vocabulary growth trajectories?

RQ3 – What are the French vocabulary growth trajectories over a one-year period for early-elementary children who are enrolled in a French-English dual language program and who come from households where French is not spoken?

RQ3a – What are their receptive French vocabulary growth trajectories?

RQ3b – What are their expressive French vocabulary growth trajectories?

Since I expect that children from French-speaking households will experience greater exposure to French outside of school, I also expect that their French lexical trajectories will be different, starting with the fact that their vocabulary performance at baseline will be higher than their peers from non-French-speaking households.

English lexical trajectories

The next part of my dissertation examines the range of vocabulary breadth trajectories in English of students in a DLI program over a one calendar-year period by answering the following questions:

RQ4 – What are the English vocabulary growth trajectories over a one-year period for early-elementary children who are enrolled in a French-English dual language program?

RQ4a – What are their receptive English vocabulary growth trajectories?

RQ4b – What are their expressive English vocabulary growth trajectories?

Based on the literature cited above, I hypothesize that students will display greater progress in their receptive English vocabulary compared to their expressive English vocabulary.

French and English

The final part of this study aims to answer the following question:

RQ5 – What is the relationship between the French and English outcomes?

It is not clear what the relationship will be between the French and English outcomes. However, I hypothesize that this relationship will be stronger for children from French-speaking households since I expect their vocabulary performance in French to be stronger than their peers from non-French-speaking households.

SECTION 3: METHODS

This section describes the participants, the instruments, the procedures, and the analyses for the present study.

Participants

The research site consists of a French-English dual language program in a public school in the Los Angeles area that was established in 2015. During the 2016-2017 school year, there were 60 students enrolled in Transitional-Kindergarten (TK)/Kindergarten (K), and 37 students enrolled in 1st grade. This section describes the study participants, including the parents, households and students.

Forty-four parents originally agreed to take part in the study, yielding a response rate of 45%, though the final number of participants included in the present study is 39. Indeed, given the small number of participants, the decision was made to remove participants from the analyses if the students did not contribute to all the waves ($N = 4$) or if the students performed as outliers ($N = 1$)[4].

Among the 39 parents included in the final analyses who answered Survey 1, 11 were male and 28 female. Table 1 presents the characteristics of the parents, based on information reported by the survey respondents. More than half of the parents (55%, $N = 43$) were born in the US. For the parents who were born outside of the country, the average length of stay in the US was 17 years (range: 5-42). According to the respondents, the majority of parents were fully proficient in English (65%, $N = 51$), whereas most parents had no proficiency in French (49%, N

[4] Having just moved from France a few weeks prior to the beginning of data collection, and with no proficiency in English at the beginning of the study, the profile of this particular student greatly differed from the rest of the participants. She thus performed as an outlier in terms of background, predictors, and/or on outcome variables.

= 38). With regards to education level, overall, the majority of parents had a four-year degree or above (68%, *N* = 53). Parents cited mostly language-related reasons for enrolling their child in the program (78%, *N* = 30), whether it was to improve their French proficiency if they came from a French-speaking household or to expose them to a foreign language if they came from a non-French-speaking household. Some parents from non-French-speaking households chose French specifically because they had learned it themselves at school (8%, *N* = 3). Parents also cited cultural awareness as a motivation (24%, *N* = 9), whether it was of their heritage or of other cultures in general. Finally, parents' motivations also evolved around issues of practicality (e.g., proximity, cost, etc.). Appendix B provides some sample responses regarding parents' motivations for enrolling their child in the program.

Table 1 - Parents' characteristics (based on responses from 39 parent respondents)

Characteristics	Number	Percent
Respondent's relationship to the student		
Mother	28	71.8
Father	11	28.2
Parents' country of birth		
US	43	55.1
Other	35	44.9
Father's level of English language proficiency		
0 - "No proficiency"	1	2.6
1	0	0
2	0	0
3	3	7.7
4	12	30.8
5 - "Native or bilingual proficiency"	23	58.9

Mother's level of English language proficiency		
0 - "No proficiency"	1	2.6
1	0	0
2	0	0
3	3	7.7
4	7	17.9
5 - "Native or bilingual proficiency"	28	71.8
Father's level of French language proficiency		
0 - "No proficiency"	21	53.8
1	4	10.2
2	0	0
3	3	7.7
4	1	2.6
5 - "Native or bilingual proficiency"	10	25.7
Mother's level of French language proficiency		
0 - "No proficiency"	17	43.6
1	10	25.6
2	5	12.8
3	3	7.7
4	1	2.6
5 - "Native or bilingual proficiency"	3	7.7
Father's educational level		
Some high school or less	2	5.1
High school graduate	5	12.8
Some college	5	12.8
2 year degree	2	5.1
4 year degree	14	35.9
Master's degree	7	17.9
Doctorate	3	7.8
Professional degree	1	2.6
Mother's educational level		
Some high school or less	2	5.1
High school graduate	3	7.8
Some college	2	5.1
2 year degree	4	10.2
4 year degree	15	38.5
Master's degree	10	25.6
Doctorate	2	5.1
Professional degree	1	2.6

Survey respondents also provided information regarding their household, as presented in Table 2. Most children that took part in the study have siblings under 18 currently living in the household (74%, *N* = 29). The majority of households earned between $100,000 and $199,999 annually (56%, *N* = 22), and only a small number of children received free/reduced priced lunch (20.5%, *N* = 8). Most households were reportedly multilingual, including 38% (*N* = 15) where multiple languages including French were spoken and 26% (*N* = 10) where multiple languages but not French were spoken (e.g., Spanish, Tagalog, Taiwanese). In contrast, 36% (*N* = 14) of the children came from English monolingual households, and none from a French monolingual household.

Table 2 - Characteristics of households (based on responses from 39 parent respondents)

Characteristics	Number	Percent
Number of children		
1	10	25.6
2	20	51.3
3	6	15.4
4	2	5.1
5	1	2.6

Annual income		
less than $10,000	0	0
between $10,001 and $19,999	0	0
between $20,000 and $29,999	4	10.2
between $30,000 and $39,999	1	2.6
between $40,000 and $49,999	2	5.1
between $50,000 and $59,999	1	2.6
between $60,000 and $69,999	0	0
between $70,000 and $79,999	1	2.6
between $80,000 and $89,999	2	5.1
between $90,000 and $99,999	2	5.1
between $100,000 and $149,999	13	33.3
between $150,000 and $199,999	9	23.1
between $200,000 and $249,999	1	2.6
between $250,000 and 299,999	2	5.1
$300,000 or more	1	2.6
Free/reduced priced lunch		
Yes	8	20.5
No	31	79.5
Languages spoken		
English only	14	36
French only	0	0
Multiple languages, including French	15	38.4
Multiple languages, but not French	10	25.6

The 39 children participants (see Table 3) were split roughly evenly between males and females. Children were entering Transitional Kindergarten (TK) (5%, $N = 2$), K (51%, $N = 20$), and 1st grade (44%, $N = 17$) in the fall of 2016, and continued onto K, 1st and 2nd grade in the fall of 2017. No child participants had documented hearing, cognitive, neurological, language, or learning disabilities, as determined by their IEP status (reported by the parent on Survey 1). In terms of race and ethnicity, the majority of student participants were White/Caucasian (49%, $N = 19$), followed by "Other" (31%, $N = 12$), Asian (8%, $N = 3$), Hispanic or Latino/a (8%, $N = 3$) and Black or African-American (5%, $N = 2$). The student participants who were born outside of the US (10%, $N = 3$) had lived most of their lives in the United States ($M = 4.7$ years, $SD = .6$).

Table 3 - Characteristics of child participants ($N = 39$)

Characteristics	Number	Percent
Males	20	51.3
Females	19	48.7
Grades (2016-2017 school year)		
Transitional Kindergarten	2	5.1
Kindergarten	20	51.3
First grade	17	43.6
Race/ethnicity		
White/Caucasian	19	48.7
Other	12	30.8
Asian	3	7.7
Hispanic or Latino/a	3	7.7
Black or African-American	2	5.1
Country of birth		
US	36	92.3
Other	3	7.7

Children participants were divided into subgroups for subsequent analyses on the French outcomes. These subgroups included whether French was reportedly spoken in the household (i.e., frspoken= 1; $N = 15$) or not (i.e., frspoken = 0; $N = 24$). Indeed, in the preliminary analyses (including fitted OLS trajectories and stem and leaf displays, as shown in Appendix C), these two groups displayed starkly different patterns in terms of initial status and growth. In addition, there was a strong significant correlation between the French spoken at home variable and the French outcomes ($r = .63$, $p < .01$ for the receptive vocabulary outcome; $r = .45$, $p < .01$ for the expressive vocabulary outcome). Chi-square tests were conducted to check whether there were significant differences between the two groups based on household and participants' characteristics, and no significant differences were found.

Instruments

Survey 1 – School Year Parent Survey

Parents who agreed to participate in the study completed Survey 1 electronically at the beginning of the study. Survey 1 gathered biographical information about the child participant and his/her parents, as well as background information on their household (see Appendix F). Sample questions included: "What is the highest level of education you completed?", "What is your child's date of birth?", or "How many adults live in your home?". In addition, the survey asked multiple-choice questions regarding the amount and nature of French language exposure (i.e., receptive language) and use (i.e., expressive language) outside of school for the focal child. Sample items include: "Your child watches television programs or movies in French. Never / Rarely / Sometimes / Often / Every day", or "Your child uses French to communicate with you. Never / Rarely / Sometimes / Often / Always". Finally, parents answered open-ended questions regarding their child's experience with learning French (e.g., "Can you share some of the challenges your child has had with learning French?").

As a native speaker of French, I translated Survey 1 into French myself, and requested two native speakers to verify the translation. In addition, Survey 1 was tried out with parents of elementary-school students. Appendix I includes a tally of participants' responses to multiple-choice questions on Survey 1.

Survey 2 – Summer Parent Survey

Following the summer vacation (i.e., at the beginning of the 2017-2018 school year), an email was sent to parents that had originally agreed to take part in the study with a link to Survey 2. Of the 39 parents that had filled out Survey 1, 29 also filled out Survey 2. The survey asked

multiple choice questions that focused on the amount and nature of French language exposure (i.e., receptive language) and use (i.e., expressive language) over the summer for the focal child (see Appendix G). Sample items included: "Relatives communicated in French with your child over the summer (e.g., Skype call with grandparents). Never / Rarely / Sometimes / Often / Every day / Not applicable", or "Your child communicated in French with children outside of home over the summer. Never / Rarely / Sometimes / Often / Every day". In addition, parents answered open-ended questions regarding their child's experience with learning or maintaining French over the summer (e.g., "What factors (e.g., financial, logistical, ...) impeded the continuation of your child's French learning experience over the summer?").

As a native speaker of French, I translated Survey 2 into French myself, and requested two native speakers to verify the translation. In addition, Survey 2 was tried out with parents of elementary-school children. Appendix I includes a tally of participants' responses to multiple-choice questions on Survey 2.

Standardized vocabulary tests

At each wave of data collection, students were assessed on two standardized vocabulary tests, namely: the *Peabody Picture Vocabulary Test Fourth Edition* (PPVT-IV; Dunn & Dunn, 2007) and the *Échelle de Vocabulaire en Images Peabody* (ÉVIP; Dunn, Dunn, & Thériault-Whalen, 1993). For each item on these tests, the examiner says a word, and the child selects the picture that best illustrates that word's meaning. The PPVT-IV measures receptive vocabulary in standard American English. It was normed on English monolingual speakers, and its internal reliability is reported to be $r = .94$. The ÉVIP is an adaptation of the second edition of the PPVT, in which items were translated into Canadian French. The ÉVIP was normed on monolingual or

bilingual speakers for whom Canadian French was the first language, and its internal reliability is reported to be $r = .82$.

These two assessments were chosen because, to my knowledge, they are the two only standardized vocabulary tests that are equivalent between French and English. ÉVIP raw scores were used to measure students' French receptive vocabulary growth. For English, the PPVT raw scores were converted to a single continuous scale, namely the growth scale value (GSV), an equal-interval scale which was created specifically to track examinees' vocabulary growth (Dunn & Dunn, 2007)[5]. Students' performance on these two tests served as outcomes (evip_raw and ppvt_gsv) in the multilevel models for change later used in the analyses.

Lexical task

Children also provided individual language samples at five time points throughout the study. The lexical task was created for this project and consisted of an oral picture description in which the focal child was asked to describe two different pictures to an imaginary friend who only speaks French or only English depending on the task so that this friend could later reproduce the pictures[6]. Appendix H describes the script that was used during the lexical task, while Appendix J provides samples from students in both French and English. One of the pictures, the "school picture," depicts a school scene, where a child is performing show-and-tell in a classroom. The other picture, the "home picture," depicts a domestic scene, where a child is doing dishes in a kitchen. The pictures are presented in Appendix H. As an indicator of content validity, I checked

[5] Students' raw scores on the ÉVIP and PPVT were also converted to age-based scaled scores that had been normed to a reference group based on age. Even if age-based scaled scores provide useful information regarding the students' vocabulary relative to children at the same age, such scores were not used in the longitudinal analyses. Indeed, the PPVT and ÉVIP norming samples are strikingly different from the study population. What's more, the fact that the reference norm group changes as the participants get older means that the standard scores may mask growth (i.e., even if a participant's vocabulary may increase over time, if that increase occurs "at the average rate, his or her standard score and percentile would stay the same", Dunn & Dunn, 2007, p. 21).

[6] This scenario was chosen to discourage students from using English, given that the students knew that the examiner was fluent in both French and English.

with the French teachers at the school that the children would be familiar with the topics covered in the school pictures. In contrast, the teachers agreed that the students would not necessarily be familiar with the vocabulary associated with the home pictures through school alone.

In order to minimize children's memorizing the picture and maximize their engagement with the task, the graphics of each picture were slightly altered at each time point. During the first wave of data collection, half of the children were randomly assigned the school picture first while the other half was assigned the home picture first. The order in which the home or school pictures was introduced first was subsequently alternated at each data collection point.

Students' responses on the lexical task were audio-recorded, and then later transcribed through the Codes for Human Analysis of Transcripts (CHAT) system, which is part of the Child Language Data Exchange System (CHILDES; MacWhinney, 2000). Utterances, ranging from single words to complex sentences with embedded clauses, constituted the units of reference. Child Language ANalysis (CLAN), a series of computer program designed specifically for analysis of CHAT files (MacWhinney, 2000), was used to automatically calculate the number of different words used by the student during the pictures descriptions. Thus, the number of different words that the students used to describe the pictures (i.e., ndwfrtotal and ndwengtotal) were used as outcomes for productive vocabulary.

Procedures

Data collection

Appendix A lays out the timeline for data collection for this project. As soon as the UCLA Internal Review Board and the Los Angeles Unified School District (LAUSD) granted permission to conduct the research in the winter of 2017, recruitment began. Parents filled out Survey 1 and children's vocabulary was assessed during the first wave of data collection (in January and

February 2017). Students' vocabulary was assessed two more times before the end of the 2016-2017 school year (in March 2017, and in May/June 2017). Then, when students returned for the new 2017-2018 school year, I reached out to the parents that had filled out Survey 1, asking them to fill out Survey 2. The last two waves of data collection occurred in the second half of 2017 (in August 2017 and November 2017). For each wave except the first[7], data were collected within a sixteen-day period.

All assessments were conducted by CITI (Collaborative Institutional Training Initiative) certified researchers on school grounds during instructional breaks (i.e., during breakfast and after-school).

Analyses

RQ1

In order to gauge central tendency and variability for each outcome, descriptive statistics (e.g., boxplots) were conducted. In addition, independent samples t-tests were conducted, comparing groups of students (e.g., frspoken=0 vs. frspoken=1) or comparing variables (e.g., engliteracy vs. frliteracy).

RQs 2, 3, and 4

Descriptive statistics were used to provide information on the mean performance for each outcome. In addition, in order to account for multicollinearity, correlations were conducted between different outcomes, or between outcomes and predictors.

The issue of summer loss was investigated by comparing the change in each vocabulary outcome in two adjacent time periods, namely the spring (between waves 2 and 3) and the summer (between waves 3 and 4). For each of these periods, a variable was created to account for the gain

[7] The longer data collection period for the first wave is due to the fact that recruitment was conducted along with data collection.

made by each student. For the spring period, for each outcome, the difference between students' performance at time point 3 and time point 2 was computed representing the spring gain. For the summer period, for each outcome, the difference between students' performance at time point 4 and time point 3 was computed representing the summer gain. A one-sample t-test was then conducted to detect if there were any significant differences between students' growth in the spring vs. the summer.

A multilevel model for change (Singer & Willett, 2003) was used to investigate the students' trajectories for each outcome. Exploratory analyses were first conducted, including: empirical growth plots, OLS regressions, stem and leaf displays (for the intercepts, slopes, and residuals), and plots of OLS estimates of the individual growth parameters against each predictor (as can be seen in Appendix D). Starting with an unconditional growth model without predictors, each vocabulary outcome was then predicted by an intercept and an overall linear slope across all occasions (i.e., the overall slope). Slope terms for season (i.e., spring, summer and fall) were then added as fixed effects in each model but were not significantly different from the overall slope, suggesting that student growth was linear. Thus, for each outcome, a linear model was thus retained over a piecewise model.

Given the limited total number of children participants (N = 39), and in the case of the French outcomes, considering the fact that the analyses were conducted separately for each subgroup (frspoken=0 and frspoken=1), the number of predictors that could be used in the final model for each outcome remained limited. For each outcome, separate models were fit with one predictor at a time (see Table 4 for a list of predictors, as well as Appendix E).

Table 4 - List of predictors and their descriptive statistics included in the preliminary analyses.[8]

Predictor	Description	Descriptive statistics
age*	Age in years at day of data collection	Overall for wave 1 *N* = 39; *M* = 6.1; *SD* = .64; Range: 5.2-7.3
collegedegree	Whether or not one of the student's parent has a four-year college degree (reference group = yes)	frspoken=0 *N(yes)* = 20; *N(no)* = 4 frspoken=1 *N(yes)* = 10; *N(no)* = 5
engliteracy*	Exposure to English print and media outside of school	Overall *N* = 39; *M* = 16.18; *SD* = 3.48; Range: 6-20 frspoken=0 *N* = 24; *M* = 17.83; *SD* = 2.42; Range: 12-20 frspoken=1 *N* = 15; *M* = 13.53; *SD* = 3.31; Range: 6-19
engonly	Whether the student comes from a monolingual English household (reference group = no)	*N(yes)* = 14; *N(no)* = 25
ethnicity	Student's ethnicity (reference group = White)	frspoken=0 *N(White)* = 12; *N(Latino)* = 3; *N(African American)* = 1; *N(Asian)* = 3; *N(Other)* = 5 frspoken=1 *N(White)* = 7; *N(African American)* = 1; *N(Other)* = 7

[8] These predictors are based on information provided by the parents in the surveys. Appendix E explains how the predictors engliteracy, frliteracy and frexposure were calculated.

frliteracy*	Percentage of exposure to French print and media outside of school	Overall *N* = 39; *M* = 7.31; *SD* = 3.7; Range: 1-16 frspoken=0 *N* = 24; *M* = 6.08; *SD* = 3.62; Range: 1-14 frspoken=1 *N* = 15; *M* = 9.27; *SD* = 2.99; Range: 5-16
frexposure*	Percentage of French input and output received/generated by the student outside of school	Overall *N* = 39; *M* = 12.35; *SD* =8.53; Range: 0-34 frspoken=0 *N* = 24; *M* = 7.96; *SD* = 5.48; Range: 0-22.5 frspoken=1 *N* = 15; *M* = 19.37; *SD* = 7.89; Range: 7.5-34
gender	Whether the student is male or female (reference group = female)	frspoken=0 *N(male)* = 11; *N(female)* = 13 frspoken=1 *N(male)* = 9; *N(female)* = 6
grade	Student's grade level at first wave of data collection (reference group = Kindergarten)	frspoken=0 N(TK) = 2; (NK) = 11; N(1st) = 11 frspoken=1 N(TK) = 0; (NK) = 9; N(1st) = 6

income*	Household annual income	frspoken=0 *N(*between $0 and $49,999*)* = 4; *N(b*etween $50,000 and $99,999*)* = 3; *N(*between $100,000 and $149,999*)* = 8; *N(*between $150,000 and $199,999*)* = 7; *N(*between $200,000 and $249,999*)* = 1; *N(*between $250,000 and 299,999*)* = 1
		frspoken=1 *N(*between $0 and $49,999*)* = 3; *N(b*etween $50,000 and $99,999*)* = 3; *N(*between $100,000 and $149,999*)* = 5; *N(*between $150,000 and $199,999*)* = 2; *N(*between $250,000 and 299,999*)* = 1; *N(*$300,000 or more*)* = 1

* Centered on the mean value

The following equations specify both the level-1 and level-2 models that were used for each outcome. Subscript *i* symbolizes individual students, while subscript *t* indicates the time point at which data was collected (i.e., number of months elapsed since the first day of data collection).

French receptive vocabulary for students from non-French-speaking households

The following level-1 and level-2 equations represent the model that was chosen for the French receptive vocabulary outcome (i.e., evip_raw) for the group of students who come from households where French is not spoken (frspoken=0, $N = 24$).

Level 1

$$\widehat{evip\_raw} = \pi_{0i} + \pi_{1i}monthselapsed_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00} + \gamma_{01}age_i$

(2) $\pi_{1i} = \gamma_{10} + \gamma_{11}age_i$

Where ε_{ij} N $(0, \sigma^2)$

In the first of the level-2 equation, Y_{00} stands for the average initial ÉVIP raw score for students from non-French-speaking families at age 6.1, and Y_{01} stands for the difference in initial ÉVIP raw score predicted by a one-year difference. In the second level-2 equation, Y_{10} represents the average monthly rate of change for the ÉVIP raw score during the data collection period for students from non-French-speaking families who were 6.1 years-old at the first wave of data collection, and Y_{11} stands for the monthly difference in slope for the ÉVIP raw score predicted by a one-unit difference in age.

As can be seen in Appendix K, the only other predictor that yielded significant result when entered individually (on the slope only) was French exposure, suggesting that a greater degree of input and output in French outside of school is associated with greater monthly progress on the ÉVIP for children who do not come from a French-speaking household. In the end, however, French exposure was not included in the final model, since it returned insignificant results when entered jointly with age. In addition, comparisons of goodness of fit statistics for age and French exposure suggested that a model with age be a better fit for these data.

French receptive vocabulary for students from French-speaking households

The following level-1 and level-2 equations represent the model that was chosen for the French receptive vocabulary outcome (i.e., evip_raw) for the group of students who come from households where French is spoken (frspoken=1, $N = 15$).

Level 1

$$\widehat{\text{evip\_raw}} = \pi_{0i} + \pi_{1i}\text{monthselapsed}_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00} + \gamma_{01}\text{grade}_i + \gamma_{02}\text{frliteracy}_i$

(2) $\pi_{1i} = \gamma_{10} + \gamma_{11}\text{grade}_i + \gamma_{12}\text{frliteracy}_i$

Where ε_{ij} N $(0, \sigma^2)$

In the first of the level-2 equations, Y_{00} stands for the average initial ÉVIP raw score for Kindergarten students from French-speaking families with average levels of French literacy, Y_{01} stands for the difference in initial ÉVIP raw score between Kindergarteners and First graders, and Y_{02} stands for the difference in initial ÉVIP raw score predicted by a one percent difference in exposure to French print and media outside of school. In the second level-2 equation, Y_{10} stands for the average rate of change for the ÉVIP raw score during the data collection period for Kindergarten students from French-speaking families with average levels of French literacy, Y_{11} stands for the difference in slope between Kindergarteners and First graders, and Y_{12} stands for the difference in slope predicted by a one-unit difference in French literacy.

As can be seen in Appendix K, the only other predictor that yielded significant result when entered individually (on the intercept only) was French exposure, suggesting that a greater degree of input and output in French outside of school is associated with greater baseline scores on the ÉVIP for children who do come from a French-speaking household. In the end, however, French exposure was not included in the final model. With so few participants, it did not make sense to include more than two predictors in the final model. Of the three predictors that yielded significant results when entered individually (i.e., grade, frexposure and frliteracy), French exposure seemed to have the least impact.

French expressive vocabulary for students from non-French-speaking households

The following level-1 and level-2 equations represent the model that was chosen for the French expressive vocabulary outcome (i.e., ndwfrtotal) for the group of students who come from households where French is not spoken (frspoken=0, $N = 24$).

Level 1

$$\widehat{\text{ndwfrtotal}} = \pi_{0i} + \pi_{1i}\text{monthselapsed}_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00} + \gamma_{01}\text{age}_i + \gamma_{02}\text{gender}_i$

(2) $\pi_{1i} = \gamma_{10} + \gamma_{11}\text{age}_i + \gamma_{12}\text{gender}_i$

Where ε_{ij} N $(0, \sigma^2)$

In the first of the level-2 equations, Y_{00} stands for the average initial number of French words used by female students from non-French-speaking households who are 6.1 years old. Y_{01} stands for the difference in initial number of French words predicted by a one-unit difference in age. Y_{02} stands for the difference in initial number of French words between males and females. In the second level-2 equation, Y_{10} stands for the average monthly rate of change for the number of French words during the data collection period for female students from French-speaking families who are 6.1 years old. Y_{11} stands for the difference in slope predicted by a one-unit difference in age. Y_{12} stands for the difference in slope between males and females.

When examining the impact of each predictor individually, gender came out as the only predictor that had a substantial effect on both the intercept and the slope. Similarly, the impact of age seemed consequential on the intercept, thus its inclusion in the final model as a predictor. As can be seen in Appendix K, there were other potential predictors that would be worth exploring in a future study with more participants. For example, French literacy had a significant, albeit minimal effect on the slope, suggesting that students from non-French-speaking households make greater monthly progress in the number of French words used in the picture description task when they have greater degrees of exposure to French print and media outside of school. Similarly, the model with parental education as a predictor suggested that having at least one parent with a four-year college degree had a positive impact on the slope for students from non-French-speaking households. Finally, with regards to the predictor ethnicity, it seems that Hispanic/Latino students

have a steeper monthly slope than White students, a trend which would be worth exploring in a future study with more participants.

French expressive vocabulary for students from French-speaking households

The following level-1 and level-2 equations represent the model that was chosen for the French expressive vocabulary outcome (i.e., ndwfrtotal) for the group of students who come from households where French is spoken (frspoken=1, $N = 15$).

Level 1

$$\hat{\text{ndwfrtotal}} = \pi_{0i} + \pi_{1i}\text{monthselapsed}_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00} + \gamma_{01}\text{frexposure}_i + \gamma_{02}\text{gender}_i$

(2) $\pi_{1i} = \gamma_{10} + \gamma_{11}\text{frexposure}_i + \gamma_{12}\text{gender}_i$

Where ε_{ij} N $(0, \sigma^2)$

In the first of the level-2 equations, Y_{00} stands for the average initial number of French words used by male students from French-speaking families with average levels of French exposure, Y_{01} stands for the difference in initial number of French words predicted by one percent difference in French input and output received and generated by the student outside of school, and Y_{02} stands for the difference in initial number of French words between males and females. In the second level-2 equation, Y_{10} stands for the average monthly rate of change for the number of French words during the data collection period for male students from French-speaking families with average levels of French exposure, Y_{11} stands for the difference in slope predicted by a one-unit difference in French exposure, and Y_{12} stands for the difference in slope between males and females.

As can be seen in Appendix K, there were no other predictors that yielded significant results when entered individually. French exposure was the only predictor that yielded

significant results for both the intercept and slope when entered individually. In addition, French exposure accounted for a substantial portion of the level-2 variation for the intercept. When entered individually, gender had a significant effect on the slope, and was kept in the final model as a control variable.

English receptive vocabulary

The following level-1 and level-2 equations represent the model that was chosen for the English receptive vocabulary outcome (i.e., ppvt_gsv, $N = 39$).

Level 1

$$\hat{}$$

$$\text{ppvt\_gsv} = \pi_{0i} + \pi_{1i}\text{monthselapsed}_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00} + \gamma_{01}\text{collegedegree}_i + \gamma_{02}\text{grade}_i$

(2) $\pi_{1i} = \gamma_{10} + \gamma_{11}\text{collegedegree}_i + \gamma_{12}\text{grade}_i$

Where ε_{ij} N $(0, \sigma^2)$

In the first of the level-2 equations, Y_{00} stands for the average initial PPVT score for Kindergarteners whose parents do not hold a four-year college degree. Y_{01} stands for the difference in initial PPVT scores between these students and their peers with at least one parent with a four-year college degree. Y_{02} stands for the difference in initial PPVT scores between Kindergarteners and other grade levels (i.e., TK and 1st grade). In the second level-2 equation, Y_{10} stands for the average monthly rate of change for PPVT scores during the data collection period for Kindergarteners whose parents do not hold a four-year college degree. Y_{11} stands for the difference in slope between these students and their peers with at least one parent with a four-year college degree. Finally, Y_{12} stands for the difference in slope between Kindergarteners and other grade levels (i.e., TK and 1st grade).

As can be seen in Appendix K, two other predictors yielded significant results when entered individually: French literacy (on the intercept only) and income (on the slope only). This suggests that on the one hand, a greater degree of exposure to French print and media outside of school is associated with greater baseline scores on the PPVT; and on the other hand, that a lower household annual income is associated with greater monthly progress on the PPVT. In the end, however, French literacy and income were not included in the final model. With so few participants, it did not make sense to include more than two predictors in the final model, and income and French literacy had a lesser impact than grade and parental education.

English expressive vocabulary

The following level-1 and level-2 equations represent the model that was chosen for the English productive vocabulary outcome (i.e., ndwengtotal, $N = 39$).

Level 1

$$\hat{\text{ndwengtotal}} = \pi_{0i} + \pi_{1i}\text{monthselapsed}_{ti} + \varepsilon_{ij}$$

Level 2

(1) $\pi_{0i} = \gamma_{00}$

(2) $\pi_{1i} = \gamma_{10}$

Where ε_{ij} N $(0, \sigma^2)$

In the level-2 equation, Y_{00} stands for the average initial number of English words, and Y_{10} represents the average monthly rate of change for the number of English words during the data collection period. Given that no predictor yielded significant results when entered individually (see Appendix K), an unconditional growth model (i.e., without predictors) was chosen as the final model.

RQ5

Pearson correlations were calculated between French and English outcomes.

SECTION 4: RESULTS

This section describes the results for each research question.

RQ1 – Exposure to French outside of school

Based on parents' responses on the surveys, it appears that, on average, students' experience with French outside of school remains very limited, both during the school year and summer time (see Table 5).

Table 5 - Average percentage of out-of-school input, output and print/media exposure in French during the school year and summer

	School year mean (*N = 39)*	Summer mean *(N = 29)*
French input	21.43	23.28
French output	22.68	29.07
French print/media exposure	29.24	24.56

French input, output and print/media exposure by French spoken status

The following boxplots display the distribution of data for French input (Figure 1), French output (Figure 2), and French print/media exposure (Figure 3) by French-speaking household status.

Figure 1 - Boxplot for the French input data (in percent) displayed by French-speaking household status

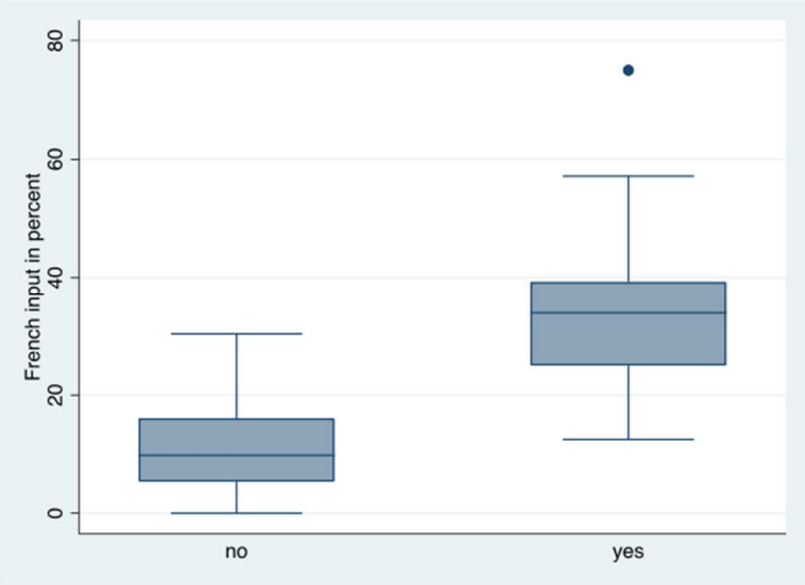


Figure 2 - Boxplot for the French output data (in percent) displayed by French-speaking household status

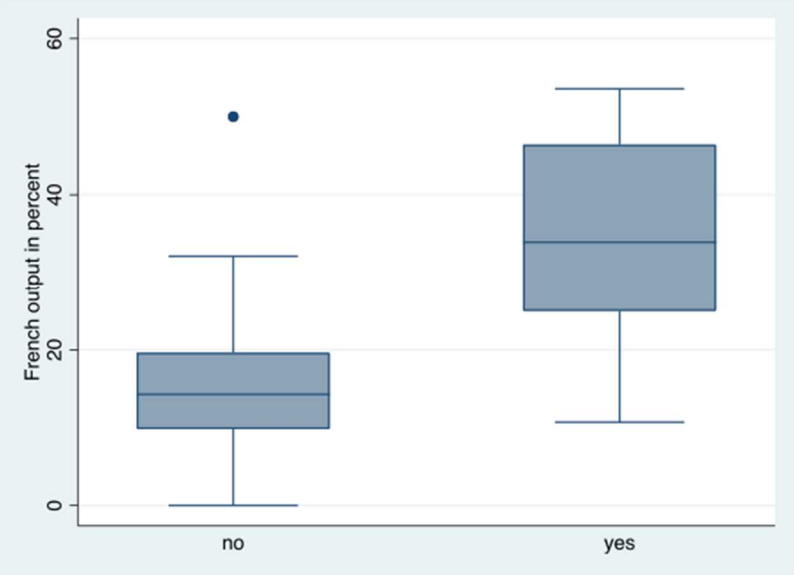
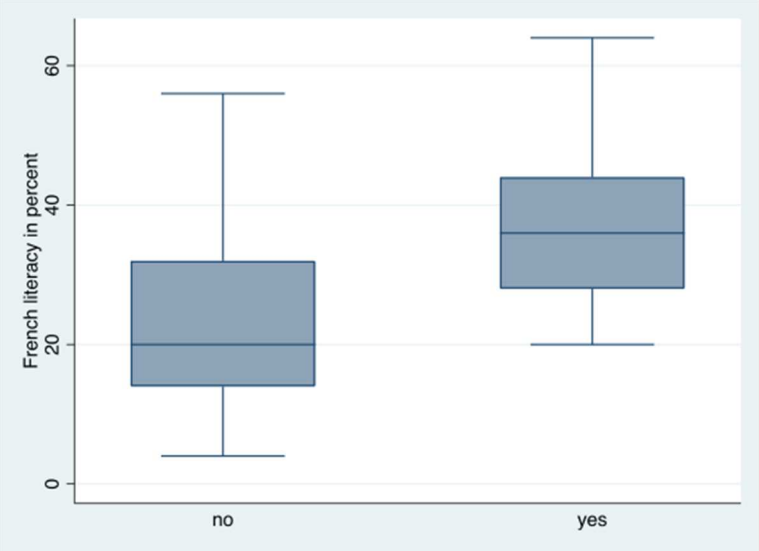


Figure 3 - Boxplot for the French print/media exposure data (in percent) displayed by French-speaking household status



Given that the students' exposure to French outside of the school context may vary by French-speaking household status, as the boxplots above illustrate, it is worth exploring if statistically significant differences arise between the two groups. As Table 6 shows, during the school year, students from French-speaking households are significantly more exposed to French than their counterparts from non-French-speaking households in terms of input, $t(37) = -5.7$, $p < .001$, output, $t(37) = -4.33$, $p < .001$, and print or media exposure, $t(37) = -2.85$, $p < .01$. Similar results are found over the summer, with students from French-speaking households significantly more exposed to French than their counterparts from non-French-speaking households in terms of French input, $t(27) = -5.12$, $p < .001$, French output, $t(27) = -4.81$, $p < .001$, as well as for French print/media exposure, $t(27) = -2.6$, $p < .01$. It should be noted, though, that this exposure remains limited, even for students from French-speaking households. Even for such students, opportunities to hear and practice French remain limited outside of school.

Table 6 - Comparing students from French-speaking households (frspoken=1) to students from non-French-speaking households (frspoken=0)

	School year			
	frspoken=1	frspoken=0	*t*	*df*

French input	35.71 (4.22)	12.5 (1.87)	-5.7***	37
French output	33.45 (3.6)	15.92 (2.28)	-4.33***	37
French print/media exposure	37.07 (3.08)	24.33 (2.96)	-2.85**	37
	Summer			
	frspoken=1	frspoken=0	*t*	*df*
French input	43.34 (7.11)	11.01 (2.42)	-5.12***	27
French output	45.78 (5.89)	18.85 (2.53)	-4.81***	27
French print/media exposure	33.45 (3.82)	19.11 (3.61)	-2.6**	27

Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses below means.

As Table 7 shows, for students from French-speaking households, there is no significant difference between French input vs. output during the school year or during the summer. In contrast, for students from non-French-speaking households, French input is significantly smaller than French output both during the school year, $t(23) = -2.86$, $p < .01$, and during the summer, $t(17) = -4.14$, $p < .001$ (see Table 7).

Table 7 - Comparing percentage of French input to French output

	School year			
	French input	French output	*t*	*df*

frspoken=1	35.71 (4.22)	33.45 (3.6)	0.77	14
frspoken=0	12.5 (1.87)	15.92 (2.28)	-2.86**	23
	Summer			
	French input	French output	*t*	*df*
frspoken=1	43.34 (7.11)	45.78 (5.89)	-.72	10
frspoken=0	11.01 (2.42)	18.85 (2.53)	-4.14***	17

Note. *= p < .05, ** = p < .01, ***= p <.001. Standard Deviations appear in parentheses below means.

French and English print/media exposure

Finally, both categories of students receive significantly more exposure to English print/media than French print/media during the school year, $t(14) = -3.54$, $p < .01$ for students from French-speaking households, and $t(23) = -14.23$, $p < .001$ for students from non-French-speaking households. The same holds true during the summer, $t(10) = -3.35$, $p < .01$ for students from French-speaking households, and $t(17) = -11.19$, $p < .001$ for students from non-French-speaking households (see Table 8).

Table 8 - Comparing French print and media exposure to English print and media exposure

	School year			
	French print/media exposure	English print/media exposure	*t*	*df*

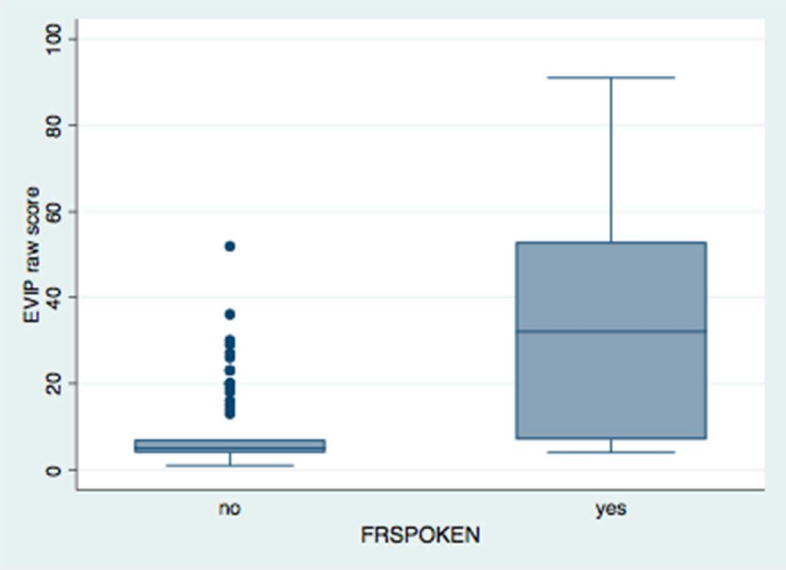
frspoken=1	1.85 (0.15)	2.71 (0.17)	-3.54**	14
frspoken=0	1.22 (0.15)	3.57 (0.1)	-14.23***	23
	Summer French print/media exposure	English print/media exposure	*t*	*df*
frspoken=1	33.45 (3.82)	51.27 (4.41)	-3.35**	10
frspoken=0	19.11 (3.61)	61.33 (3.12)	-11.19***	17

Note. *= p < .05, ** = p < .01, ***= p <.001. Standard Deviations appear in parentheses below means.

Distribution of data for French outcomes

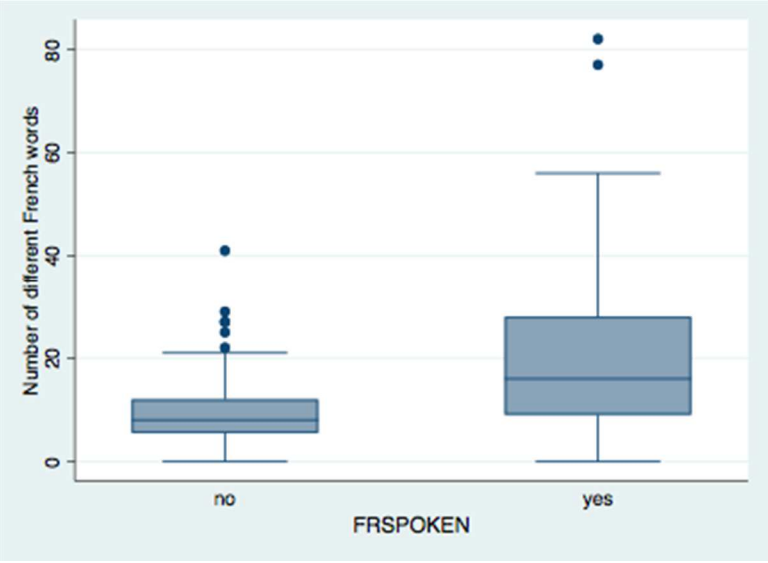
The following boxplot (Figure 4) displays the distribution of data for the French receptive vocabulary outcome (i.e., evip_raw). On the left are data for students who come from households where French is not spoken (frspoken=0, N = 24), and on the right are data for students from French-speaking households (frspoken=1, N = 15).

Figure 4 - Boxplot for the French receptive vocabulary data displayed by French-speaking household status



The following boxplot (Figure 5) displays the distribution of data for the French expressive vocabulary outcome (i.e., ndwfrtotal). On the left are data for students who come from households where French is not spoken (frspoken=0, N = 24), and on the right are data for students from French-speaking households (frspoken=1, N = 15).

Figure 5 - Boxplot for the French expressive vocabulary data displayed by French-speaking household status



As explained previously and as can be seen on the boxplots above (Figures 4 and 5), exploratory analyses hinted at key differences among students based on their home language

background (frspoken=0 and frspoken=1). This trend was confirmed by results from independent means t-tests showing that students from French-speaking households performed significantly better than their peers from non-French-speaking households on measures of French expressive vocabulary ($t(193) = -7.01$, $p < .001$) and receptive vocabulary ($t(193) = -11.32$, $p < .001$). Consequently, the decision was made to fit separate models for each group of students. Results are thus presented separately for the two groups of students.

RQ2 – French lexical trajectories of students from French-speaking households

There was a significant correlation between the two French outcomes (i.e., the ÉVIP raw scores and the number of different French words) for students who come from households where French is spoken ($r = .47$, $p < .01$, $N = 15$), though no discernible trend was detected when calculating correlations separately for each wave of data collection[9]. For students from French-speaking households ($N = 15$), the French receptive vocabulary outcome was significantly correlated with the predictors: age ($r = .6$, $p < .01$), gender ($r = .29$, $p < .05$), English media/literacy ($r = -.35$, $p < .01$), and grade ($r = .66$, $p < .01$). Similarly, the French expressive vocabulary outcome was significantly correlated with the predictors age ($r = .45$, $p < .01$), income ($r = .34$, $p < .01$) and grade ($r = .45$, $p < .01$).

Table 9 displays means and standard deviations across five waves of receptive and expressive French scores for students who come from households where French is spoken.

Table 9 - Descriptive statistics for the receptive and expressive French scores for students who come from households where French is spoken ($N = 15$)

[9] The correlations were not statistically significant for waves 1 and 3 and the correlations were roughly the same for the other waves ($r = .53$, $p < .05$ for wave 2; $r = .58$, $p < .05$ for wave 4; $r = .54$, $p < .05$ for wave 5).

Scores	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Receptive French vocabulary - Raw ÉVIP scores	*M* = 27.2 *SD* = 22.15 *Range* = 4-77	*M* = 36.53 *SD* = 30.16 *Range* = 6-91	*M* = 34.07 *SD* = 24.7 *Range* = 5-87	*M* = 39.8 *SD* = 29.64 *Range* = 6-89	*M* = 44.47 *SD* = 24.52 *Range* = 5-80
Receptive French vocabulary - Standardized ÉVIP scores	*M* = 72.67 *SD* = 17.71 *Range* = 52-112	*M* = 73.87 *SD* = 24.09 *Range* = 47-116	*M* = 76.07 *SD* = 19.34 *Range* = 49-118	*M* = 73.2 *SD* = 23.93 *Range* = 45-109	*M* = 80.47 *SD* = 16.85 *Range* = 49-109
Expressive French vocabulary - number of different words	*M* = 17.73 *SD* = 15.03 *Range* = 0-41	*M* = 19.07 *SD* = 12.09 *Range* = 1-39	*M* = 21.4 *SD* = 14.05 *Range* = 0-56	*M* = 20.87 *SD* = 18.75 *Range* = 5-77	*M* = 24.33 *SD* = 19.07 *Range* = 8-82

Note. Receptive French vocabulary scores account for scores from standardized vocabulary tests (the ÉVIP). Expressive French vocabulary scores account for the number of different words students used in a lexical task.

Students who came from households where French was spoken used a significantly higher number of different words when describing the "school" picture than the "home" picture in French $t(75) = -2.74$, $p < .01$.

French receptive vocabulary

The left column in Table 10 displays the results from the unconditional growth model without covariates. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for each ($p < .01$), estimating that the average ÉVIP true change trajectory for students from French-speaking families has an intercept of 29.35 and a slope of 1.53. In other words, the initial ÉVIP raw score for a student who comes from a household where French is spoken is 29.35 and that raw score increases on average by 1.53 per month. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability in initial status and slope. The null hypothesis is rejected for these

variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

The right column in Table 10 displays the results when grade and French literacy are entered as predictors. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for the intercept ($p < .01$), but not for the slope, estimating that the average baseline ÉVIP raw score is 19.36 for a Kindergartener from a French-speaking family with average levels of exposure to French media and literacy. In other words, the initial ÉVIP raw score for a student who comes from a French-speaking household with mean levels of exposure to French media and literacy is 19.36. The significant result for the predictor grade in the initial status indicates that compared to Kindergarteners, First graders score 25.15 points higher on the ÉVIP at baseline. The significant result for the predictor French literacy in the initial status indicates that for every one percent increase in amount of exposure to French media and literacy, the initial ÉVIP raw score increases by .74. The null hypothesis cannot be rejected for the slope, suggesting that the monthly rate of change is not different from zero. In other words, Kindergarten students from French-speaking families with average levels of exposure to French media and literacy do not improve on the EVIP for the duration of the study. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

Table 10 – Results of fitting an unconditional growth model and a model with grade and French media/literacy exposure as predictors to the French receptive vocabulary data for students who come from French-speaking families ($N = 15$)

	Unconditional growth model	Model with grade and frliteracy entered as predictors
Fixed effects		
Initial status (π_{0i})		
Intercept	29.35*** (5.86)	19.36*** (5.18)
grade		25.15** (8.31)
frliteracy		.74* (.35)
Rate of change (π_{1i})		
Overall slope	1.53*** (.45)	1.04 *ns* (.58)
grade		1.2 *ns* (.91)
frliteracy		.005 *ns* (.04)
Variance components (σ^2)		
Level 1 – Within person	166.15 (30.33)	162.33 (29.64)
Level 2 – In initial status	420.24 (185.57)	140.69 (80.22)
Level 2 – In rate of change	.13 (.32)	.03 (.16)
Covariance	7.36 (8.84)	-2.17 (5.73)
-2LL	637.72	617.93

Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that students' growth on the ÉVIP did not differ between these two time periods ($t(14) = .85$, *ns*).

Number of different French words

Table 11 displays the results from the longitudinal analyses. In the left column is the unconditional growth model without covariates, and in the right column is the model with French exposure and gender entered as predictors. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability in initial status and slope. The covariance estimates whether the true initial status and true monthly rate of change are correlated.

For the unconditional growth model (in the left column), the null hypothesis is rejected for the initial status ($p < .01$), estimating that the average true change trajectory for students from French-speaking families has an intercept of 17.9. The null hypothesis is not rejected for the slope. In other words, when no predictors are taken into account, the initial raw number of French words for a student who comes from a household where French is spoken is 17.9 and there is no monthly increase. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

When French input and output and gender are entered as predictors in the model (in the right column), the null hypothesis is rejected ($p < .01$) for the initial status but not for the overall

slope. This means that female students with an average level of French exposure at home use 37.35 words in the lexical task at baseline, but they make no monthly progress. The null hypothesis is rejected (p <.01) for French exposure as a predictor for the initial status, meaning that a one-percent increase in French exposure corresponds to a 1.54 increase in the number of French words used at baseline. The null hypothesis cannot be rejected for the predictor gender, meaning that there is no significant difference between female and male students at baseline or in the rate of change. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

Table 11 – Results of fitting an unconditional growth model and a model with French exposure and gender as predictors to the French expressive vocabulary data for students who come from French-speaking families (N = 15)

	Unconditional growth model	Model with frexposure and gender as predictors
Fixed effects		
Initial status (π_{0i})		
Intercept	17.9***	37.35***
	(3.15)	(4.06)
frexposure		1.54***
		(.31)
gender		6.54 *ns*
		(4.83)
Rate of change (π_{1i})		
Overall slope	.59 *ns*	-.58 *ns*
	(.43)	(.82)

frexposure		-.02 *ns* (.06)
gender		1.42 *ns* (.98)
Variance components (σ^2)		
Level 1 – Within person	33.19 (6.99)	33.34 (7.06)
Level 2 – In initial status	129.61 (54.38)	30.52 (18.42)
Level 2 – In rate of change	2.15 (1)	1.45 (.75)
Covariance	.62 (5.25)	5.37 (2.75)
-2LL	545.29	523.64

Note. *= p < .05, ** = p < .01, ***= p <.001. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that students' growth on the French expressive vocabulary outcome did not differ between these two time periods ($t(14) = -.88$, *ns*).

RQ3 – French lexical trajectories of students from non-French-speaking households

There was no significant correlation between the two French outcome measures (i.e., the ÉVIP raw scores and the number of different French words) for students who come from

households where French is not spoken ($N = 24$). There was a significant correlation between the French receptive vocabulary outcome and the predictors age ($r = .3$, $p < .01$) and grade ($r = .34$, $p < .01$). The French expressive vocabulary outcome was also significantly correlated with the predictors age ($r = .31$, $p < .01$) and grade ($r = .21$, $p < .01$).

Table 12 displays means and standard deviations across five waves of receptive and expressive French scores for students who come from households where French is not spoken.

Table 12 – Descriptive statistics for the receptive and expressive French scores for students who come from households where French is not spoken ($N = 24$)

Scores	January/February	March	May/June	August	November
Receptive French vocabulary - Raw ÉVIP scores	*M* = 3.92 *SD* = 1.21 *Range* = 2-7	*M* = 8.54 *SD* = 6.88 *Range* = 1-27	*M* = 6.04 *SD* = 6.53 *Range* = 2-36	*M* = 10.04 *SD* = 7.99 *Range* = 3-30	*M* = 8.79 *SD* = 10.82 *Range* = 3-52
Receptive French vocabulary - Standardized ÉVIP scores	*M* = 51.21 *SD* = 5.57 *Range* = 41-58	*M* = 47.17 *SD* = 6.52 *Range* = 39-66	*M* = 50.58 *SD* = 8.1 *Range* = 39-76	*M* = 45.46 *SD* = 5.64 *Range* = 39-58	*M* = 49.42 *SD* = 10.17 *Range* = 39-84
Expressive French vocabulary - Number of different words	*M* = 4.67 *SD* = 7.28 *Range* = 0-27	*M* = 7.87 *SD* = 4.5 *Range* = 0-21	*M* = 11.21 *SD* = 5.42 *Range* = 6-27	*M* = 10.87 *SD* = 8.56 *Range* = 2-41	*M* = 11.62 *SD* = 4.44 *Range* = 5-25

Note. Receptive French vocabulary scores are scores from standardized vocabulary tests (the ÉVIP). Expressive French vocabulary scores account for the number of different words students used in a lexical task.

French receptive vocabulary

Table 13 displays the results from the unconditional growth model that was used without covariates in the left column. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for each ($p < .01$), estimating that the average true change trajectory for ÉVIP for students from non-French-speaking families has an intercept of 5.41 and a slope of .44. In other words, the initial ÉVIP raw score for

a student who comes from a household that does not speak French is 5.41 and that raw score increases on average by .44 per month. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability. The null hypothesis is rejected for these variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

When age is entered as a predictor in the model (in the right column), the null hypothesis is rejected for the initial status (p <.01) but not the overall slope (though it is borderline significant at the .05 level). This means that students who are 6.1 years old obtain a raw score of 4.96 on the ÉVIP at baseline, without making significant monthly progress. The null hypothesis is rejected (p <.01) for age as a predictor for the initial status, but not for the slope, meaning that a one-unit increase in age is associated with a 2.09 higher score on the ÉVIP at baseline. In other words, older students are more likely to score higher on the ÉVIP at baseline. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

Table 13 – Results of fitting an unconditional growth model and a model with age as a predictor to the ÉVIP data for students who come from non-French-speaking families (N = 24)

	Unconditional growth model	Model with age as a predictor
Fixed effects		
Initial status (π_{0i})		
Intercept	5.41*** (.85)	4.96*** (.89)

age		2.09* (1.04)
Rate of change (π_{1i})		
Overall slope	.44* (.2)	.55 *ns* (.28)
age		-.31 *ns* (.24)
Variance components (σ^2)		
Level 1 – Within person	25.56 (3.69)	24.64 (3.6)
Level 2 – In initial status	2.23 (2.46)	1.04 (1.69)
Level 2 – In rate of change	.51 (.24)	.61 (.29)
Covariance	1.06 (.52)	-.8 (.58)
-2LL	775.26	771.61

Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that there was more growth on the ÉVIP over the summer period than the spring period for students from non-French-speaking households ($t(23) = 2.6$, $p < .05$).

Number of different French words

Students who came from households where French was not spoken used a significantly higher number of different words when describing the "school" picture than the "home" picture in French $t(119) = -5.34$, $p < .001$.

Table 14 displays the results from the unconditional growth model without covariates in the left column. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for each ($p < .01$), estimating that the average French expressive vocabulary true change trajectory for students from non-French-speaking families has an intercept of 6.2 and a slope of .64. In other words, the initial raw number of French words for a student who comes from a household that does not speak French is 6.2 and that raw number increases on average by .64 words per month. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability in initial status and slope. The null hypothesis is rejected for these variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

When age and gender are entered as a predictors in the model (in the right column), the null hypothesis is rejected for both the initial status ($p < .01$) and the overall slope ($p < .001$). This means that female students who are 6.1 years old use 2.93 words in the lexical task at baseline, with a monthly increase of 1.08 words. The null hypothesis is rejected for age as a predictor for the initial status ($p < .001$) but not for the slope, meaning that a one-unit increase in age is associated with a 3.67 additional words used at baseline. In other words, older participants from non-French-speaking households use more words in the picture description at baseline, but their monthly progress is not significantly different from that of the average-age students. The null

hypothesis is rejected for gender as a predictor for the initial status ($p < .001$) and the slope ($p < .01$), meaning that on average, male students use 5.97 more words at baseline than female students, whereas their slope is less steep, since they use on average .83 less words per month than female students. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. Note that the model would not allow for a random slope, meaning that the predictors account for most of the level-2 variation.

Table 14 – Results of fitting an unconditional growth model and a model with age and gender as predictors to the French expressive vocabulary data for students who come from non-French-speaking families ($N = 24$)

	Unconditional growth model	Model with age and gender entered as predictors
Fixed effects		
Initial status (π_{0i})		
Intercept	6.2*** (1.13)	2.93* (1.29)
age		3.67** (1.21)
gender		5.97*** (1.83)
Rate of change (π_{1i})		
Overall slope	.64*** (.18)	1.08*** (.25)
age		-.39 *ns* (.21)
gender		-.83** (.32)
Variance components (σ^2)		

Level 1 – Within person	36.33 (5.22)	34.02 (4.39)
Level 2 – In initial status	9.32 (9.03)	1.01e-19 (8.31e-19)
Level 2 – In rate of change	.11 (.17)	
Covariance	-1.03 (1.22)	
-2LL	780.96	763.78

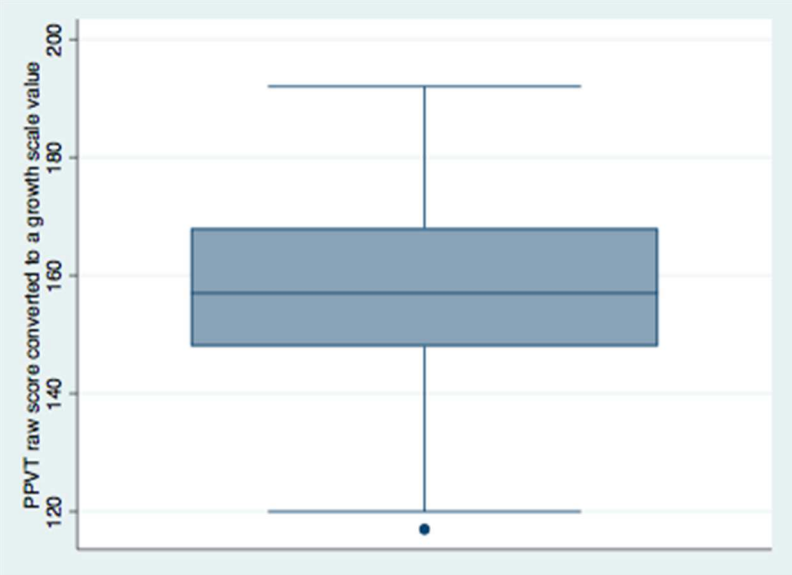
Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that students' growth on the French expressive vocabulary outcome did not differ between these two time periods ($t(23) = -1.29$, *ns*).

RQ4 – English lexical trajectories

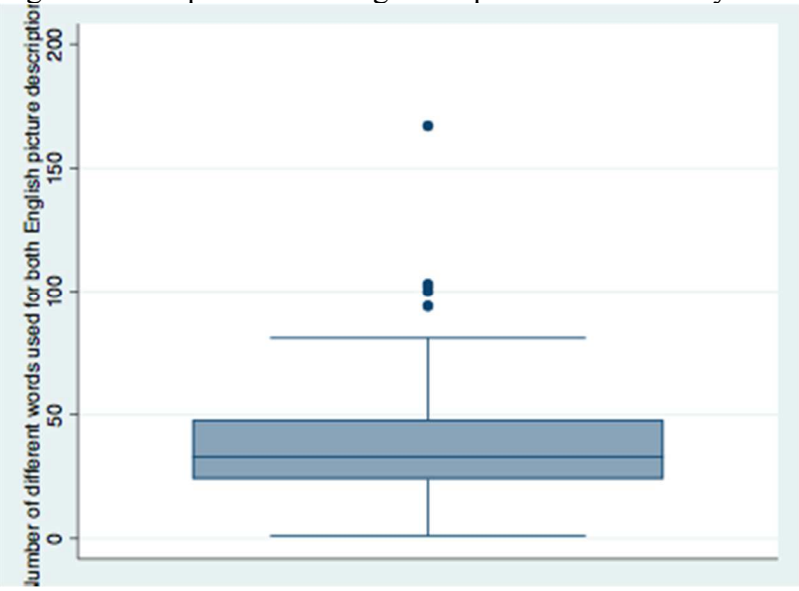
The following boxplot (Figure 6) displays the distribution of data for the English receptive vocabulary outcome (i.e., ppvt_gsv).

Figure 6 - Boxplot for the English receptive vocabulary data



The following boxplot (Figure 7) displays the distribution of data for the English expressive vocabulary outcome (i.e., ndwengtotal).

Figure 7 - Boxplot for the English expressive vocabulary data



There was a significant correlation overall between the English outcome measures (i.e., the PPVT scores and the number of different English words) ($r = .22$, $p < .01$), though the correlations

were not always statistically significant when calculated separately by wave of data collection[10]. The English expressive vocabulary outcome was significantly correlated to the predictors: age (r = .19, p < .01), income (r = .15, p < .05), and grade (r = .17, p < .05). The English receptive vocabulary outcome was significantly correlated to the predictors: age (r = .5, p < .01), ethnicity (r = -.17, p < .05), and parental education (r = .25, p < .01).

Table 15 displays means and standard deviations across five waves of receptive and expressive English scores.

Table 15 – Descriptive statistics for the receptive and expressive English scores (N = 39)

Scores	January/February	March	May/June	August	November
Receptive English vocabulary - PPVT raw scores	*M* = 115.1 *SD* = 21.71 *Range* = 65-157	*M* = 119.56 *SD* = 21.26 *Range* = 70-156	*M* = 122.15 *SD* = 20.02 *Range* = 80-162	*M* = 128.54 *SD* = 19.84 *Range* = 75-157	*M* = 132.02 *SD* = 18.03 *Range* = 84-172
Receptive English vocabulary - PPVT standardized scores	*M* = 110.46 *SD* = 14.63 *Range* = 85-146	*M* = 110.56 *SD* = 13 *Range* = 85-137	*M* = 112.35 *SD* = 13.51 *Range* = 90-147	*M* = 112.02 *SD* = 12.48 *Range* = 84-134	*M* = 114.97 *SD* = 11.78 *Range* = 87-150
Receptive English vocabulary - PPVT GSV scores	*M* = 152.1 *SD* = 15.04 *Range* = 117-181	*M* = 153.38 *SD* = 14.13 *Range* = 120-179	*M* = 156.95 *SD* = 13.97 *Range* = 128-185	*M* = 159.31 *SD* = 13.39 *Range* = 124-179	*M* = 163.87 *SD* = 12.6 *Range* = 131-192
Expressive English vocabulary - Number of different words	*M* = 38.02 *SD* = 22.74 *Range* = 1-102	*M* = 36.2 *SD* = 16.87 *Range* = 11-77	*M* = 40.08 *SD* = 27.21 *Range* = 10-167	*M* = 37.05 *SD* = 17.47 *Range* = 16-100	*M* = 37.05 *SD* = 18.54 *Range* = 14-103

Note. Receptive English vocabulary scores are scores from standardized vocabulary tests (the PPVT-IV). Expressive English vocabulary scores account for the number of different words students used in a lexical task.

English receptive vocabulary

[10] For wave 1, r = .06, *ns*; for wave 2, r = .35, p < .05; for wave 3, r = .28, *ns*; for wave 4, r = .25, *ns*; for wave 5, r = .28, *ns*.

Table 16 displays the results from the unconditional growth model without covariates. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for each (p <.01), estimating that the average true change trajectory has an intercept of 151.29 and a slope of 1.25. In other words, the initial PPVT score on the growth value scale (i.e., ppvt_gsv) is 151.29 and that score increases on average by 1.25 per month. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability in initial status and slope. The null hypothesis is rejected for these variance components, meaning that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

When parent college degree and student grade are entered as predictors in the model (in the right column), the null hypothesis is rejected for both the initial status (p < .01) and the overall slope (p < .001). This means that Kindergarteners whose parents do not hold a four-year college degree have a baseline score of 137.88 on the PPVT, with a monthly increase of 11.73. The null hypothesis is rejected for parent college decree as a predictor for the initial status (p < .05) but not the slope, meaning that on average, Kindergarteners with at least one parent with a four-year college degree score 11.59 points higher at baseline. The null hypothesis is rejected for 1st grade as a predictor for the initial status (p < .05) but not the slope, meaning that on average, 1st-graders score 11.73 points higher than Kindergarteners at baseline. The null hypothesis cannot be rejected for TK for the initial status and the slope, meaning that TK students did not perform significantly differently than Kindergarteners. The null hypothesis is rejected for the level-1 and level-2 variance components, meaning that there remains within- and between-person variation. The null

hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

Table 16 – Results of fitting an unconditional growth model and a model with parental education level and grade as predictors to the English receptive vocabulary data ($N = 39$)

	Unconditional growth model	Model with collegedegree and grade as predictors
Fixed effects		
Initial status (π_{0i})		
Intercept	151.29*** (2.28)	137.88*** (4.25)
collegedegree		11.59* (4.47)
grade – TK		-11.67 *ns* (8.72)
grade – 1st		11.73* (3.85)
Rate of change (π_{1i})		
Overall slope	1.25*** (.11)	1.6*** (.25)
collegedegree		-.48 *ns* (.26)
grade – TK		.24 *ns* (.51)
grade – 1st		.01 *ns* (.23)
Variance components (σ^2)		
Level 1 – Within person	25.53 (2.89)	25.11 (2.84)
Level 2 – In initial status	187.63 (45.8)	121.63 (30.83)

Level 2 – In rate of change	.05 (.05)	.04 (.04)
Covariance	-3.12 (1.75)	-2.19 (1.4)
-2LL	1320.77	1301.45

Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that students' growth on the English receptive vocabulary outcome did not differ between these two time periods ($t(38) = -.65$, *ns*).

Number of different French words

Students used a significantly higher number of different words when describing the "school" picture than the "home" picture in English $t(194) = -4.7$, $p < .001$.

Table 17 displays the results from the unconditional growth model that was used without covariates[11]. The fixed effects estimate the starting point (π_{0i}) and slope (π_{1i}) of the population average change trajectory. The null hypothesis is rejected for the intercept ($p < .01$), estimating that the average English expressive vocabulary true change trajectory has an intercept of 38. The null hypothesis for the slope of -.07 is not rejected. In other words, the initial number of English words used in the picture description is 38 and that raw number does not increase by month. The level-1 residual variance summarizes the scatter of each student's data around his or her own linear change trajectory, while the level-2 residual variance summarizes between-person variability in initial status and slope. The null hypothesis is rejected for these variance components, meaning

[11] No predictor yielded significant results when entered individually, so an unconditional growth model was chosen.

that there remains within- and between-person variation. The null hypothesis cannot be rejected for the covariance component, indicating that the intercepts and slopes of the individual true change trajectories are uncorrelated.

Table 17 – Results of fitting an unconditional growth model to the English expressive vocabulary data ($N = 39$)

	Unconditional growth model
Fixed effects	
Initial status (π_{0i})	
Intercept	38*** (3.09)
Rate of change (π_{1i})	
Overall slope	-.07 *ns* (.3)
Variance components (σ^2)	
Level 1 – Within person	164.62 (21.43)
Level 2 – In initial status	278.65 (85.42)
Level 2 – In rate of change	.68 (.87)
Covariance	-3.98 (6.67)
-2LL	1641.7

Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

In addition, to explore the issue of summer loss, a one-sample t-test was conducted to see if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4). Results suggest that students' growth on the

English expressive vocabulary outcome did not differ between these two time periods ($t(38) = -1.18$, *ns*).

RQ5 – Relationship between French and English outcomes

There was no significant correlation between English and French receptive vocabulary outcomes for students as a whole ($N = 39$). In contrast, there was a strong positive correlation between the number of different words used in French and English overall ($r = .46$, $p < .01$). Although the two outcomes were not significantly correlated at every wave of data collection, they were correlated from wave 1 onward ($r = .31$, *ns* at wave 1; $r = .39$, $p < .05$ at wave 2; $r = .6$, $p < .01$ at wave 3; $r = .51$, $p < .01$ at wave 4; and $r = .6$, $p < .01$ at wave 5).

Relationships between French and English outcomes were then examined by frspoken status. There was no significant correlation between English and French receptive vocabulary outcomes for students who do not speak French at home ($N = 24$). In contrast, for students from French-speaking households ($N = 15$), there was a modest significant correlation overall between English and French receptive vocabulary outcomes ($r = .28$, $p < .05$)[12].

To conclude, for all students, the expressive vocabulary outcomes in French and English were significantly correlated, though no discernable pattern seemed to emerge. For the group of students from non-French-speaking households, there was a modest positive correlation between the number of different words used in French and English overall ($r = .26$, $p < .01$), though the two outcomes were not significantly correlated at each wave of data collection ($r = .46$, $p < .05$ at wave 1; $r = .43$, $p < .05$ at wave 2; $r = .27$, *ns* at wave 3; $r = -.03$, *ns* at wave 4; and $r = .45$, $p < .05$ at wave 5). Similarly, for the group of students from French-speaking households, there was a strong

[12] However, there was no significant correlation between the English and French receptive vocabulary outcomes when analyses were conducted by individual wave.

positive correlation between the number of different words used in French and English overall (r = .47, p < .01), though the two outcomes were not significantly correlated at each wave of data collection (r = .01, *ns* at wave 1; r = .45, *ns* at wave 2; r = .63, p < .05 at wave 3; r = .78, p < .01 at wave 4; and r = .59, p < .05 at wave 5).

SECTION 5: DISCUSSION

This study contributes to the literature on students in DLI programs in the United States by examining their bilingual lexical development in light of their out-of-school language practices. Results showed that in terms of French exposure and use during the school year and over the summer, students' experiences remain limited outside of school, even for those coming from French-speaking households. Students from French-speaking households displayed different French lexical trajectories than their peers from households where French was not spoken. For the former, monthly progress was not achieved on either vocabulary measure, whereas for the latter, monthly progress was achieved on the expressive vocabulary measure, but not on the receptive vocabulary measure. Furthermore, students made progress on the English receptive vocabulary measure, but not on the expressive vocabulary measure. Finally, no obvious pattern emerged in terms of the relationship between the French and English outcomes.

French exposure outside of school

Results from the first research question suggest that early-elementary students in this French-English DLI program receive little exposure to the partner language outside of school. Though students from households where French is spoken (frspoken=1) benefit from more input, output and print and media exposure in French, compared to their peers from non-French-speaking households (frspoken=0), their opportunities to use French remain limited. This holds true both during the school year and the summer time. In other words, both groups of students receive very limited exposure to French outside of school (in terms of spoken French, French print and media, or opportunities to speak French). Additionally, both groups of students receive significantly more exposure to English than French print and media during the school year and over the summer,

emphasizing the dominance of English in their lives outside of school. These findings confirm prior research on the home language practices of students in bilingual programs in the United States, which documented the fact that English is often the preferred language (Babino & Stewart, 2017; Potowski, 2004). Anecdotal evidence from time spent in the classroom suggests that the same pattern also occurs at school, with the widespread use of English even among children from French-speaking households.

Interestingly, unlike most other studies in which parents expressed concern that being enrolled in a bilingual program may hinder their child's English language development (e.g., Choi, Lee, & Oh, 2016), the parents in this study did not seem preoccupied with their child's proficiency in the dominant language. This may be because the families featured in this study differ from most families involved in prior studies. For example, as can be seen in the participants section, more than half of the parents were born in the U.S. and among the foreign-born parents, there were very few recent immigrants who did not speak English. Instead, in the open-ended questions on the first survey, parents voiced concerns about their child's French language development. Parents from both French-speaking and non-French-speaking households lamented the limited opportunities to practice French outside of school, confirming the minority status of the French language in the Southwestern United States. Such results cast doubt on whether the students in the program may reach eventually high levels of proficiency in French, given the limited opportunities to practice the language in their communities. As Duursma et al. (2007) note, for young dual language learners, developing proficiency in the minority language – regardless of whether it is the child's first or heritage language – requires language support outside of school.

As the results from the second research question show, two of the significant predictors that were used in the final models for the group of students from French-speaking households

relate specifically to French language use. On the one hand, exposure to French print and media was a significant predictor for the French receptive vocabulary, which highlights the importance of media/print exposure for vocabulary development in a minority language (see also Duursma et al., 2007). Another significant predictor for the group of students from French-speaking households (for the French expressive vocabulary outcome) was French exposure, meaning that the more input and output in French outside of school, the larger the French vocabulary used in the picture description task. Studies have indeed found that frequency of input (especially from parents) has a significant impact on bilingual children's lexical development (e.g., Pearson et al., 1997). In line with the dynamic systems theory (Larsen-Freeman, 2013), it seems that participants from French-speaking households benefit from more "affordances" in French since they enjoy more occasions to engage in communicative interactions in that language.

It is worth noting that these two predictors (i.e., French print/media and French exposure) were not significant for the group of students who come from households where French is not spoken, which is most likely due to the fact that there was less variation among this group. Indeed, as the level-2 variance components in the different longitudinal models attest, there is a great deal of variation within the group of students from French-speaking households. For example, when comparing the unconditional growth models for the expressive French vocabulary (i.e., ndwfrtotal), the level-2 variance for the intercept is almost fifteen times higher for the group of students from French-speaking households than the group of students from non-French-speaking households. In other words, the level-2 residual for initial status indicates that, with regards to the baseline, there is much more additional variation that needs to be accounted for in the case of students from French-speaking households, compared to their peers from non-French-speaking households. Similarly, in the same model, the population variance of the level-2 residuals for the

monthly rate of change is roughly eighteen times higher in the group of students from French-speaking households, suggesting that with regards to the rate of change, there is much more additional variation that needs to be accounted for in the case of students from French-speaking households, compared to their peers from non-French-speaking households. The ÉVIP level-2 variance components also show that the students from French-speaking households group is much more heterogeneous than the students from non-French-speaking households in terms of receptive vocabulary performance. In the ÉVIP unconditional growth models, the level-1 variance for the group of students from French-speaking households is also much larger than for the group of students from non-French-speaking households, suggesting a greater degree of variability within a student's trajectory. In other words, for the group of students exposed to French at home, performance on the French vocabulary measures greatly varies within-students (as indicated by the level-1 variance), as well as between students (as indicated by the level-2 variance). Such a great degree of variation within and between students in the longitudinal models underlines the non-uniform nature of language development that is expected within the framework of the dynamic systems theory.

By focusing on French exposure outside of school, it became apparent that in the context of this research, the dichotomy that is often used in DLI research of "native speakers of English" vs. "native speakers of the target language" was not fitting. On the one hand, in terms of English lexical development, students' home language profile did not seem to impact their English trajectory. Indeed, English-only status was not a significant predictor in any of the final models, suggesting that the distinction between students from monolingual (in English) vs. multilingual (English and another language) households was a moot point. As Kim et al. (2018) point out, multiple language profiles are found under the generic term "bilingual speakers", based on the

balance between English and the partner language spoken both at home and at school. On the other hand, students' home language profile yielded a different lexical trajectory for the partner language (i.e., French). When examining French lexical development among children in this DLI program, the distinction was thus made between whether or not French is spoken in the home (i.e., frspoken=0 vs. frspoken=1). As the results suggest, students from these two groups display different French lexical trajectories. But even within the group of students from French-speaking households, the large variation hinted at much heterogeneity in terms of French language proficiency levels. Instead of being considered "native speakers" of French, it seems that some of the children in the present study that belong in the French-speaking household group should be labeled instead as *heritage* speakers of French, learning it as a foreign or second language. At the same time, some students within this group performed on par with French native speakers of the same age, as their age-based standard scores on the ÉVIP indicate. Overall, the number of students was too small (N = 15) to conduct analyses separately between these subcategories of students. Future research should determine if children who come from households where French is spoken could be divided into subgroups (e.g., high-levels of French input and output vs. low-levels of French input and output) that display different French lexical trajectories.

Examining students' lexical trajectories

The dynamic systems theory acknowledges the important role played by initial conditions for language development (Larsen-Freeman, 2011), and as the different longitudinal models showed, predictors greatly influenced initial status in both English and French. The fact that grade and age were the most common predictors that were included in four of the six final models points to the developmental nature of vocabulary growth (e.g., Uccelli & Páez, 2007). However, of the six final models in this study (i.e., French expressive and receptive vocabulary for students from

French-speaking and non-French-speaking households, as well as English expressive and receptive vocabulary), only two featured a statistically significant slope. The lack of progress on most of the vocabulary measures may be of concern for students' future reading performance, given the predictive role of vocabulary on reading skills (Sénéchal, Ouellette, & Rodney, 2006).

All but one predictor (i.e., gender in the model for the French expressive vocabulary for the group of students from non-French-speaking households) impacted the intercept only, and not the slope. In other words, predictors had a significant effect at baseline, meaning that when the study began, students were at different levels of French and English vocabulary based on certain characteristics (e.g., exposure to French outside of school, parental education level. etc.). However, these same predictors did not come into play in terms of yearly trajectories, suggesting that students' monthly progress was homogeneous across groups. Such findings seem at odds with a tenet of the dynamic systems theory that was used as a framework for this study, namely the idea of language development as a nonlinear process. However, these findings echo the literature on school readiness (which is especially relevant considering that this study involved early-elementary students), which notes that inequalities that crystalize before school entry (e.g., Janus, Hughes, & Duku, 2010) have long-term impacts on students' achievement (Duncan et al., 2007). Summer loss scholars go even further and posit that most academic inequalities are amplified during times spent outside of school, with school serving as a homogenizing force (e.g., Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996). Here, the fact that the piecewise model yielded results that were not significant suggests that a seasonal perspective may not be a suitable way to describe the students' vocabulary trajectory in this study.

It is possible that seasonal patterns were not detectable in the short duration of the study (one calendar year), but would appear over the span of several years, as in scholarship on summer

loss (e.g., Lawrence, Hinga, Mahoney, & Vandell, 2015). The one-sample t-tests that were conducted to detect if there was a significant difference between the gains made over the spring (between waves 2 and 3) and over the summer (between waves 3 and 4) also proved inconclusive, with one notable exception. The group of students from non-French-speaking households made more gains on the French receptive vocabulary measure over the summer than over the spring. It is not immediately clear why the summer benefited the French lexical trajectory of such students[13], and it is suggested that qualitative research be conducted in the future to uncover a potential explanation.

French lexical trajectories

As the results from the second and third research questions indicate, students from households where French is spoken have a different trajectory than their peers from non-French-speaking households. The latter made monthly progress in their expressive vocabulary (as measured by the number of words used in the picture description task), but not their receptive vocabulary (as measured by the ÉVIP), whereas the former made no monthly progress in their receptive or expressive vocabulary.

As can be seen in the unconditional growth models for the French receptive vocabulary, the average initial raw ÉVIP score for a student from a French-speaking household is roughly six times higher than for a student who comes from a non-French-speaking household. Similarly, the average monthly rate of change for a student from a French-speaking household is roughly three times larger than for a student who comes from a non-French-speaking household. When controlling for grade level and levels of French print and media exposure, students who are

[13] Based on information gathered in the summer survey, regression analyses were conducted to check whether participation in a summer language program or summer travels to a French-speaking country predicted higher scores on the ÉVIP, and no significant results were found.

exposed to French at home have a baseline average raw score of around 19 on the ÉVIP, and do not appear to make monthly progress in their performance on the French receptive vocabulary assessment. On the other hand, when controlling for age, students from non-French-speaking households have a baseline average raw score of around 5 on the ÉVIP, and do not appear to make monthly progress in their performance on the French receptive vocabulary assessment. This lack of monthly progress on the French receptive vocabulary measure (both for students from French-speaking households and non-French-speaking households) may be due to the limited exposure to French outside of school.

As can be seen in the unconditional growth models for the French expressive vocabulary, at baseline, students from French-speaking households used more than three times as many words in French as their peers from non-French-speaking households when describing pictures in the lexical task. When controlling for gender and levels of French input and output, students from French-speaking households use on average 17 French words in the picture description task at baseline, and do not appear to make monthly progress over the year. In addition, when controlling for gender and age, students from non-French-speaking households use on average three French words in the picture description task at baseline, and their performance increases by roughly one word per month over the year. A ceiling effect may account for the lack of progress in French expressive vocabulary for the group of students from French-speaking households. In contrast, the fact that students from non-French-speaking households make monthly progress in their French expressive vocabulary may be possible thanks to their low baseline score on the picture description task. Future research should examine the content of the transcripts to gauge whether the quality of students' expressive vocabulary changes over time. For example, the two students featured in Appendix J display different trajectories in terms of the French words used to describe the pictures.

The student from the non-French-speaking household goes from refusing to take part in the task at first (wave 1), to listing the colors that she can identify in the pictures (waves 2, 3, and 4), to eventually (wave 5) using very short descriptive sentences in which she intersperses English words (such as in the description of the home picture). The student from the French-speaking household also uses more words as time goes by, going from listing items that are found in the pictures (waves 1 and 2) to describing the pictures and the characters' actions in increasing detail (waves 3, 4, and 5).

Gender was a predictor in the French expressive vocabulary final models, with female students performing lower than male students at baseline but making greater progress overall. It is worth noting that while gender was included in the final models for French expressive vocabulary, it did not yield significant results for English expressive vocabulary. A potential explanation may be that female students experienced a form of foreign language anxiety when describing the pictures in French, since foreign language anxiety is known to be more prevalent among female learners than male learners (e.g., Park & French, 2013)[14]. This may hold true even among the group of students from French-speaking households, given that, as highlighted earlier, French serves more as a heritage language than a "native" language.

It comes as no surprise that students from French-speaking households outperformed their peers on French lexical measures. Indeed, results from the first research question show that students from French-speaking households receive significantly more exposure to spoken French and to French print and media, and speak French to a larger extent outside of school, both during the school year and over the summer. At the same time, the stark difference in vocabulary performance between the heritage and non-heritage language students seems at odds with Steele

[14] Given that most studies on foreign language anxiety have been conducted with older language learners, it is not clear whether this trend would be found among younger learners.

et al. (2017), who found no significant difference on reading and speaking performance in Spanish between heritage and non-heritage language students. However, students in the Steele et al.'s (2017) study had already undergone four years of immersion learning, whereas the children in the current study were at the beginning of their immersion education experience. It is possible that the gap between French heritage and non-heritage language students will gradually decrease over the years so that there is eventually no significant difference in French language performance. To illustrate, when comparing the unconditional growth between the two groups of students on the expressive vocabulary measure (i.e., ndwfrtotal), unlike the French heritage group, the non French heritage group is making monthly progress. In other words, the students from French-speaking households did not display growth in the number of French words used in the lexical task, whereas their peers from households where French was not spoken used more French words as the year went by. This may indicate that the homogenization process between the heritage and non-heritage language students is beginning, at least for French expressive vocabulary.

English lexical trajectories

Results from the fourth research question suggest that when controlling for grade level and parental education level, early-elementary students in this French-English DLI program have a baseline average score of 138 on the PPVT, and their performance increases by almost two score points each month over the year. As for their expressive English vocabulary, students use on average 38 English words in the picture description task at baseline, and do not appear to make monthly progress over the year. In sum, students made monthly progress in their receptive vocabulary (as the significantly positive slope in the final model for receptive English vocabulary attests), but not their expressive vocabulary (as can be seen in their non-significant slope in the

final model for expressive English vocabulary). While progress in English receptive vocabulary attests to students' ongoing lexical growth, the lack of progress in English expressive vocabulary may be attributed to a ceiling effect. Bilingual students in other studies also display faster or steadier growth in receptive than expressive vocabulary (e.g., Pham & Kohnert, 2014).

As noted earlier, English only status was not included as a predictor for either of the final models in English, meaning that students from monolingual English households did not perform significantly differently than their peers from multilingual households. While English-only students generally perform better than English learners on English lexical measures (see August et al., 2005), bilingual students who speak both English and a minority language at home may perform better than English-only students (e.g., Umbel, Pearson, Fernández, & Oller, 1992) or more predictably, students who only speak the minority language at home (e.g., Hoff, Rumiche, Burridge, Ribot, & Welsh, 2014). In the present study, survey results suggest that English is very much present in the children's life outside of school (at least when it comes to their print and media exposure), and one can extrapolate that English use is prevalent even in multilingual households. Rather than determining whether or not English is the sole language spoken in the household (as indicated by the predictor engonly), a better predictor for performance on English lexical measures may be English input and output outside of school (on which information was not gathered in the surveys).

Instead, in this study, college education was a significant predictor for English receptive vocabulary, hinting at the relationship between parental education level (which often serves as a proxy for socioeconomic status) and vocabulary development (Hart & Risley, 1995). The majority of households in this sample included at least one parent with a four-year degree ($N = 30$). In all but seven of these households, the other parent also had a four-year college degree or beyond. In

contrast, among the ten households where none of the parents held a four-year degree (i.e., collegedegree=0), three featured parents with no college experience, including two where neither parents graduated from high school. In other words, the group of parents with a college education was highly educated, with most households featuring both parents with a college degree, whereas in comparison, the other group was at a disadvantage, since none featured a parent with a four-year college degree. In addition, it is worth noting that parental education was a significant predictor for children's vocabulary in English but not in French, which raises the question of the language in which the parents were primarily educated (which was not asked on the survey). Indeed, Sorenson Duncan and Paradis (2018) find that for immigrant and refugee families in Canada, the language in which mothers were educated influenced the input they provided to their children: mothers who had completed most of their higher education in their native language provided more input in the heritage language, whereas mothers who had completed most of their higher education in English provided more input in English. In the present study, one can hypothesize that one reason why parental education influences children's English vocabulary is that mothers likely received their higher education in English, thus providing more English input to their children.

Relationship between French and English

In line with the dynamic systems theory, the influence of the environment on the organization of the systems of language is confirmed by the fact that different predictors reflecting the variation in the language environment outside of school were used for the French and English lexical outcomes. Results indicate that students have stronger lexical skills in English than in French. Though it is not possible to establish strict comparisons between students' scores on the ÉVIP and PPVT-IV (since there is no common growth scale between the two tests), the means for

the age-based standardized scores in both languages hint at some trends. Irrespective of their household language backgrounds, on average, participants performed within two or three standard deviations below the norming population in French, whereas they performed within one standard deviation above the norming population in English. In other words, students performed less well on the ÉVIP than the average French monolingual speakers of the same age. This is to be expected, given that "bilingual children tend to know fewer words in one of their languages than comparable monolingual speakers of that language" (Bialystok, Luk, Peets, & Yang, 2010, p. 529). However, such a trend is not found in English: study participants, including those from monolingual households and bi/multilingual households, outperformed the norming population on the PPVT-IV. In other words, overall, while children in this dual language program do not reach "native-like" proficiency in the partner language (French), they perform better than English-only children of the same age on a standardized English test. On the other hand, the number of different words used to describe the two pictures in the lexical task served as a proxy for students' expressive vocabulary. Students used more words to describe the same pictures in English than in French, which suggests that the size of their expressive vocabulary is larger in English than in French, no matter their household language background.

As the results from the fifth research question show, no significant relationship was established between French and English receptive vocabulary performance for students from non-French-speaking households, whereas there was a modest correlation between the two receptive vocabulary outcomes for students from French-speaking households. The correlation between the French and English expressive vocabulary outcomes was significant for both groups of students, and it was stronger for the students from French-speaking households. In sum, the relationship between the French and English outcomes seemed rather inconclusive, which points to little or no

cross-language transfer between French and English, even if the languages are related. This is surprising given the students' high level of English vocabulary (as the age-based normed results on the PPVT demonstrate). Indeed, Pham and colleagues (Pham, Donovan, Dam, & Contant, 2018) found that children with strong L1 and L2 skills who received vocabulary training in both languages displayed better results in terms of L1 learning and cross-language transfer to the L2, compared to peers with similar levels of L2 proficiency but with weaker L1 skills. In other words, for bilinguals, high proficiency in the L1 seems to be a prerequisite for lexical transfer to the L2. Here, it seems that the students from French-speaking households have such low levels of proficiency in French (their L1) that it resulted in little transfer to English. On the other hand, students as a whole scored above average compared to monolingual peers of the same age on the English standardized assessment, but this did not seem to transfer to strong lexical performance on the French measures. This may be because the study participants are slightly younger than the 6-8 year-olds involved in Pham et al.'s (2018) study. Indeed, the fact that age and grade were meaningful predictors in many of the longitudinal models in this study attest to the importance of age, which may account for differences in vocabulary performance.

SECTION 6: CONCLUSION

This dissertation showed that early-elementary students in this French-English DLI program receive little exposure to French outside of school, both during the school year and the summer (as reported by parents on surveys regarding French language use outside of school). Students from French-speaking households displayed different French lexical trajectories than their peers from households where French was not spoken. Regarding the students' English lexical trajectories, monthly progress was achieved on the receptive vocabulary measure, but not on the expressive vocabulary measure. Finally, there seemed to be inconsistent relationships between students' performance in French and English. In terms of correlations between French and English lexical performance, students from French-speaking households displayed stronger relationships than their counterparts from non-French-speaking households, even though these relationships remained modest.

There are several limitations to this study. Firstly, the fact that no summer effect was detected and the notable lack of progress on most lexical outcomes may be due to the small sample size of the study. Secondly, this study's emphasis on input failed to take into account child-level factors (e.g., motivation, aptitude) that may mediate the relationship between input and bilingual proficiency (Hoff, 2018). Indeed, as the dynamic systems theory explains, L1 and L2 development emerge not only from social interactions and experiences, but also from cognitive mechanisms (Larsen-Freeman, 2011). Next, in order to limit the survey completion time, most survey questions focused on children's French exposure outside of school, except for a few survey questions that focused on English-language media and literacy exposure. This prevented obtaining a full picture of children's out-of-school language experiences, especially considering the fact that some of these experiences may have been in languages other than French and English. The fact that the survey

was available in French and English may also have contributed to selection bias among the parents (e.g., some parents who speak a language other than English or French may have been underrepresented). Furthermore, there are major concerns with regards to the measure used to gauge students' French vocabulary. First, the fact that a sizable portion of students got extremely low scores on the ÉVIP casts doubt on its validity for this population. In addition, the ÉVIP raw scores used in the longitudinal analyses may be misleading given that they were not scaled. Indeed, two test forms were used alternatively at each time point to maximize students' engagement, and a one point difference on test form A does not necessarily convert to a one point difference on test form B[15]. Finally, in the absence of scaled ÉVIP scores, it is impossible to establish direct comparisons between students' performance on the French and English tests (i.e., between the ÉVIP and the PPVT). On the other hand, there are also concerns regarding the validity of the picture description task. Students may have been unfamiliar with such an assignment, which may be why many students refused to answer the prompt in French (thus getting a score of 0). This raises the question of whether the picture description task was age appropriate since early elementary students are still developing perspective-taking abilities (Shute & Slee, 2015).

The fact that gender was a significant predictor in the final models for the French expressive vocabulary raises the possibility that there was gender bias in the task. Indeed, both pictures display male characters as main figures. However, even if the same pictures were used in English, gender did not come into play.

Finally, another critique that might be raised is that students' French and English lexical trajectories were examined separately, suggesting a fragmented instead of an integrated view of

[15] In order to investigate whether the students' average performance significantly differed on these two test forms, two variables were created to account for the student's mean performance on each test form. Results from a one-sample t-test show that there is no significant difference for students' performance on these two test forms ($t(38) = -1.82$, *ns*).

bilingualism, when in fact, "the bilingual is not two monolinguals in one person" (Grosjean, 1989). Such an approach leaves no room for translanguaging practices (i.e., the "hybrid practices of *languaging* bilingually" García, Makar, Starcevic, & Terry, 2011)[16].

Despite these limitations, the present research provides guidance for future studies. Given the fact that there were not enough participants to conduct more complex analyses, future research should aim to replicate this study with a larger number of students. In addition, there are possible additional avenues of research with the existing data. For instance, a more in-depth analysis of the students' transcripts from the picture description tasks could yield information on their bilingual development in other domains (e.g., syntactic, morphological, etc.).

This research also offers implications for practice. Given the importance of vocabulary for literacy development, DLI programs may want to put the emphasis on vocabulary teaching. This study shows that DLI students' performance on French lexical measures lags behind their performance on English ones, and suggestions should be made to harness these strengths in English in order to benefit French lexical development. For example, in the aforementioned Pham et al.'s (2018) study, the researchers conducted an intervention in which the participants received a vocabulary training paradigm. Such a training may positively benefit transfer to French for students with English as an L1, given their high levels of English lexical proficiency as demonstrated by their age-based standardized scores on the PPVT. Indeed, as Pham et al. (2018) showed, there was increased transfer to an L2 following a vocabulary training paradigm when a child displayed strong lexical skills in their L1.

To conclude, the proposed study seems timely given the renewed interest in bilingual education. In California, with French being the second most requested language for the seal of

[16] In view of the participants' English lexical strengths (compared to French), I hypothesize that translanguaging practices would likely favor English (as in Hamman, 2018).

biliteracy (Ainsworth, 2018), it is of critical importance to examine the factors that come into play in the French lexical development of students enrolled in a French-English DLI program. Knowledge about the students' out-of-school experience in French, as well as their English lexical trajectories helps paint a more complete picture. Findings from this study will inform future research, and possibly practice related to bilingual education, more precisely with regards to the development of French as a partner language.

Appendix A – Timeline for data collection

Wave	Time	Instruments/Materials
1	January/February 2017 Duration: 22 days	Survey 1 PPVT ÉVIP Lexical task
2	March 2017 Duration: 14 days	PPVT ÉVIP Lexical task
3	May/June 2017 Duration: 16 days	PPVT ÉVIP Lexical task
4	August 2017 Duration: 11 days	Survey 2 PPVT ÉVIP Lexical task
5	November 2017 Duration: 16 days	PPVT ÉVIP Lexical task

Appendix B – Parents' motivations

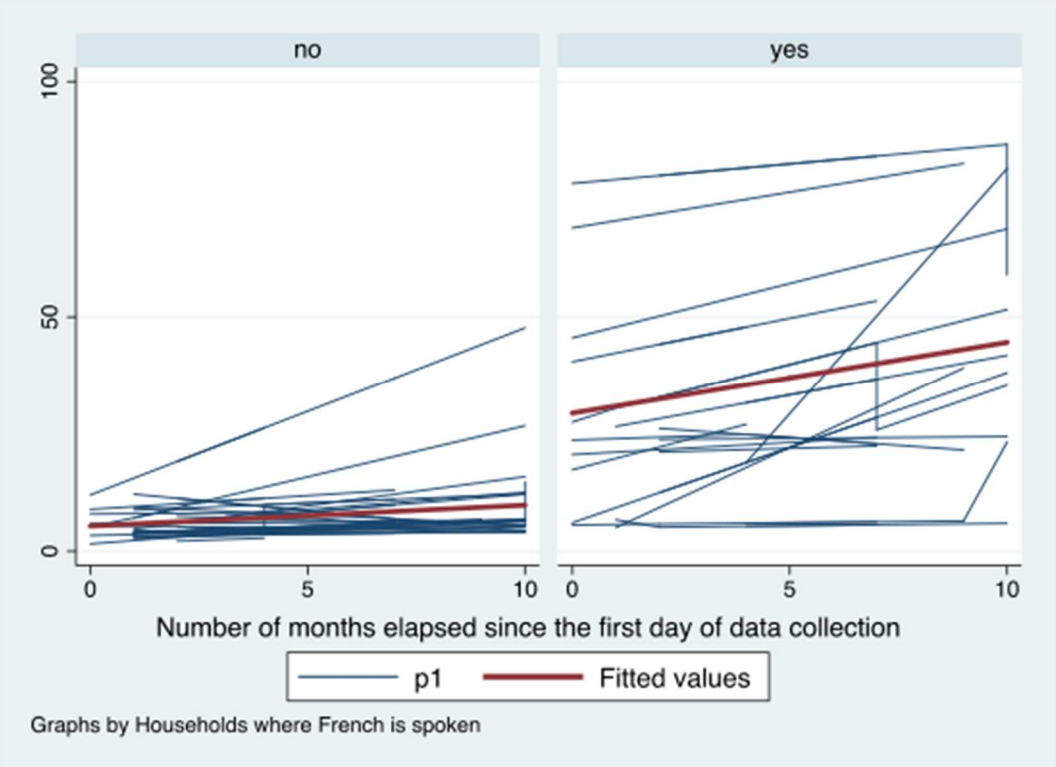
Parents answered an open-ended question on Survey 1 about their motivations for enrolling their child in this French-English dual language program. Below are some sample responses.

- "We wanted him to have an opportunity to learn a second language and we think it will help him in many ways."
- "My husband speaks Spanish, and I studied French in high school and college. I wanted either her Dad or I to be able to help her with homework in whatever language program we chose, so we narrowed it down to Spanish and English."
- "I believe that it's important to be bilingual. I speak Spanish and want my kids to have a second language."
- "We don't want him to lose French by living in an English speaking country with an English speaking mother."
- "French is part of our family's cultural heritage. We thought that her French education would help our family to become more grounded in our Francophone identity and make French a bigger part of our daily life."
- "I speak Spanish (though not fluently) and have travelled a lot and know how important a second language is to developing empathy and global understanding."
- "It is also fortunately for us our neighborhood school, so the community or neighborhood aspect of being there was important to me."

Appendix C – Preliminary analyses for the French outcomes

ÉVIP

Observed variation in fitted OLS trajectories by French-speaking household status



Stem and leaf displays for the frspoken=0 group

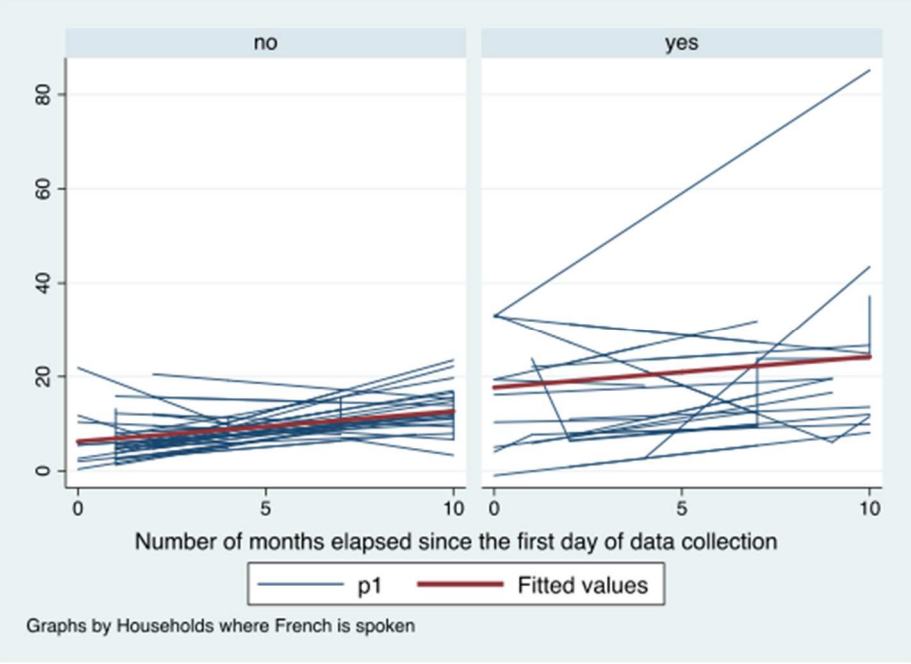
Intercepts	Slopes	Residual variance
0t | 222333 0f | 44444445555 0s | 6 0. | 889 1* | 0 1t | 23	-0** | 88 -0** | 41,24,09 0** | 00,02,07,10,12,14,16,31,31,32,36,39,42,43 0** | 59,73,75 1** | 25 1** 2** | 18 2** 3** 3** | 57	0* | 00001111112235 1* | 69 2* 3* | 2 4* | 39 5* | 6 6* 7* | 2 8* 9* 10* 11* | 9 12* 13* 14* | 5 15* 16* | 4

Stem and leaf displays for the frspoken=1 group

Intercepts	Slopes	Residual variance
0* | 3566 1* | 7 2* | 14588 3* 4* | 036 5* 6* | 9 7* | 8	-0** | 66 -0** 0** | 08,09,10,26 0** | 83 1** 1** | 52,70,85 2** | 32,34,42 2** 3** | 19,21 3** | 88	

ndwfrtotal

Observed variation in fitted OLS trajectories by French-speaking household status



Stem and leaf displays for the frspoken=0 group

Intercepts	Slopes	Residual variance
0∗ | 001222333444 0. | 555568 1∗ | 0224 1. | 6 2∗ | 2	−1∗∗ | 09 −0∗∗ −0∗∗ | 66 −0∗∗ | 51 −0∗∗ | 38,31,22 −0∗∗ 0∗∗ 0∗∗ | 33,35 0∗∗ | 46,55 0∗∗ | 65,73,74 0∗∗ | 89,96 1∗∗ | 01 1∗∗ | 22,23,23,30,35,36 1∗∗ 1∗∗ 1∗∗ 2∗∗ | 18 2∗∗ | 21	0∗ | 0333688 1∗ | 1226777 2∗ | 13 3∗ | 1 4∗ | 5 5∗ | 05 6∗ 7∗ | 1 8∗ | 9 9∗ 10∗ | 6 11∗ 12∗ 13∗ 14∗ 15∗ 16∗ 17∗ 18∗ 19∗ 20∗ 21∗ 22∗ 23∗ 24∗ 25∗ 26∗ 27∗ | 6

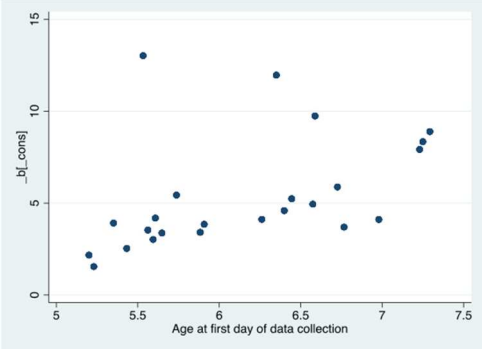
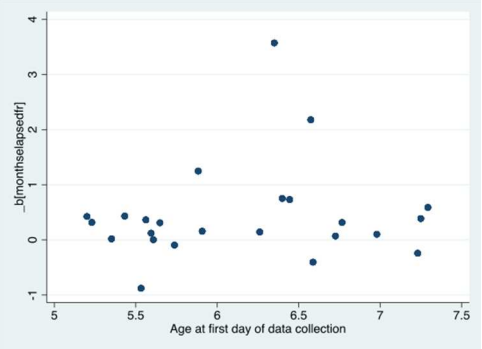
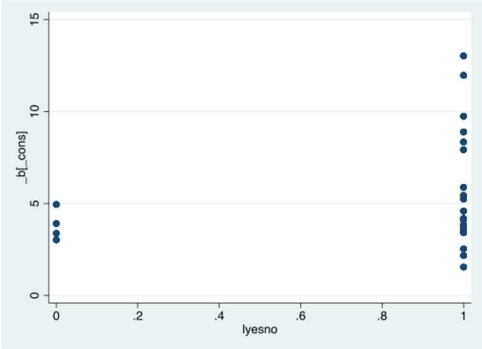
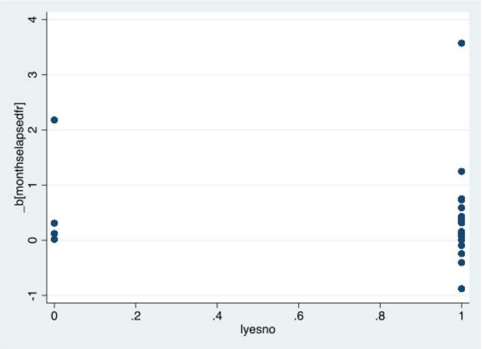
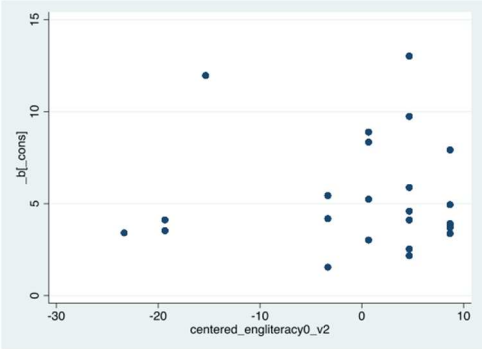
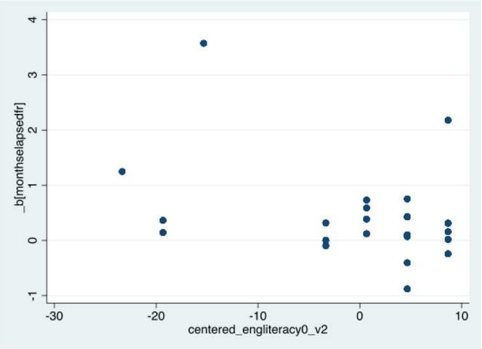
Stem and leaf displays for the frspoken=1 group

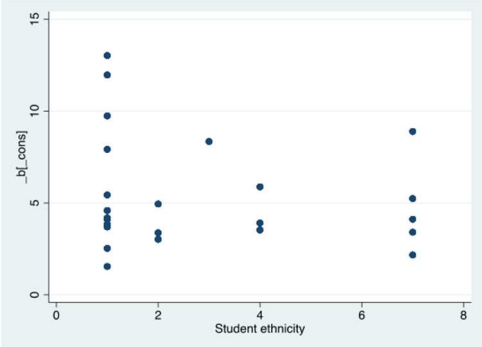
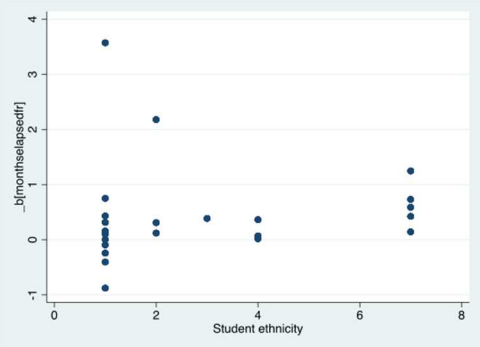
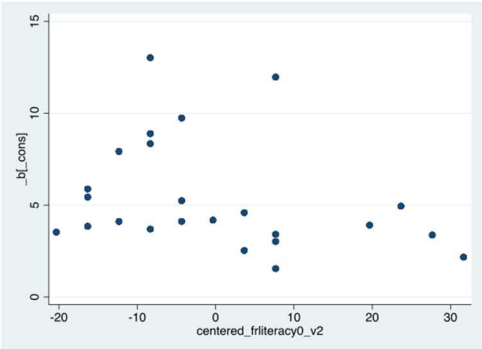
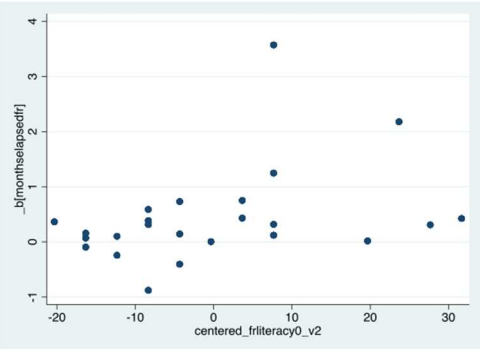
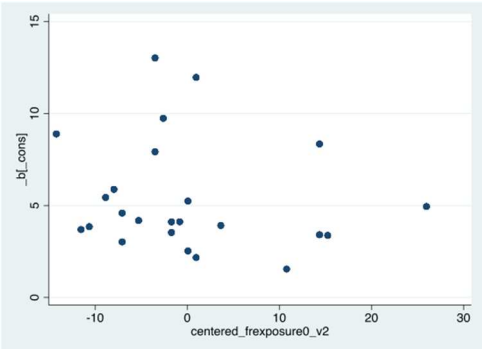
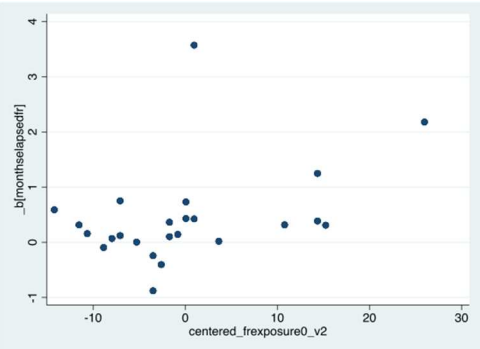
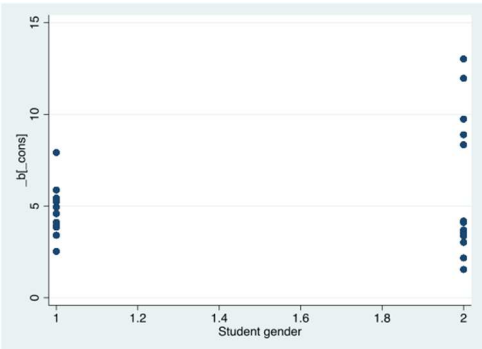
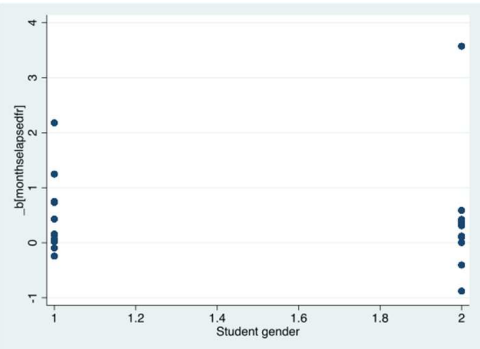
Intercepts	Slopes	Residual variance
−0∗ | 1 0∗ | 4557 1∗ | 0699 2∗ | 24 3∗ | 3339	−3∗∗ | 03 −2∗∗ −1∗∗ −0∗∗ | 80,30 0∗∗ | 00,25,33,38,44,51,65,68,91 1∗∗ | 73,79 2∗∗ 3∗∗ 4∗∗ 5∗∗ | 22	0∗ | 3479 1∗ | 123348 2∗ | 6 3∗ 4∗ | 8 5∗ 6∗ 7∗ 8∗ 9∗ | 7 10∗ | 9 11∗ | 4

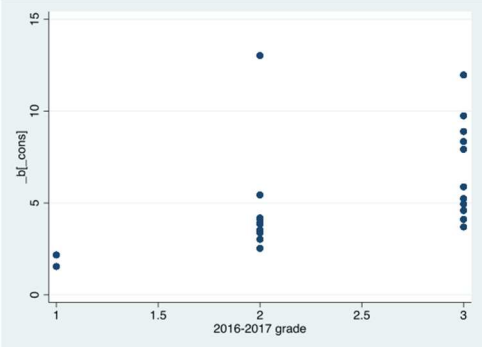
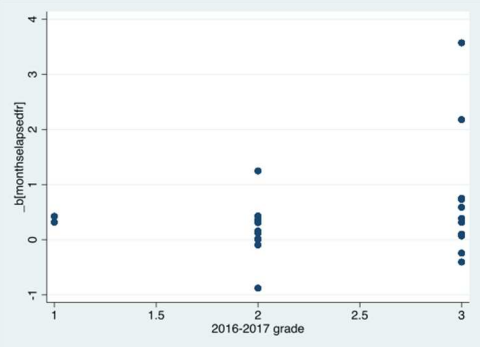
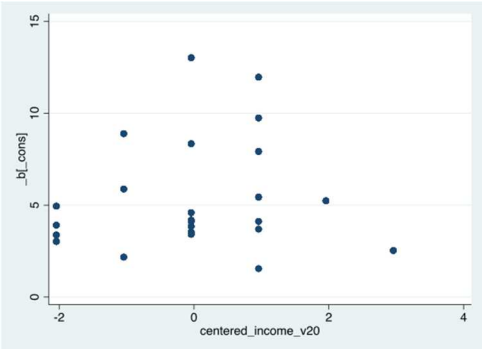
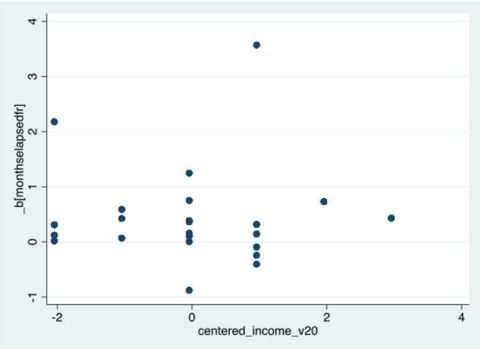
Appendix D – Plots of OLS estimated growth parameters vs. selected predictors

These exploratory analyses explore the relationship between the estimated intercepts and slopes for each outcome and each predictor.

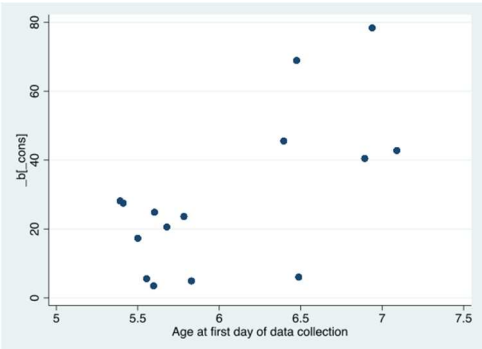
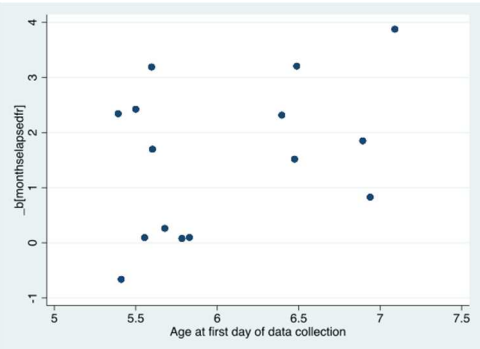
French receptive vocabulary for students from non-French-speaking households

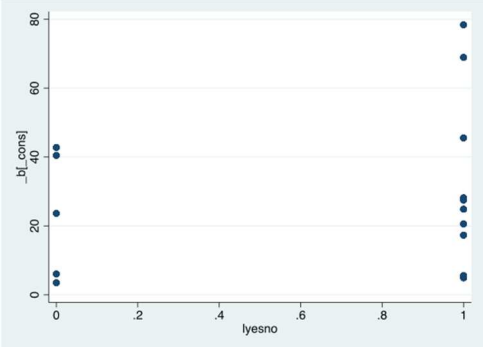
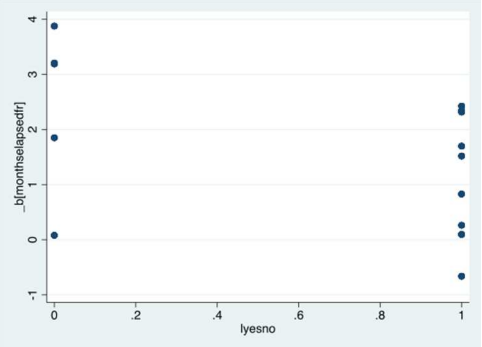
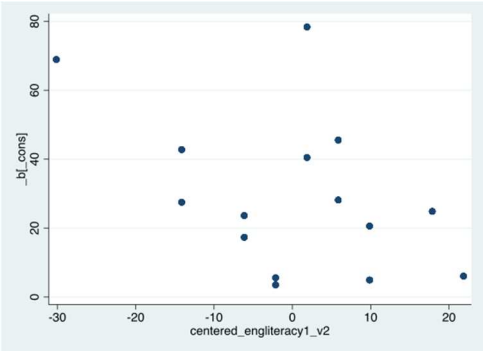
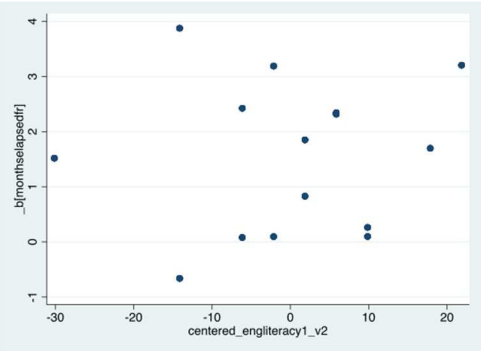
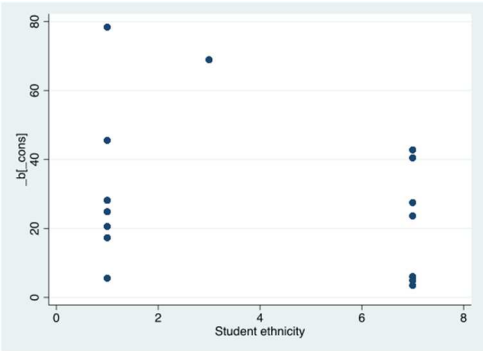
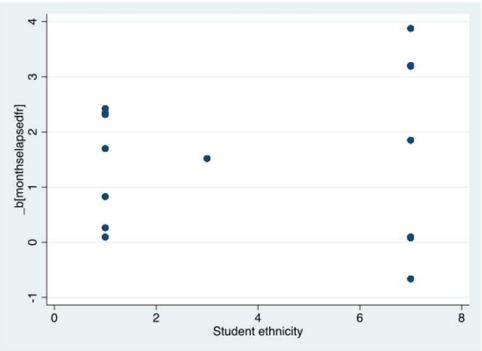
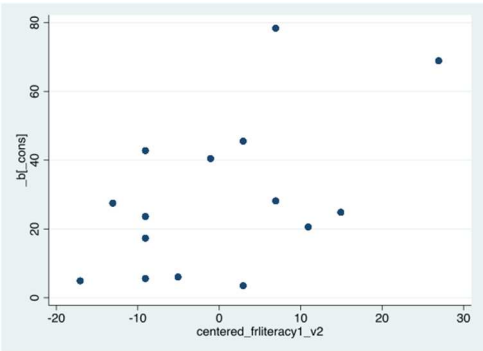
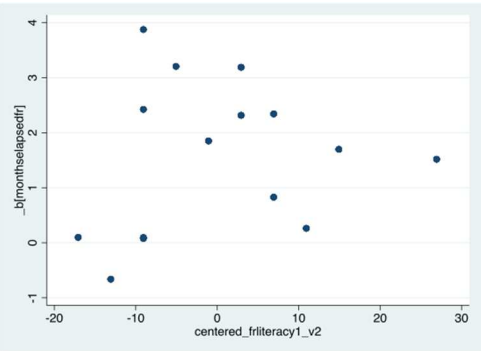
Predictor	Intercept	Slope
age		
collegedegree		
engliteracy		

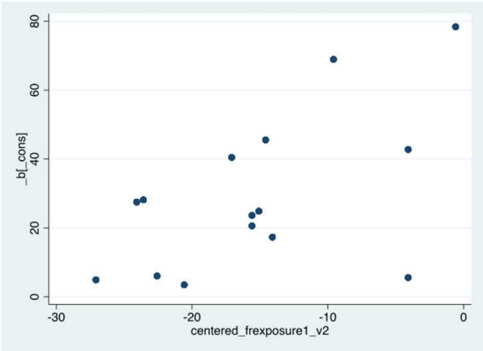
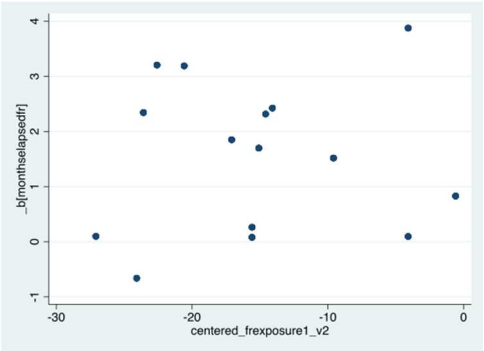
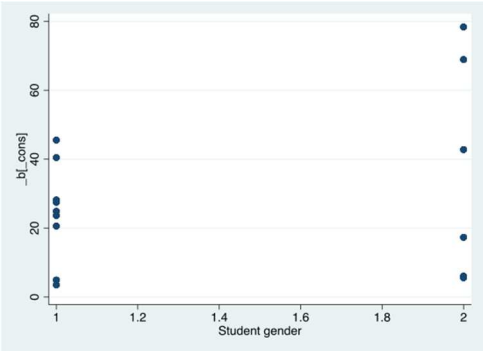
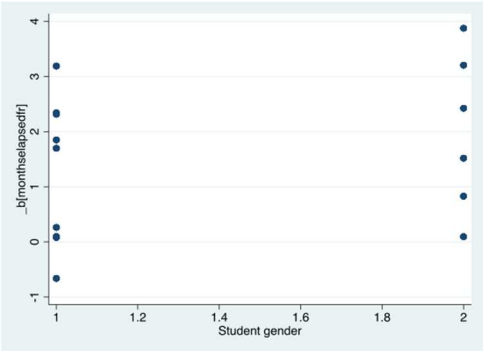
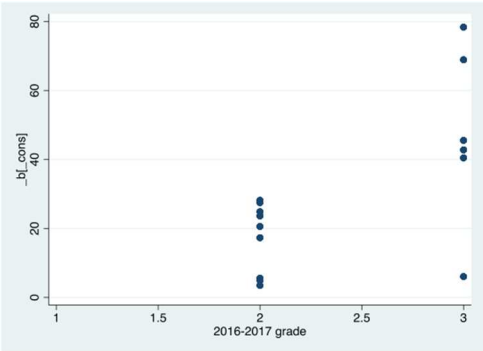
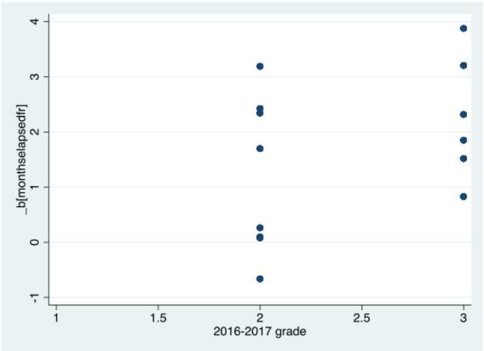
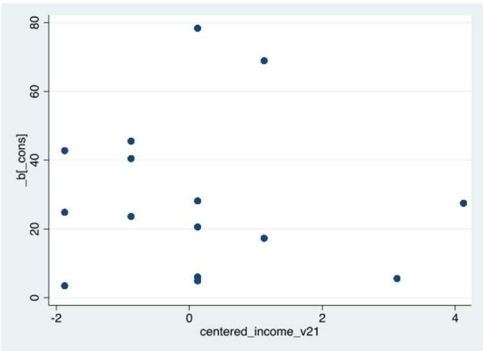
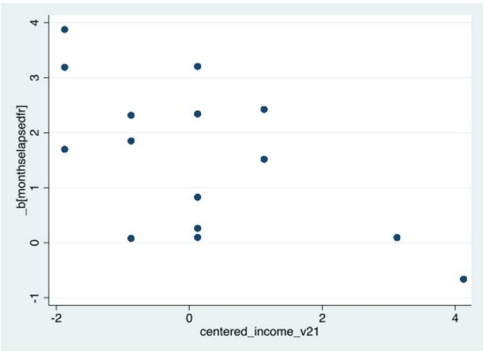
ethnicity		
frliteracy		
frexposure		
gender		

grade		
income		

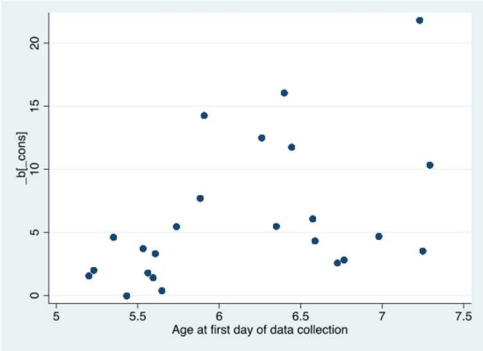
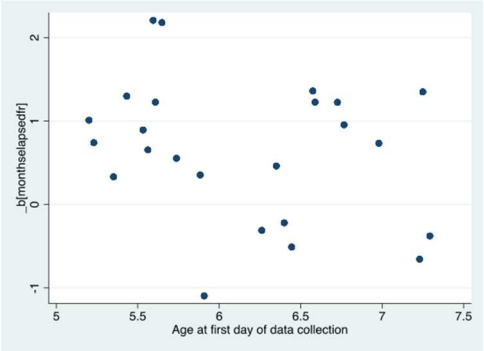
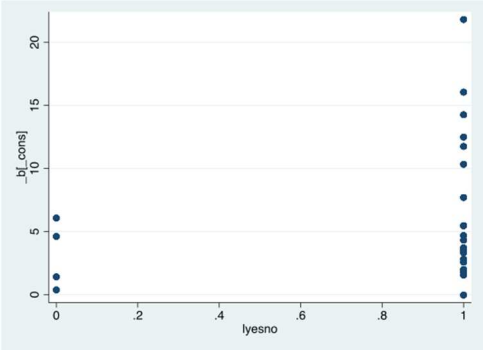
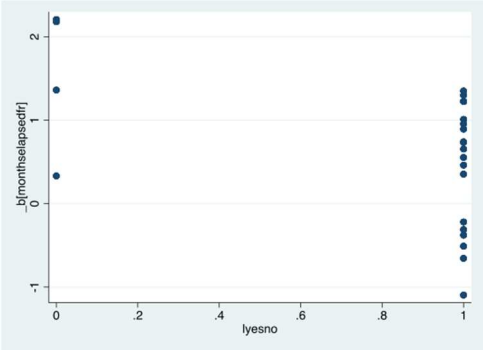
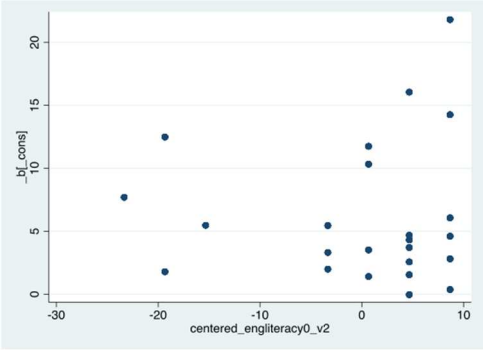
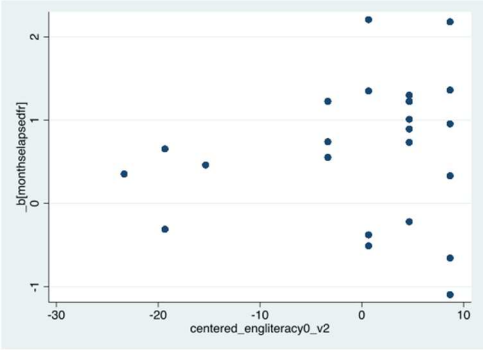
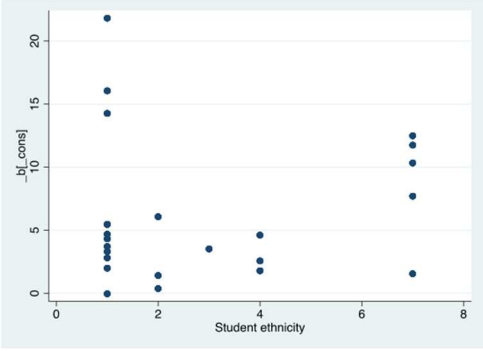
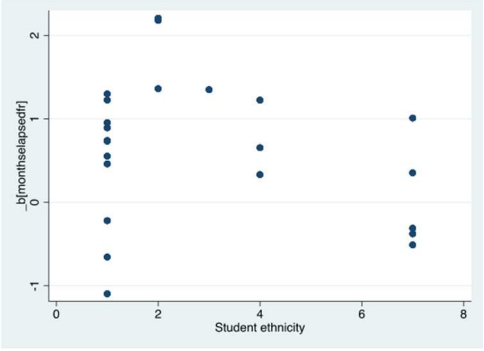
French receptive vocabulary for students from French-speaking households

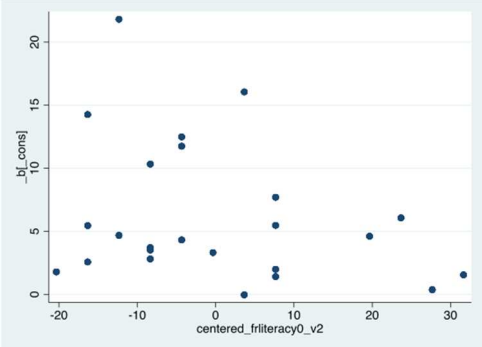
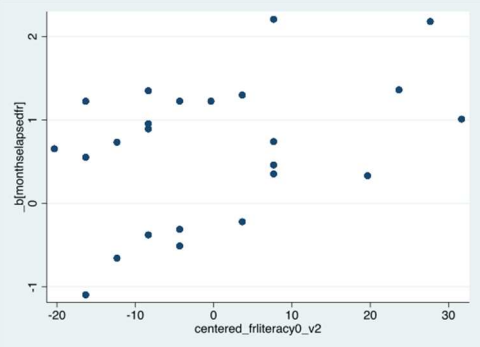
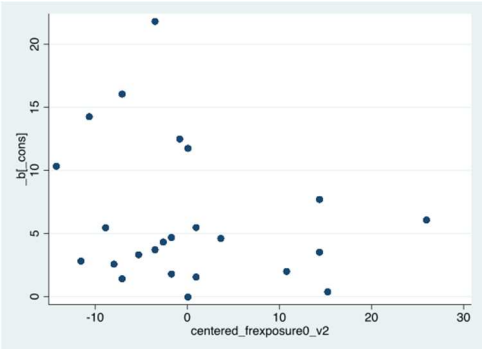
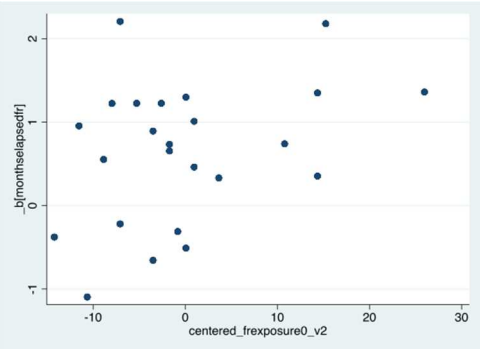
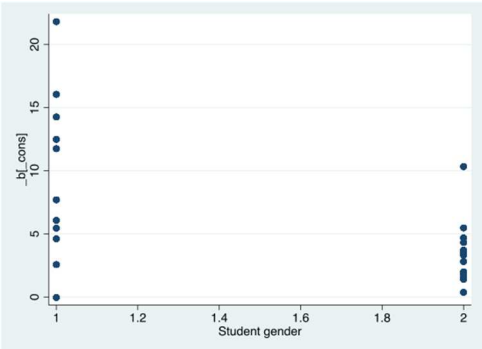
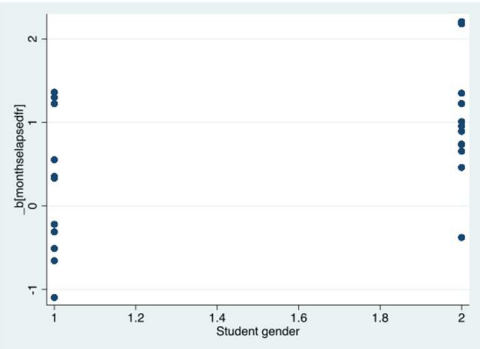
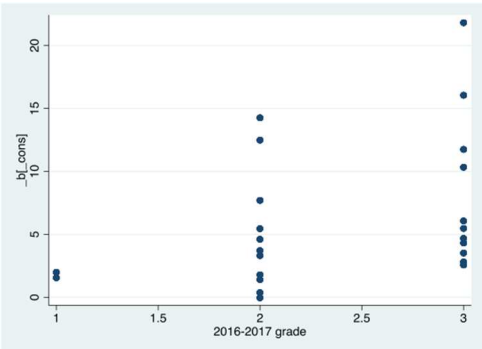
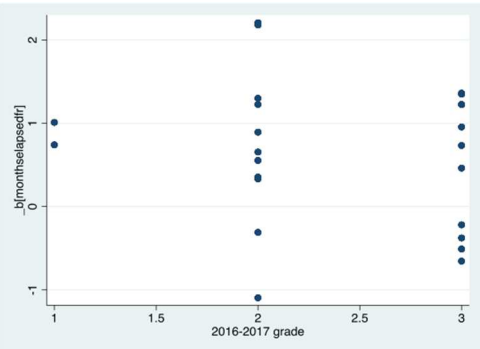
Predictor	**Intercept**	**Slope**
age		

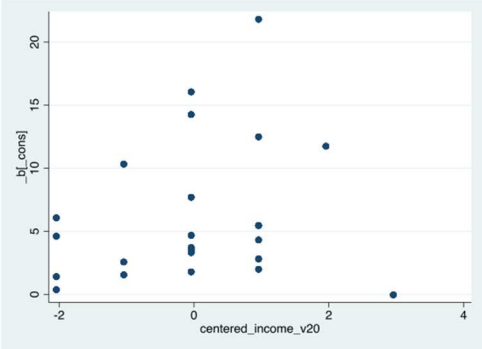
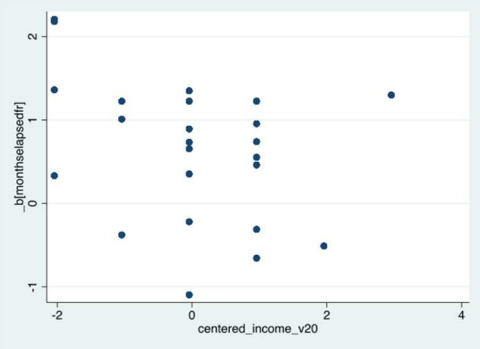
collegedegree		
engliteracy		
ethnicity		
frliteracy		

frexposure		
gender		
grade		
income		

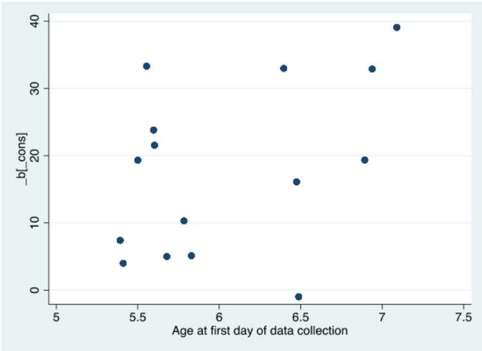
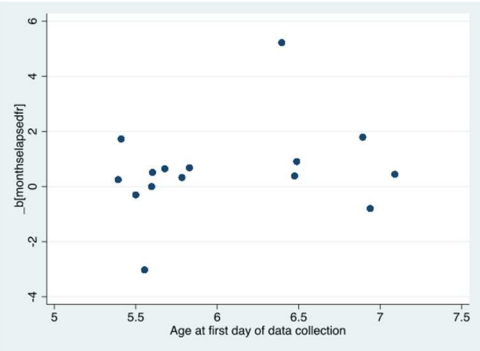
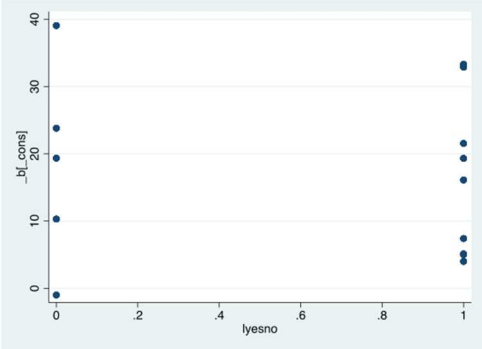
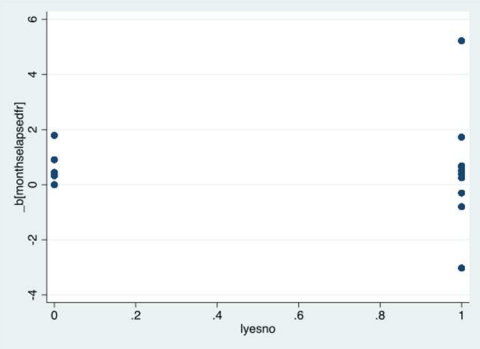
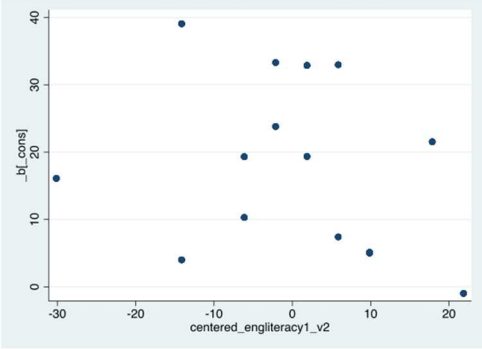
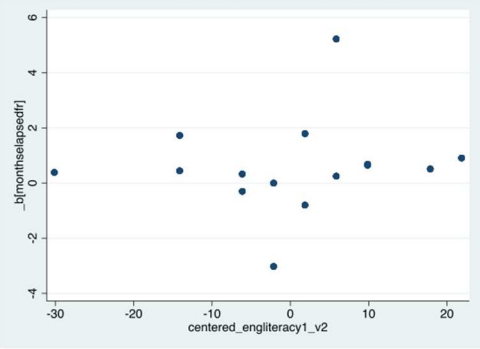
French expressive vocabulary for students from non-French-speaking households

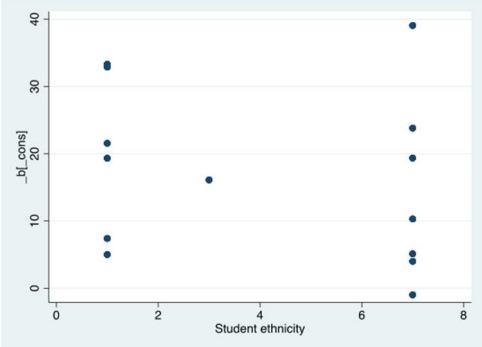
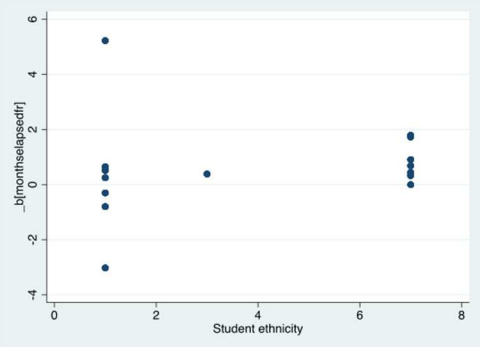
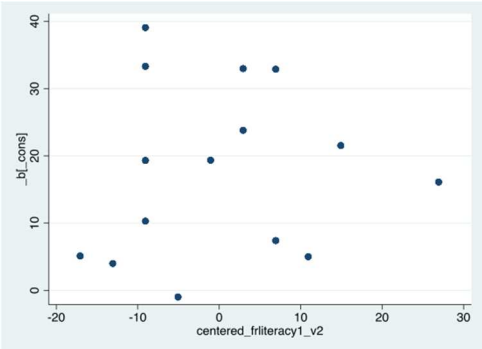
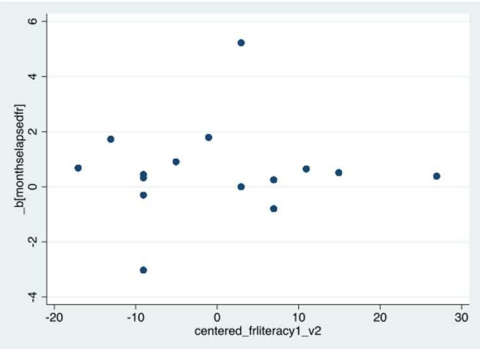
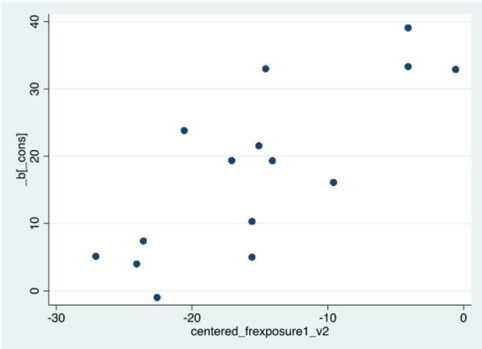
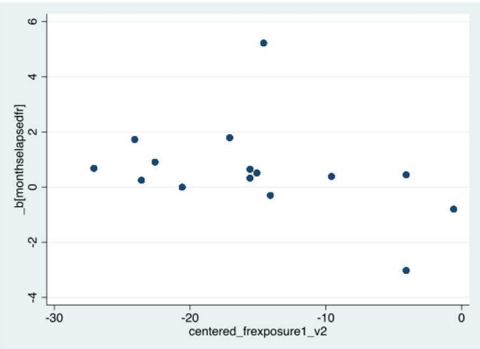
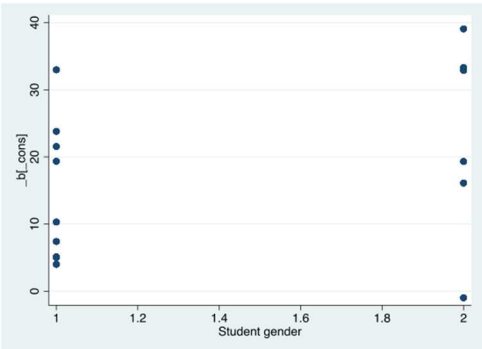
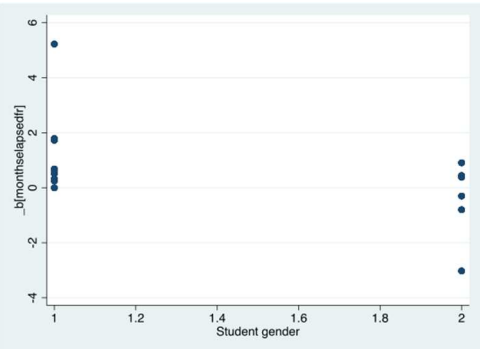
Predictor	Intercept	Slope
age		
collegedegree		
engliteracy		
ethnicity		

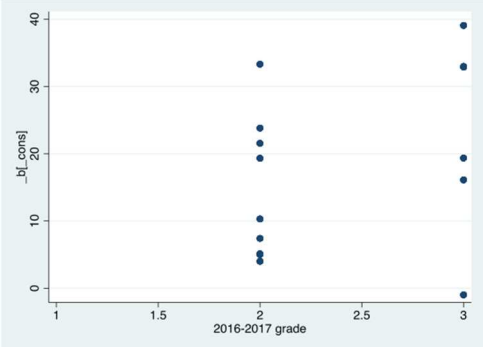
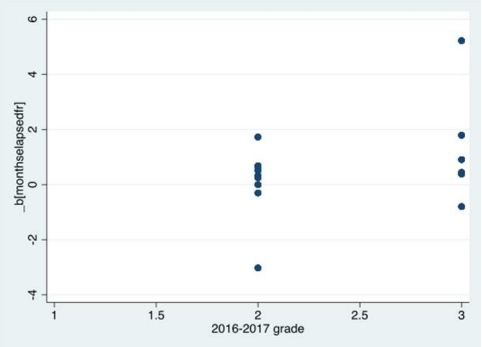
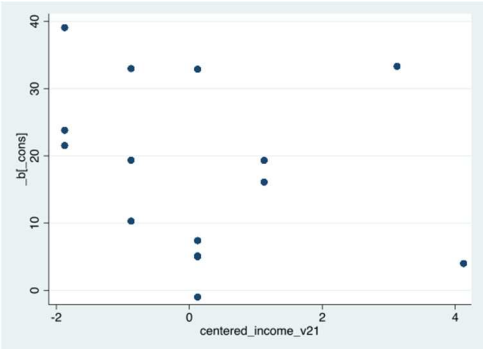
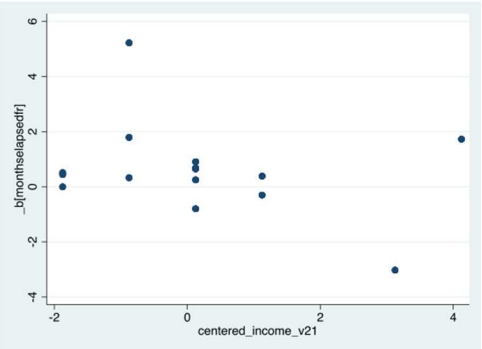
frliteracy		
frexposure		
gender		
grade		

income		

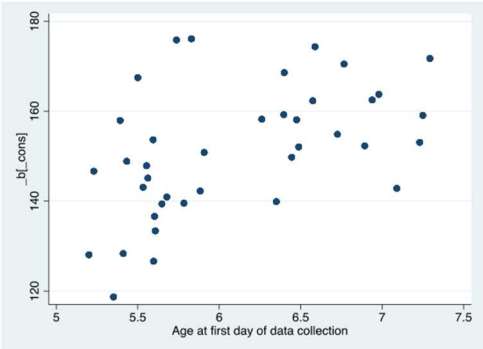
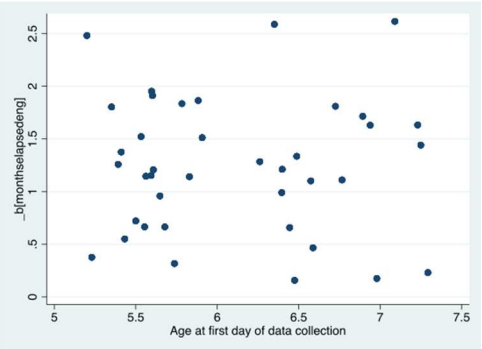
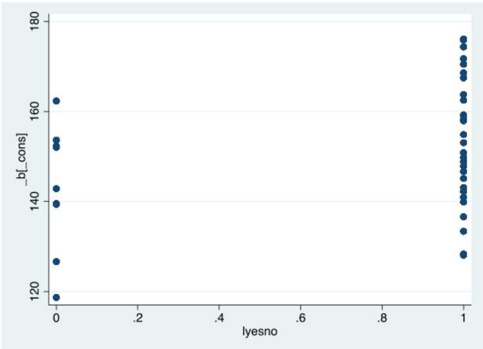
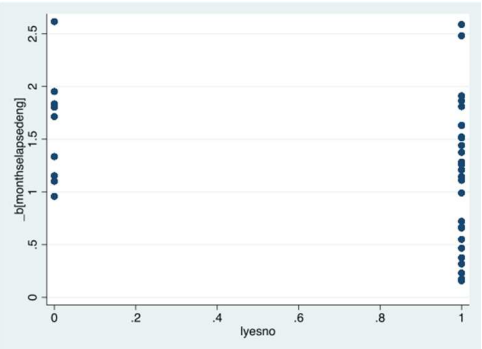
French expressive vocabulary for students from French-speaking households

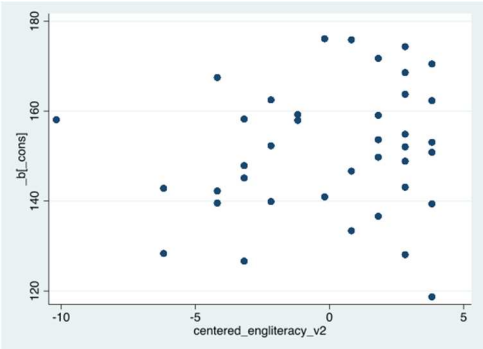
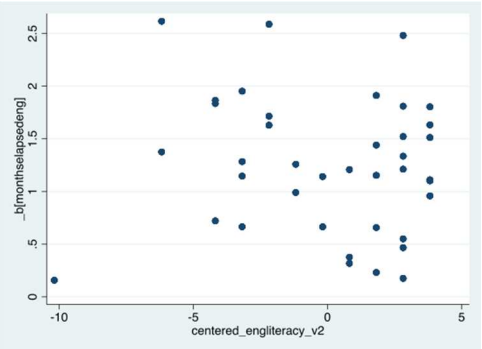
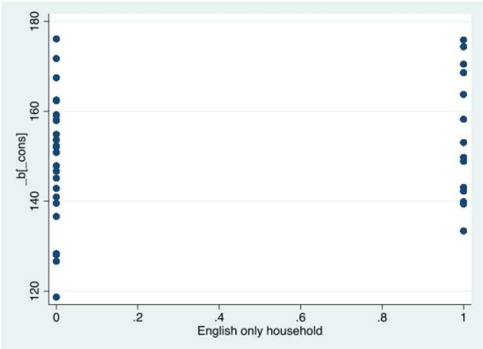
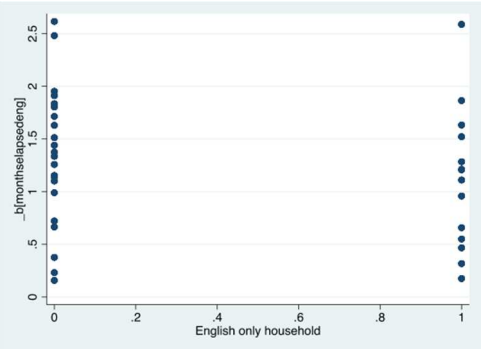
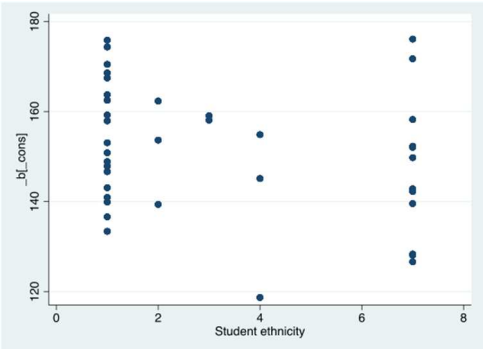
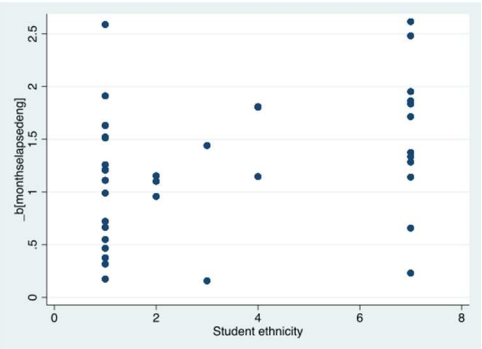
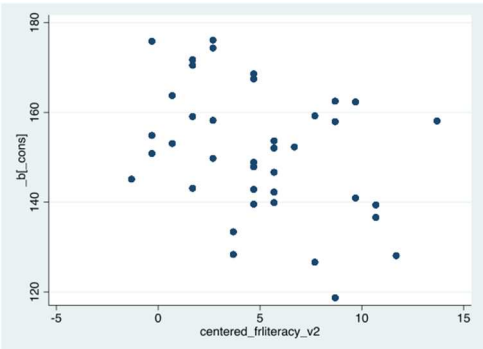
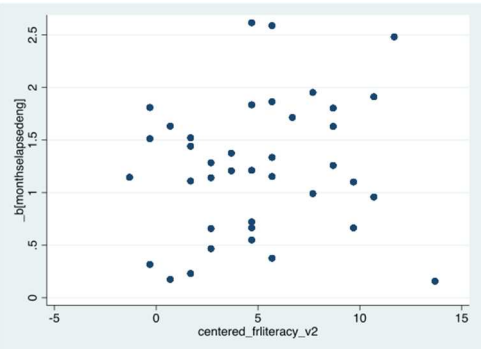
Predictor	Intercept	Slope
age		
collegedegree		
engliteracy		

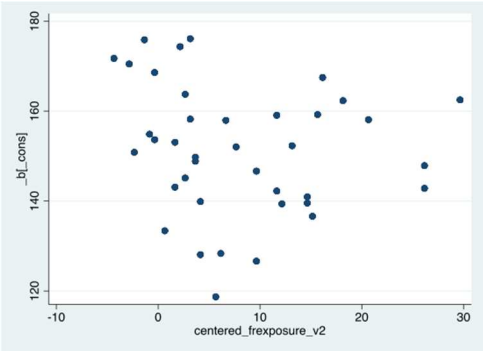
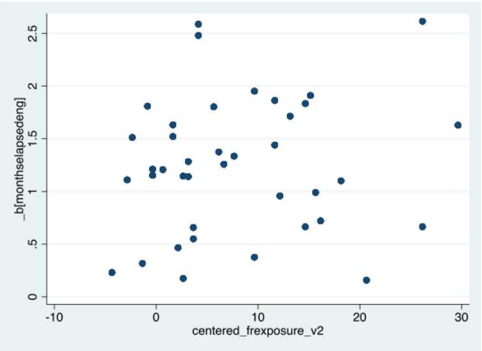
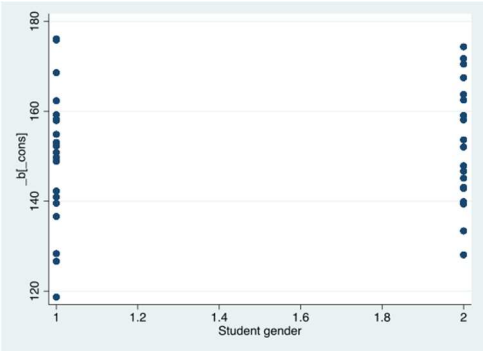
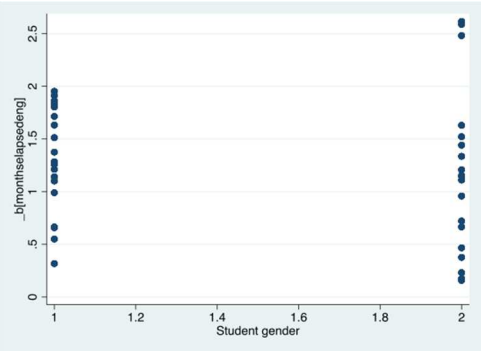
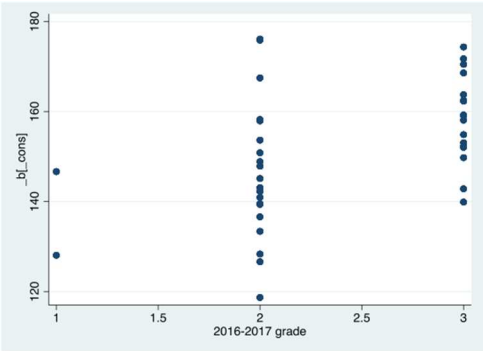
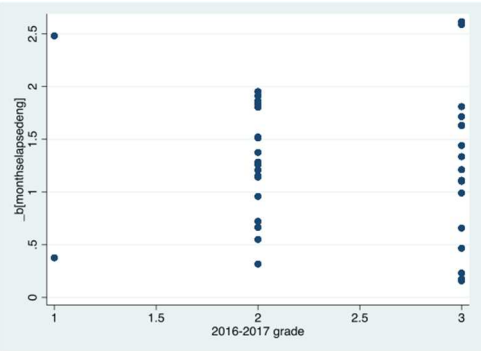
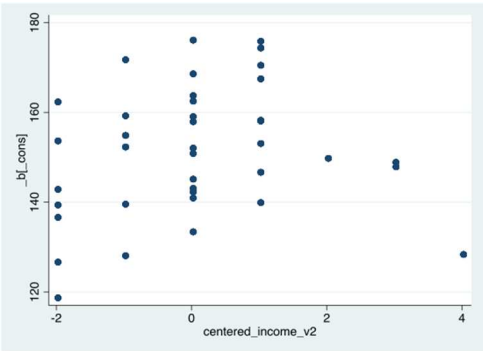
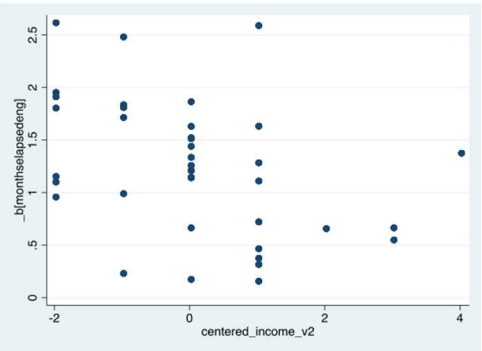
ethnicity		
frliteracy		
frexposure		
gender		

grade		
income		

English receptive vocabulary

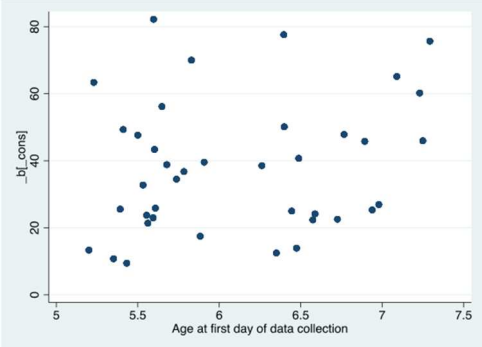
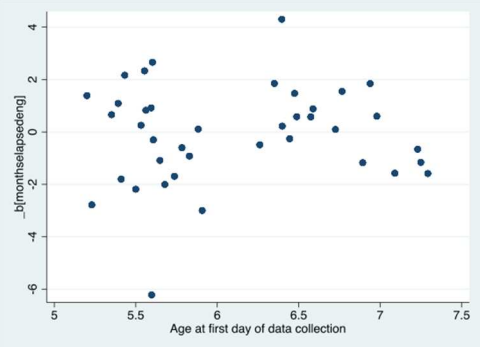
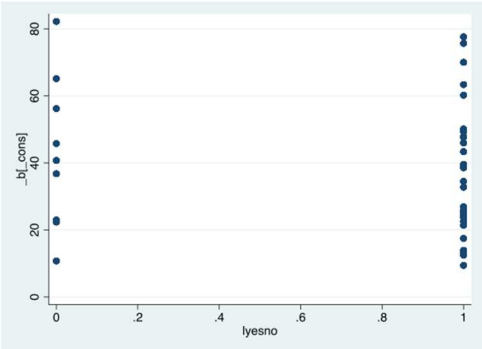
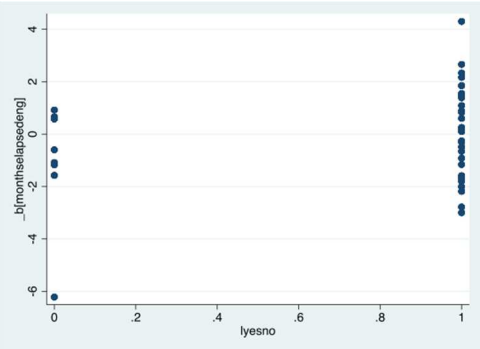
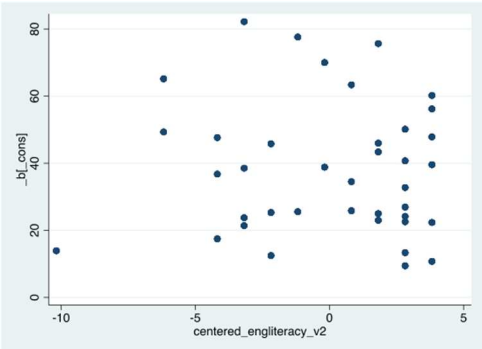
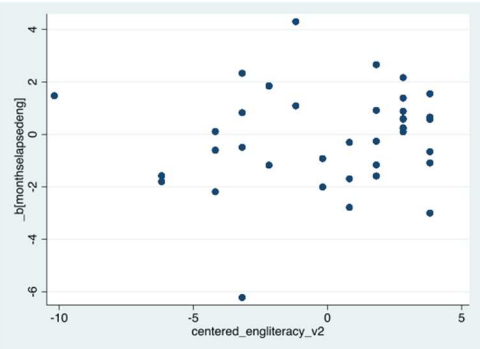
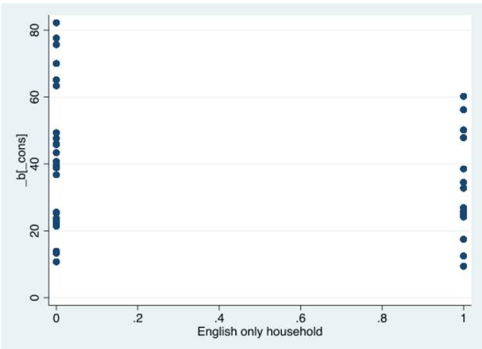
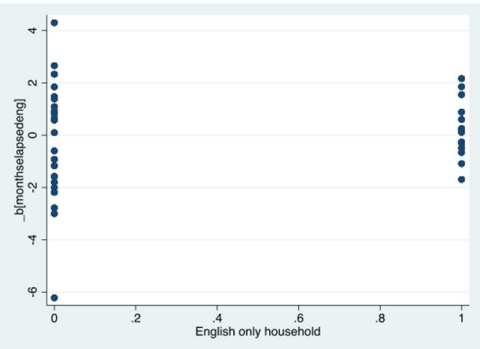
Predictor	**Intercept**	**Slope**
age		
collegedegree		

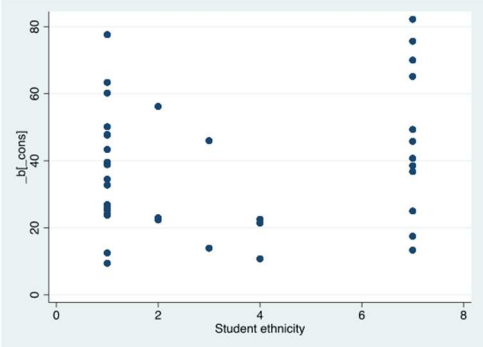
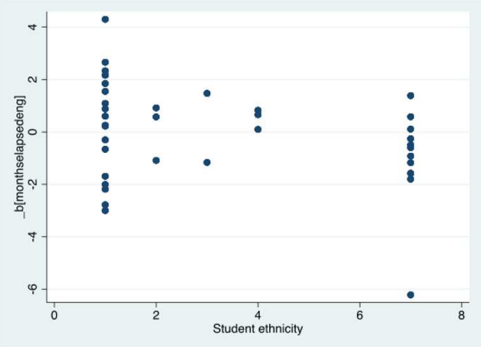
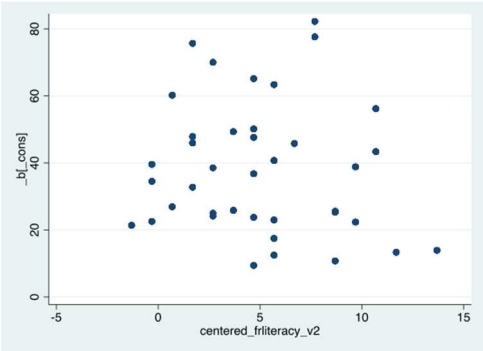
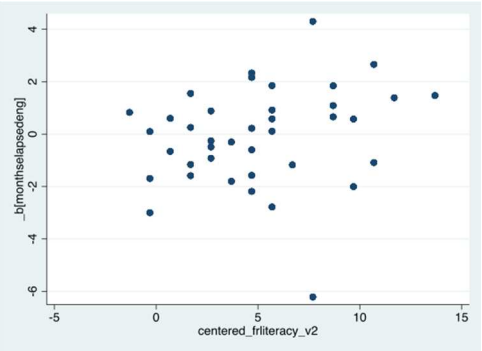
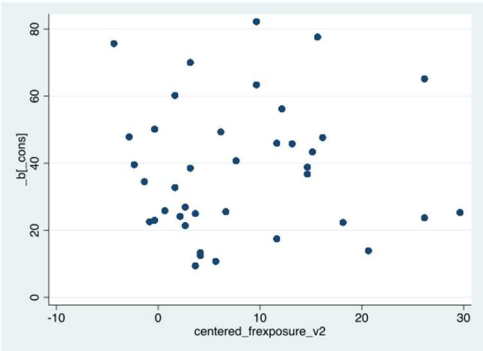
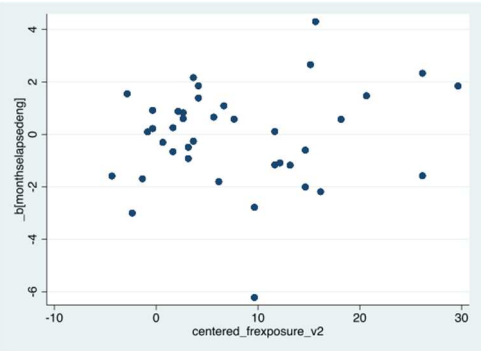
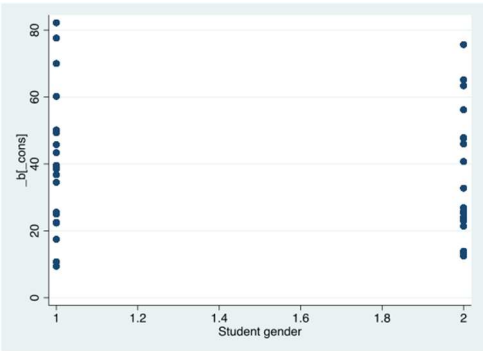
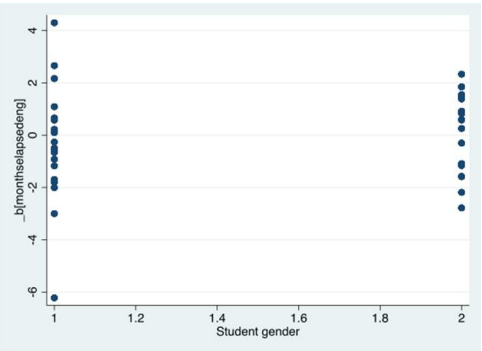
engliteracy		
engonly		
ethnicity		
frliteracy		

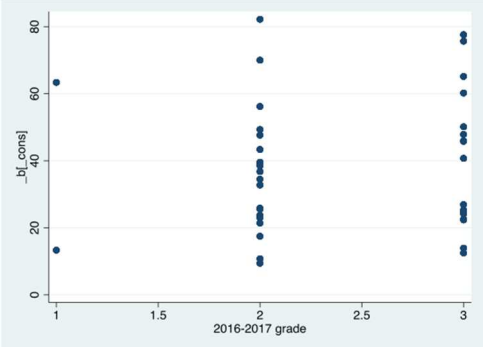
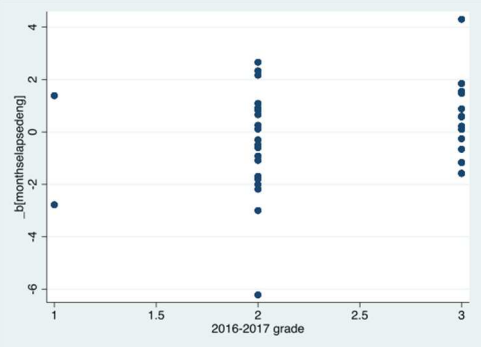
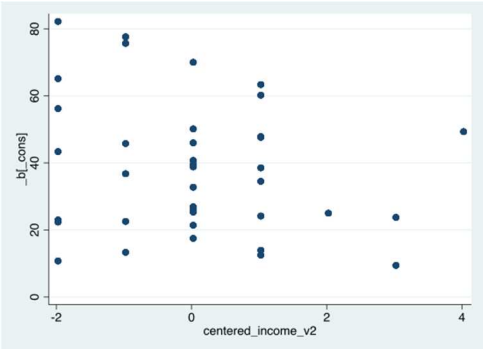
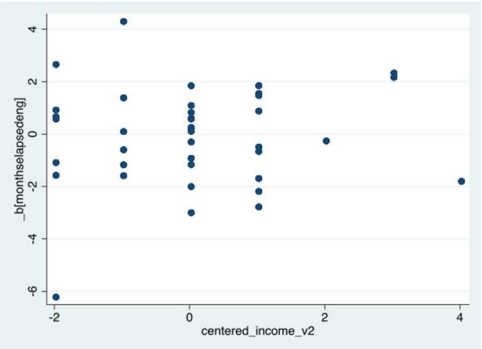
frexposure		
gender		
grade		
income		

English expressive vocabulary

Predictor	**Intercept**	**Slope**

age		
collegedegree		
engliteracy		
engonly		

ethnicity		
frliteracy		
frexposure		
gender		

grade		
income		

Appendix E – Calculating the predictors engliteracy, frliteracy, and frexposure

The table below provides more details on how the scores for the predictors engliteracy, frliteracy, and frexposure were calculated. Parents answered multiple-choice items on Survey A. For each item, a value was assigned to their response on the scale (0 = "never", 1 = "rarely", 2 = "sometimes", 3 = "often", and 4 = "always or every day"). Questions were grouped based on topical areas and parents' answers tallied. The first column lists the name of the predictor. The second column lists the questions that were used in the tally. The third column provides a range of possible scores: the lowest score would be if the survey respondent answered "never" for each question, the highest score would be if the survey respondent answered "always" or "every day" for each question.

Predictor	Survey questions	Range of possible scores
engliteracy	You and/or other adults in the home read in **English** to XXX.	0-20
	XXX reads in **English** at home.	
	XXX watches television programs or movies in **English**.	
	XXX plays games (educational or recreational) in **English** on a computer, a tablet or a smartphone.	
	XXX listens to songs in **English** at home.	
frliteracy	You and/or other adults in the home read in **French** to XXX.	0-20
	XXX reads in **French** at home.	

	XXX watches television programs or movies in **French**.	
	XXX plays games (educational or recreational) in **French** on a computer, a tablet or a smartphone.	
	XXX listens to songs in **French** at home.	
frexposure	Children outside of home and school interact in **French** with XXX. (1)	0-56
	XXX interacts in **French** with children outside of home and school. (2)	
	Adults outside of home and school (e.g., family friends) interact in **French** with XXX. (3)	
	XXX interacts in **French** with adults outside of home and school. (4)	
	XXX uses **French** when playing by himself/herself. (1)	
	The adults in your household communicate with each other in **French**. (2)	
	You use **French** to communicate with XXX. (3)	
	XXX uses **French** to communicate with you. (4)	
	The other parent uses **French** to communicate with XXX. (5)	

	XXX uses **French** to communicate with the other parent. (6)	
	Relatives communicate **in French** with XXX (e.g., Skype call with grandparents). (1)	
	XXX uses **French** to communicate with other relatives (e.g., Skype call with grandparents). (2)	
	Children in your home interact with XXX in **French**. (1)	
	XXX uses **French** to interact with other children in the home. (2)	

Appendix F – Survey 1

Start of Block: Consent form

Examining the influence of out-of-school input on the lexical development of early-elementary students in a French-English two-way immersion program

You and your child are asked to participate in a research study conducted by Ève Ryan, M.A., under the supervision of Professor Alison L. Bailey, Ed.D. at the Department of Education, University of California, Los Angeles. Your child was selected as a possible participant in this study because your child currently attends a French-English two-way immersion school in the Los Angeles area. Your participation in this research study is voluntary.

Why is this study being done?

In this study, we hope to learn more about how children's language is impacted by input outside of school, at home and during the summer break. This study's findings may have important implications for how children develop a foreign language outside of the school context.

What will happen if we take part in this research study?

If you and your child volunteer to participate in this study, you will be asked to do the following: You will be asked to fill out two electronic surveys. All of the information collected on both surveys will be kept strictly confidential and used only for research purposes. You can fill out the first survey now. The survey questions include some background information about your education, family income, and the French exposure that your child receives outside of school. This survey will take approximately 15 minutes to complete.

The second survey will include questions about your child's exposure to French over the summer vacation. The second survey will be distributed electronically after the 2017 summer vacation. The second survey will take approximately 10 minutes to complete. Throughout the year 2017, the researcher will schedule times with your child's teacher to come and administer an assessment to your child at school. Such assessments will take place in the classroom. Your child will be asked to participate in five individual assessment sessions. Each session should last about 10 minutes. During each assessment session, your child will be told a word in English or in French and asked to point to the corresponding picture on an easel. In addition, your child will be asked to describe two pictures in French and in English. Each session will be audio-recorded, and you may request to review, edit, and erase recordings of your child's participation.

How long will we be in the research study?

Your own participation in the study (filling out the surveys) will take a total of about 30 minutes. Your child's participation in the study will take a total of about 60 minutes over a period of 12 months.

Are there any potential risks or discomforts that we can expect from this study?

Some of the questions asked on the survey are private and may make you slightly uncomfortable. You will be asked about personal information such as income or language spoken at home. We ask you these questions to better understand the background of children

who are taking part in the study.

Your child may become tired or frustrated during assessment sessions. Your child will be told that he or she may take breaks at any time, and assessment may be picked up again after such breaks. Your child does not have to answer any questions that would cause additional stress.

Are there any potential benefits if we participate?

Although you and your child will likely not receive any direct benefits from your participation in this research, your child may enjoy playing word games. Children often enjoy the opportunity to work with someone individually while doing new activities that are engaging.

The results of the research may help educators, researchers, and parents better understand what they can do to support the educational needs of children.

Will my child and I receive any payment if we participate in this study?

All children who participate will get to choose a small prize (i.e., French stickers) from a treasure box at the end of each assessment session. All families who fill out the first survey will be entered into a drawing to possibly receive one of five children's books in French. In addition, all families who fill out the second survey will be entered into a drawing to possibly receive one of five children's books in French.

Will information about our participation be kept confidential?

Any information that is obtained in connection with this study and that can identify you and your child will remain confidential. It will be disclosed only with your permission or as required by law. Confidentiality will be maintained by never placing your name on any forms. You and your child will be given a number that will be used throughout the study for identification purposes. Only authorized research team members will have access to the information.

What are our rights if we take part in this study?

You may withdraw your consent at any time and discontinue participation without penalty or loss of benefits to which you were otherwise entitled.

You can choose whether to be in this study or not, and whether or not to allow your child to be in this study. Your child can refuse to participate in the study, even if you decide to enroll. If you agree to participate and to allow your child to participate in this study, you may withdraw your consent at any time without consequences of any kind. You are not waiving any legal rights if you choose to be in this research study.

Who can answer questions we might have about this study?

If you have any questions, comments or concerns about the research, you can talk to the researcher. Please contact Ève Ryan at 617-286-2056 (everyan@ucla.edu) or Professor Alison Bailey at 310-825-1731 (abailey@gseis.ucla.edu).

If you wish to ask questions about your rights as a research participant, or if you wish to voice any problems or concerns you may have about the study to someone other than the researchers, please call the Office of the Human Research Protection Program at (310) 825-7122 or write to Office of the Human Research Protection Program, UCLA, 11000 Kinross Avenue, Suite 102,

Box 951694, Los Angeles, CA 90095-1694.
IRB#16-001729

Q1 Do you agree to participate in the surveys?

- Yes (1)
- No (2)

Skip To: End of Survey If Do you agree to participate in the surveys? = No

Q2 Do you agree to allow your child to participate in the assessments?

- Yes (1)
- No (2)

Skip To: End of Survey If Do you agree to allow your child to participate in the assessments? = No

Q3 Please provide your email address. (Your email address is needed to send you the link to the second survey. It will not be shared with anyone.)

_____

Page Break

End of Block: Consent form

Start of Block: Child's demographics

Q4 Please fill in the details below.

- Child's first name (1) _____
- Child's last name (2) _____
- Child's date of birth (3) _____

Page Break

Q5 Please specify XXX's ethnicity.

▼ White (1) ... Other (7)

Q6 What grade is XXX in?

▼ Transitional Kindergarten (TK) (1) ... First grade (1) (3)

Q7 Please specify XXX's gender.

▼ Male (1) ... Female (2)

Q8 Was XXX born in the US?

- Yes (1)
- No (2)

Skip To: Q11 If Was XXX born in the US? = Yes

Q9 If XXX was not born in the US, how many years has he/she been living in the US?

▼ less than one (1) ... 10 (11)

Q10 Does XXX have an Individualized Education Program (IEP)?

- Yes (1)
- No (2)

Page Break

End of Block: Child's demographics

Start of Block: Parents demographics

Q11 What is your relationship to XXX?

- Mother (1)
- Father (2)
- Grandparent (3)
- Other (4) _____

Q12 Were you born in the US?

- Yes (1)
- No (2)

Skip To: Q14 If Were you born in the US? = Yes

Q13 How many years have you been living in the US?

▼ less than one (1) ... 60 (61)

Q14 Please indicate the highest level of education you completed.

▼ Some high school or less (1) ... Professional degree (8)

Q15 Please indicate your language proficiency level in **English**.

▼ 0 - No practical proficiency (1) ... 5 - Native or Bilingual Proficiency (6)

Q16 Please indicate your language proficiency level in **French**.

▼ 0 - No Practical Proficiency (1) ... 5 - Native or Bilingual Proficiency (6)

Page Break

Q17 Was XXX other parent born in the US?

- Yes (1)
- No (2)

Skip To: Q19 If Was XXX's other parent born in the US? = Yes

Q18 How many years has XXX's other parent been living in the US?

▼ less than one (1) ... 60 (61)

Q19 Please indicate the highest level of education completed by XXX's other parent.

▼ Some high school or less (1) ... Professional degree (8)

Q20 Please indicate the language proficiency level in **English** of XXX's other parent.

▼ 0 - No practical proficiency (1) ... 5 - Native or Bilingual Proficiency (6)

Q21 Please indicate the language proficiency level in French of XXX's other parent.

▼ 0 - No Practical Proficiency (1) ... 5 - Native or Bilingual Proficiency (6)

Page Break

Q22 What is your household's annual income?

▼ Less than $10,000 (1) ... $300,000 or more (15)

Q23 Does XXX qualify for free and reduced price school meals?

- Yes (1)
- No (2)

Page Break

End of Block: Parents demographics

Start of Block: Siblings

Q24 Are there any other children age younger than 18 besides XXX that live in your home?

- Yes. If so, how many? (1) _____
- No (2)

Skip To: End of Block If Are there any other children age younger than 18 besides XXX that... = No

Q25 What is XXX's birth order, that is order relative to older or younger siblings?

▼ 1st (1) ... 6th (6)

Q26 How many of the children living in your home besides XXX are enrolled in the French Program at XXX Elementary School?

_____

Q27 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)
Children in your home interact with XXX in **French**. (1)					
XXX uses **French** to interact with other children in the home. (2)					

Page Break

End of Block: Siblings

Start of Block: Relatives and other adults in household

Q28 Do you have French-speaking relatives?

- Yes (1)
- No (3)

Skip To: Q31 If Do you have French-speaking relatives? = No

Q29 How often and for how long do your French-speaking relatives come to visit XXX?

_____

_____

_____

_____

_____

Q30 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., once every few months) (2)	Sometimes (i.e., once every few weeks) (3)	Often (i.e., once a week) (4)	Every day (5)
Relatives communicate **in French** with XXX (e.g., Skype call with grandparents). (1)					
XXX uses **French** to communicate with other relatives (e.g., Skype call with grandparents). (2)					

Page Break

Q31 Are there any adult that live in your home besides you and the other parent?

○ Yes. If so, please specify (e.g., au pair) (1)

_____

○ No (2)

Skip To: End of Block If Are there any adult that live in your home besides you and the other parent? = No

Q32 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)
The other adult that lives in the home, uses **French** to communicate with XXX. (1)					
XXX uses **French** to communicate with the other adult that lives in the home. (2)					

End of Block: Relatives and other adults in household

Start of Block: French exposure

Page Break

Display This Question:

If What grade is XXX in? = Kindergarten (K)

Or What grade is XXX in? = First grade (1)

Q33 Did XXX attend preschool, daycare, or Transitional Kindergarten (TK) in French prior to enrolling in Kindergarten?

- Yes (1)
- No (2)

Display This Question:

If What grade is XXX in? = Transitional Kindergarten (TK)

Q34 Did XXX attend preschool or daycare in French prior to enrolling in Transitional Kindergarten (TK)?

- Yes (1)
- No (2)

Q35 Does XXX currently receive tutoring in French?

- Yes. Please indicate how many hours per week. (1) _____
- No (2)

Q36 Has XXX traveled to a French-speaking country?

- No (1)
- Yes. Please indicate how often and for how long. (2) _____

Page Break

Q37 Please indicate XXX's current French teacher.

- Teacher 1 (1)
- Teacher 2 (2)
- Teacher 3 (3)

Q38 Why did you decide to send XXX to the French Academy at XXX Elementary School?

_____

_____

_____

_____

_____

Page Break

Q39 What language(s) is/are spoken in your home?

_____

Q40 Do you have any specific methods or rules when it comes to language(s) in your household? Please explain.

_____

_____

_____

_____

_____

Page Break

Q41 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)
XXX uses **French** when playing by himself/herself. (1)					
The adults in your household communicate with each other in **French**. (2)					
You use **French** to communicate with XXX. (3)					
XXX uses **French** to communicate with you. (4)					
The other parent uses **French** to communicate with XXX. (5)					
XXX uses **French** to communicate with the other parent. (6)					

Page Break

Q42 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

Children outside of home and school interact in **French** with XXX. (1)	
XXX interacts in **French** with children outside of home and school. (2)	
Adults outside of home and school (e.g., family friends) interact in **French** with XXX. (3)	
XXX interacts in **French** with adults outside of home and school. (4)	

Page Break

Q43 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

You and/or other adults in the home read in **French** to XXX. (1)	
XXX reads in **French** at home. (2)	
XXX watches television programs or movies in **French**. (3)	
XXX plays games (educational or recreational) in **French** on a computer, a tablet or a smartphone. (4)	
XXX listens to songs in **French** at home. (5)	

Q44 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

You and/or other adults in the home read in **English** to XXX. (1)	
XXX reads in **English** at home. (2)	
XXX watches television programs or movies in **English**. (3)	
XXX plays games (educational or recreational) in **English** on a computer, a tablet or a smartphone. (4)	
XXX listens to songs in **English** at home. (5)	

Page Break

Q45 Please share some of the successes XXX has had with learning French.

_____

_____

_____

_____

_____

Q46 Please share some of the challenges XXX has had with learning French.

_____

_____

_____

_____

_____

Page Break

Q47 Do you have any concerns regarding XXX's experience with learning French? If so, please explain.

_____

_____

_____

_____

_____

Q48 In what ways has XXX's French learning experience impacted his/her English language?

_____

_____

_____

_____

_____

Q49 Please write down any additional comments you have about XXX's experience with learning French.

_____

_____

_____

_____

_____

End of Block: French exposure

Appendix G – Survey 2

Start of Block: Child's demographics

Q1 Please fill in the details below.

- Child's first name (1) _____
- Child's last name (2) _____
- Name of child's current French teacher (3) _____
- Your email address (for the prize drawing) (4) _____

End of Block: Child's demographics

Start of Block: Parents demographics

Q2 What is your relationship to XXX?

- Mother (1)
- Father (2)
- Grandparent (3)
- Other (4) _____

Page Break

End of Block: Parents demographics

Start of Block: Siblings

Q3 Were there any other children age younger than 18 besides XXX that lived in your home **over the summer**?

- ○ Yes. If so, how many? (1) _____
- ○ No (2)

Skip To: End of Block If Were there any other children age younger than 18 besides XXX tha... = No

Q4 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)
Children in your home interacted with XXX in **French** over the summer. (1)					
XXX used **French** to interact with other children in the home over the summer. (2)					

Page Break

End of Block: Siblings

Start of Block: Relatives and other adults in household

Q5 Do you have French-speaking relatives?

- ○ Yes (1)
- ○ No (2)

Skip To: Q8 If Do you have French-speaking relatives? = No

Q6 Did your French-speaking relatives visit XXX **over the summer**?

- ○ Yes. If so, for how long? (1) _____
- ○ No (2)

Q7 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., once over the summer) (2)	Sometimes (i.e., two or three times over the summer) (3)	Often (i.e., once a week) (4)	Every day (5)
Relatives communicated **in French** with XXX (e.g., Skype call with grandparents) over the summer. (1)					
XXX used **French** to communicate with other relatives (e.g., Skype call with grandparents) over the summer. (2)					

Page Break

Q8 Were there any adult that lived in your home besides you and the other parent **over the summer**?

- ○ Yes. If so, please specify (e.g., au pair) (1)

_____

- ○ No (2)

Skip To: End of Block If Were there any adult that lived in your home besides you and the other parent over the summer? = No

Q9 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)
The other adult that lived in the home used **French** to communicate with XXX over the summer. (1)					
XXX used **French** to communicate with the other adult that lived in the home over the summer. (2)					

End of Block: Relatives and other adults in household

Start of Block: French exposure

Page Break

Q10 Did XXX receive tutoring in French **over the summer**?

- Yes. Please indicate how many hours per week. (1) _____
- No (2)

Q11 Did XXX travel to a French-speaking country **over the summer**?

- No (1)
- Yes. Please indicate for how long. (2) _____

Q12 Did XXX attend a summer camp in French **over the summer**?

- ○ Yes. If so, please specify for how long and the name of the camp. (1) _____
- ○ No (2)

Page Break

Q13 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every day) (2)	Sometimes (i.e., once or twice a day) (3)	Often (i.e., more than twice a day, but not consistently) (4)	Always (5)

XXX used **French** when playing by himself/herself over the summer. (1)	
The adults in your household communicated with each other in **French** over the summer. (2)	
You used **French** to communicate with XXX over the summer. (3)	
XXX used **French** to communicate with you over the summer. (4)	
The other parent used **French** to communicate with XXX over the summer. (5)	
XXX used **French** to communicate with the other parent over the summer. (6)	

Page Break

Q14 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

Children outside of home played in **French** with XXX over the summer. (1)	
XXX played in **French** with children outside of home over the summer. (2)	
Adults outside of home (e.g., family friends) interacted in **French** with XXX over the summer. (3)	
XXX interacted in **French** with adults outside of home over the summer. (4)	

Page Break

Q15 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

You and/or other adults in the home read in **French** to XXX over the summer. (1)	
XXX read in **French** at home over the summer. (2)	
XXX watched television programs or movies in **French** over the summer. (3)	
XXX played games (educational or recreational) in **French** on a computer, a tablet or a smartphone over the summer. (4)	
XXX listened to songs in **French** at home over the summer. (5)	

Q16 For each statement below, check the appropriate box.

	Never (1)	Rarely (i.e., every once in awhile, but not every week) (2)	Sometimes (i.e., once or twice a week) (3)	Often (i.e., more than twice a week, but not every day) (4)	Every day (5)

You and/or other adults in the home read in **English** to XXX over the summer. (1)	
XXX read in **English** at home over the summer. (2)	
XXX watched television programs or movies in **English** over the summer. (3)	
XXX played games (educational or recreational) in **English** on a computer, a tablet or a smartphone over the summer. (4)	
XXX listened to songs in **English** at home over the summer. (5)	

Page Break

Q17 What factors (e.g., financial, logistical, ...) made it **easy** for XXX to continue learning and/or practicing French over the summer?

_____

_____

_____

_____

_____

Q18 What factors (e.g., financial, logistical, ...) made it **difficult** for XXX to continue learning and/or practicing French over the summer?

_____

_____

_____

_____

_____

Q19 Please write down any additional comments you have about XXX's experience with learning or maintaining French over the summer.

_____

_____

_____

_____

_____

End of Block: French exposure

Appendix H - Script for the lexical task

French picture description

Time point 1

Let me show you a photo of a child. (*Show picture.*) His name is François. François is French and does not speak English. François likes to draw a lot.

Now, let's play a game. I'm going to show you two pictures and have you say what's on them for François so that he can later draw the pictures without looking at them. So, I want you to tell me as much as you can about the picture. And I want you to do it in French, because as I said, François doesn't speak English. I'm going to record you so that François can listen to what you said.

Alright? Let's start. Here is the first picture. (*Show picture.*) Remember, tell me as much as you can about the picture in French so that François can draw it without looking at it. Go ahead.
(*Child describes first picture.)*

Anything else?

Good job! Now let's continue with the second picture. (*Show picture.*) Again, remember: tell me as much as you can about the picture in French so that François can draw it without looking at it. Go ahead.
(*Child describes second picture.)*

Anything else?

Excellent job! Thank you!

Subsequent time points

Do you remember François? (*Show picture.*) He really enjoyed drawing what you described the last time and he wants to play that game again!

I'm going to show you two pictures and have you say what's on them for François so that he can later draw the pictures without looking at them. So, I want you to tell me as much as you can about the pictures. And I want you to do it in French, because as you know, François does not speak English. I'm going to record you so that François can listen to what you said.

Alright? Let's start. Here is the first picture. (*Show picture.*) Remember, tell me as much as you can about the picture in French so that François can draw it without looking at it. Go ahead.
(*Child describes first picture.)*

Anything else?

Good job! Now let's continue with the second picture. (*Show picture.*) Again, remember: tell me as much as you can about the picture in French so that François can draw it without looking at it. Go ahead.
(*Child describes second picture.)*

Anything else?

Excellent job! Thank you!

English picture description

Time point 1

Let me show you a photo of a child. (*Show picture.*) Her name is Mary. Mary only speaks English and likes to draw a lot.

Now, let's play a game. I'm going to show you two pictures and have you say what's on them for Mary so that she can later draw the pictures without looking at them. So, I want you to tell me as much as you can about the picture. And I want you to do it in English, because as I said, Mary only speaks English. I'm going to record you so that Mary can listen to what you said.

Alright? Let's start. Here is the first picture. (*Show picture.*) Remember, tell me as much as you can about the picture in English so that Mary can draw it without looking at it. Go ahead.
(*Child describes first picture.)*

Anything else?

Good job! Now let's continue with the second picture. (*Show picture.*) Again, remember: tell me as much as you can about the picture in English so that Mary can draw it without looking at it. Go ahead.
(*Child describes second picture.)*

Anything else?

Excellent job! Thank you!

Subsequent time points

Do you remember Mary? (*Show picture.*) She really enjoyed drawing what you described the last time and wants to play that game again.

I'm going to show you two pictures and have you say what's on them for Mary so that she can later draw the pictures without looking at them. So, I want you to tell me as much as you can about the pictures. And I want you to do it in English, because as you know, Mary only speaks English. I'm going to record you so that Mary can listen to what you said.

Alright? Let's start. Here is the first picture. (*Show picture.*) Remember, tell me as much as you can about the picture in English so that Mary can draw it without looking at it. Go ahead.
(*Child describes first picture.)*

Anything else?

Good job! Now let's continue with the second picture. (*Show picture.*) Again, remember: tell me as much as you can about the picture in English so that Mary can draw it without looking at it. Go ahead.
(*Child describes second picture.)*

Anything else? Excellent job! Thank you!

Pictures for the lexical task

Home picture

School picture

Appendix I – Survey responses

French input

Adults in household interacted in French with each other	French spoken in the household		Total
	Yes	No	
Never	6	19	25
Rarely	4	4	8
Sometimes	2	1	3
Often	1	0	1
Always or every day	2	0	2
Total	15	24	39

Adults in household interacted in French with each other during the summer	French spoken in the household		Total
	Yes	No	
Never	3	16	19

Rarely	1	1	2
Sometimes	4	1	5
Often	1	0	1
Always or every day	2	0	1
Total	11	18	29

Respondent interacts in French with the student	French spoken in the household		Total
	Yes	No	
Never	1	10	11
Rarely	0	12	12
Sometimes	4	2	6
Often	4	0	4
Always or every day	6	0	6
Total	15	24	39

	French spoken in the household		Total

Respondent interacted in French with the student during the summer	Yes	No	
Never	0	9	9
Rarely	2	7	9
Sometimes	6	2	8
Often	0	0	0
Always or every day	3	0	3
Total	11	18	29

Other parent interacts in French with the student	French spoken in the household		Total
	Yes	No	
Never	6	17	23
Rarely	3	6	9
Sometimes	0	1	1
Often	3	0	3
Always or every day	3	0	3

Total	15	24	39

Other parent interacted in French with the student during the summer	French spoken in the household		Total
	Yes	No	
Never	2	17	19
Rarely	3	0	3
Sometimes	0	1	1
Often	2	0	2
Always or every day	4	0	4
Total	11	18	29

Children in household interact in French with the student	French spoken in the household		Total
	Yes	No	
N/A	4	6	10
Never	1	12	13

Rarely	5	6	11
Sometimes	3	0	3
Often	2	0	2
Always or every day	0	0	0
Total	15	24	39

Children in household interacted in French with the student during the summer	French spoken in the household		Total
	Yes	No	
N/A	3	3	6
Never	0	12	12
Rarely	3	3	6
Sometimes	3	0	3
Often	2	0	2
Always or every day	0	0	0
Total	11	18	29

Children outside the household interact in French with the student	French spoken in the household		Total
	Yes	No	
Never	3	16	19
Rarely	6	7	13
Sometimes	5	0	5
Often	1	0	1
Always or every day	0	1	1
Total	15	24	39

Children outside the household interacted in French with the student during the summer	French spoken in the household		Total
	Yes	No	
Never	3	12	15
Rarely	5	4	9
Sometimes	2	1	3
Often	1	1	2

Always or every day	0	0	0
Total	11	18	29

Adults outside the household interact in French with the student	French spoken in the household		Total
	Yes	No	
Never	2	12	14
Rarely	7	8	15
Sometimes	5	2	7
Often	0	0	0
Always or every day	1	2	3
Total	15	24	39

Adults outside the household interacted in French with the student during the summer	French spoken in the household	Total

	Yes	No	
Never	2	10	12
Rarely	3	6	9
Sometimes	3	1	4
Often	1	1	2
Always or every day	2	0	2
Total	11	18	29

Relatives interact in French with the student	French spoken in the household		Total
	Yes	No	
N/A	5	19	24
Never	1	1	2
Rarely	2	3	5
Sometimes	4	0	4
Often	3	1	4
Always or every day	0	0	0
Total	15	24	39

Relatives interacted in French with the student during the summer	French spoken in the household		Total
	Yes	No	
N/A	3	16	19
Never	0	0	0
Rarely	2	0	2
Sometimes	1	2	3
Often	4	0	4
Always or every day	1	0	1
Total	11	18	29

Other adults in the household besides the parents interact in French with the student	French spoken in the household		Total
	Yes	No	
N/A	15	24	39

Total	15	24	39

Other adults in the household besides the parents interacted in French with the student during the summer	French spoken in the household		Total
	Yes	No	
N/A	10	17	27
Never	0	0	0
Rarely	0	1	1
Sometimes	0	0	0
Often	0	0	0
Always or every day	1	0	1
Total	11	18	29

French output

	French spoken in the household	Total

Student interacts in French with the respondent	Yes	No	
Never	3	11	14
Rarely	4	10	14
Sometimes	4	3	7
Often	2	0	2
Always or every day	2	0	2
Total	15	24	39

Student interacted in French with the respondent during the summer	French spoken in the household		Total
	Yes	No	
Never	1	10	11
Rarely	6	7	13
Sometimes	4	1	5
Often	0	0	0
Always or every day	0	0	0
Total	11	18	29

Student interacts in French with the other parent	French spoken in the household		Total
	Yes	No	
Never	6	15	21
Rarely	4	8	12
Sometimes	0	1	1
Often	3	0	3
Always or every day	2	0	2
Total	15	24	39

Student interacted in French with the other parent during the summer	French spoken in the household		Total
	Yes	No	
Never	4	15	19
Rarely	2	3	5
Sometimes	1	0	1
Often	3	0	3

Always or every day	1	0	1
Total	11	18	29

Student interacts in French with children in the household	French spoken in the household		Total
	Yes	No	
Not applicable	4	6	10
Never	1	12	13
Rarely	3	6	9
Sometimes	5	0	5
Often	2	0	2
Always or every day	0	0	0
Total	15	24	39

Student interacted in French with children in the	French spoken in the household	Total

household over the summer	Yes	No	
Not applicable	3	3	6
Never	0	10	10
Rarely	6	5	11
Sometimes	2	0	2
Always or every day	0	0	0
Total	11	18	29

Student interacts in French with children outside the household	French spoken in the household		Total
	Yes	No	
Never	3	18	21
Rarely	6	5	11
Sometimes	5	0	5
Often	1	0	1
Always or every day	0	1	1
Total	15	24	39

Student interacted in French with children outside the household during the summer	French spoken in the household		Total
	Yes	No	
Never	4	11	15
Rarely	5	5	10
Sometimes	1	1	2
Often	0	1	1
Always or every day	1	0	1
Total	11	18	29

Student interacts in French with adults outside the household	French spoken in the household		Total
	Yes	No	
Never	1	14	15
Rarely	8	5	13
Sometimes	5	3	8

Often	0	0	
Always or every day	1	2	3
Total	15	24	39

Student interacted in French with adults outside the household during the summer	French spoken in the household		Total
	Yes	No	
Never	0	9	9
Rarely	7	6	13
Sometimes	2	2	4
Often	0	1	1
Always or every day	2	0	2
Total	11	18	29

Student interacts in French with relatives	French spoken in the household		Total
	Yes	No	

Not applicable	5	19	24
Never	1	2	3
Rarely	3	3	6
Sometimes	5	0	5
Often	1	0	1
Total	15	24	39

Student interacted in French with relatives during the summer	French spoken in the household		Total
	Yes	No	
Not applicable	3	16	19
Never	0	1	1
Rarely	2	0	2
Sometimes	2	1	3
Often	4	0	4
Always or every day	0	0	0
Total	11	18	29

Student interacts in French with other adults in the household besides the parents	French spoken in the household		Total
	Yes	No	
Not applicable	15	24	39
Total	15	24	39

Student interacted in French with other adults in the household besides the parents during the summer	French spoken in the household		Total
	Yes	No	
Not applicable	10	17	28
Never	0	0	0
Rarely	0	1	1
Sometimes	0	0	0
Often	0	0	0
Always or every day	1	0	1
Total	11	18	29

Student uses French when playing by himself/herself	French spoken in the household		Total
	Yes	No	
Never	2	5	7
Rarely	9	7	16
Sometimes	2	9	11
Often	1	3	4
Always or every day	1	0	1
Total	15	24	39

Student used French when playing by himself/herself during the summer	French spoken in the household		Total
	Yes	No	
Never	0	6	6
Rarely	5	8	13
Sometimes	4	4	8
Often	2	0	2

Always or every day	0	0	0
Total	11	18	29

Print and media exposure

French

Student watches television programs or movies in French	French spoken in the household		Total
	Yes	No	
Never	0	9	9
Rarely	6	10	16
Sometimes	5	3	8
Often	4	2	6
Always or every day	0	0	0
Total	15	24	39

	French spoken in the household	Total

Student watched television programs or movies in French during the summer	Yes	No	
Never	0	9	9
Rarely	3	3	6
Sometimes	5	4	9
Often	3	2	5
Always or every day	0	0	0
Total	11	18	29

Student plays games in French on a computer, a tablet, or a smartphone	French spoken in the household		Total
	Yes	No	
Never	2	8	10
Rarely	9	7	16
Sometimes	3	7	10
Often	1	2	3

Always or every day	0	0	0
Total	15	24	39

Student played games in French on a computer, a tablet, or a smartphone during the summer	French spoken in the household		Total
	Yes	No	
Never	2	7	9
Rarely	5	5	10
Sometimes	2	3	5
Often	2	3	5
Always or every day	0	0	0
Total	11	18	29

Student listens to songs in French	French spoken in the household		Total
	Yes	No	

Never	1	4	5
Rarely	4	8	12
Sometimes	6	7	13
Often	3	3	6
Always or every day	1	2	3
Total	15	24	39

Student listened to songs in French during the summer	French spoken in the household		Total
	Yes	No	
Never	2	6	8
Rarely	3	7	10
Sometimes	5	2	7
Often	1	3	4
Always or every day	0	0	0
Total	11	18	29

	French spoken in the household		Total

Parents read in French to the student	Yes	No	
Never	0	5	5
Rarely	0	10	10
Sometimes	8	7	15
Often	5	1	6
Always or every day	2	1	3
Total	15	24	39

Parents read in French to the student during the summer	French spoken in the household		Total
	Yes	No	
Never	0	8	8
Rarely	2	7	9
Sometimes	5	3	8
Often	3	0	3
Always or every day	1	0	1
Total	11	18	29

Student reads in French	French spoken in the household		Total
	Yes	No	
Never	1	7	8
Rarely	5	12	17
Sometimes	7	2	9
Often	2	1	3
Always or every day	0	2	2
Total	15	24	39

Student read in French during the summer	French spoken in the household		Total
	Yes	No	
Never	3	9	12
Rarely	3	2	5
Sometimes	4	7	11
Often	1	0	1
Always or every day	0	0	0
Total	11	18	29

English

Student watches television programs or movies in English	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	1	0	1
Sometimes	4	2	6
Often	5	4	9
Always or every day	5	18	23
Total	15	24	39

Student watched television programs or movies in English during the summer	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	1	0	1

Sometimes	1	2	3
Often	7	9	16
Always or every day	2	7	9
Total	11	18	29

Student plays games in English on a computer, a tablet, or a smartphone	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	3	0	3
Sometimes	5	4	9
Often	4	8	12
Always or every day	3	12	15
Total	15	24	39

	French spoken in the household	Total

Student played games in English on a computer, a tablet, or a smartphone during the summer	Yes	No	
Never	2	0	2
Rarely	2	2	4
Sometimes	1	4	5
Often	5	9	14
Always or every day	1	3	4
Total	11	18	29

Student listens to songs in English	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	2	2	4
Sometimes	3	1	4
Often	5	3	8
Always or every day	5	18	23

Total	15	24	39

Student listened to songs in English during the summer	French spoken in the household		Total
	Yes	No	
Never	1	0	1
Rarely	1	0	1
Sometimes	2	2	4
Often	1	5	6
Always or every day	6	11	17
Total	11	18	29

Parents read in English to the student	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	1	0	1
Sometimes	3	0	3
Often	7	3	10

Always or every day	4	21	25
Total	15	24	39

Parents read in English to the student during the summer	French spoken in the household		Total
	Yes	No	
Never	0	0	0
Rarely	0	0	0
Sometimes	4	3	7
Often	5	7	12
Always or every day	2	8	10
Total	11	18	29

Student reads in English	French spoken in the household		Total
	Yes	No	
Never	0	1	1
Rarely	4	2	6

Sometimes	4	1	5
Often	5	2	7
Always or every day	2	18	20
Total	15	24	39

Student read in English during the summer	French spoken in the household		Total
	Yes	No	
Never	1	2	3
Rarely	2	2	4
Sometimes	5	3	8
Often	1	6	7
Always or every day	2	5	7
Total	11	18	29

Appendix J – Students' samples from the picture description task

Below are samples from the picture description task from two students who performed the highest among their group (i.e., frspoken=0 and frspoken=1) on the French picture description task during the last wave of data collection. Student 154 (on the left columns in the tables below) is a female Latina student who was in Kindergarten at the beginning of the study. She comes from a household where French is not spoken. Student 207 (on the right columns in the tables below) is a male Caucasian student who was in 1st grade at the beginning of the study. He comes from a household where French is spoken. English translations are provided below each French wave.

French description of the school picture

Student 154	Student 207
Wave 1 *Refused to say anything.*	Wave 1 Lundi, xxx, mercredi, janvier, septembre, mardi. *Researcher: Anything else?* xxx, garçon, xxx. *Monday, xxx, Wednesday, January, September, Tuesday.* *Researcher: Anything else?* *xxx, boy, xxx.*
Wave 2 Bleu, vert, orange, rouge, vert, blanc, rouge. *Blue, green, orange, red, green, white, red.*	Wave 2 Des enfants, une camion, des voitures, une sac, une maîtresse, le date, les jours de la semaine, une chat, mmm, une fenêtre, des lettres, beaucoup de couleurs. *Children, a truck, cars, a bag, a teacher, the date, the days of the week, a cat, mmm, a window, letters, lots of colors.*

Wave 3
Garçon. *(Long pause)*

Researcher: How about the colors?

Rouge, rose, blanc, jaune, bleu, vert, jaune, rouge, et blanc.

Boy. (Long pause)

Researcher: How about the colors?

Red, pink, white, yellow, blue, green, yellow, red and white.

Wave 3
Une, une sac, des, des enfants. Neuf ,dix, onze, douze enfants. Une fenêtre, une arbre dedans le fenêtre. Les petits enfants assis sur le ... *Qu'est que c'est ça?*

Researcher: Tapis?

Assis sur le tapis. *Hein?* Une calendrier, une camion, des voitures, des euh ... *Qu'est que c'est ça?*

Researcher: Cube.

Des cubes, um des chaussures. Euh et sur le tapis il y a une main. Et, et les petits enfants a, a, a ... *Qu'est que c'est ça encore?*

Researcher: Les doitgs?

Il a tracé les, son main et ses deux mains. Et il la met sur le mur. Et un de les enfants est debout. Et il tourne une, une ... *Qu'est que c'est ça?*

Researcher: Parapluie?

Une parapluie.

A, a bag, children. Nine, ten, eleven, twelve children. A window, a tree inside the window. Little children sitting on the ... What's that?

Researcher: Carpet?

Sitting on the carpet. Huh? A calendar, a truck, cars, uh ... What's that?

Researcher: Block.

Cubes, um shoes. Uh and on the carpet there is a hand. And, and the little children has, a, a ... What's that again?

Researcher: The fingers?

He traced the, his hand and both his hands. And he puts it on the wall. And one of the children is standing up. And he turns a, a ... What's that?

Researcher: Umbrella?

An umbrella.

Wave 4
Un garçon. *I'm going to tell you the colors.*

Researcher: Can you speak a little louder?

I wanted to say the colors. Jaune, rouge, bleu, orange, rouge, bleu, vert, violette, rose, blanc, blanc, rouge, orange.

A boy. I'm going to tell you the colors.

Researcher: Can you speak a little louder?

I wanted to say the colors. Yellow, red, blue, orange, red, blue, green, violet, pink, white, white, red, orange.

Wave 4
Il a… C'est comme tu regardes dedans une ordinateur. Et tu es comme ... L'ordinateur c'est là. Et en suite toi tu es là. Et c'est un petit peu noir. Et ça c'est comment le photo est. Et il a une ... Et il a des petits enfants. Et, et il a des, et il a um, et il a, et il a une, des ... Et il a une sac et dedans le ... Et le sac c'est um, à côté de une petit enfant avec um, avec une, avec une, avec une ... *Qu'est ce que c'est ca?*

Researcher: Parapluie.

Avec une parapluie et les petits enfants regardent. Et le maîtresse dit, et qu'est ce que c'est avec une parapluie. Et, et, et il a le calendrier. Et aussi um, il a des jouets que tu peux um, jouer avec. Um, et il a une fenêtre à le um um …À côté de cet jouet que tu peux joue de um, des qui tu peux ... C'est comme une cuisine jouet qui tu peux jouer avec.

He has ... It's like you're looking inside a computer. And you're like ... The computer it's there. And then you are there. And it's a little bit black. And that's how the photo is. And he has a ... And he has little children. And, and he has, and he has um, and he has, and he has a, some ... And he has a bag and inside the ... And the bag it's um, next to a little kid with um, with a, with a, with a ... What is this?

Researcher: Umbrella.

With an umbrella and the little children are watching. And the teacher says, and what is it with an umbrella. And, and, and he has the calendar. And also um, he has toys that you can um play with. Um, and he has a window at the um um ... Next to this toy you can play ofum, those who you can ... It's like a toy kitchen whom you can play with.

Wave 5
Ça c'est un … Quatre garçons et cinq filles. Et un garçon debout de parle. Et la maîtresse reste um, parce que le garçon il parle.

That is a ... Four boys and five girls. And a boy standing up speaks. And the teacher stays um, because the boy he is talking.

Wave 5
Maîtresse, garçon, parapluie, enfants, tapis. Um, tiroir, camion, beaucoup de jouets. Um, fenêtre, une fenêtre. A, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y et z. Ça c'est comme le tapis. Um, um, il y a aussi une sac. Um, y a des tir-, il y a plus de tiroirs que un. Et ça c'est bien. *I mean,* il a une triangle, une carré, une étoile, une ... Et il a des mains. Il a des mains par le ... Il a une main xx.

Teacher, *boy, umbrella, children, carpet. Um, drawer, truck, a lot of toys. Um, window, a window. A, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y and z. That is like the carpet. Um, um, there is also a bag. Um, there are dra-, there are more drawers than one. And that's good. I mean, he has a triangle, a square, a star, a ... And he has hands. He has hands by the ... He has a hand xx.*

French description of the home picture

Student 154

Wave 1
Refused to say anything.

Student 207

Wave 1
Garçon, rouge, gris, marron.

Researcher: anything else?

Noir et blanc.

Boy, red, grey, brown.

Researcher: anything else?

Black and white.

Wave 2 Rouge, vert, violet, bleu, rose, blanc. *Red, green, purple, blue, pink, white.*	Wave 2 De l'eau, du savon, mmm, une télé, des livres, une chaise, des tiroirs, une, des bols, des cuillères. *Water, soap, mmm, a TV, books, a chair, drawers, a, bowls, spoons.*
Wave 3 Orange, rouge, jaune, bleu, vert, jaune, et bleu. *Orange, red, yellow, blue, green, yellow, and blue.*	Wave 3 Du l'eau, une, une verre, une chaise, une petite télé, le bur- bureau, le lavabo. De savon, des cuillères, des fourchettes. Euh une, des verres, des tiroirs. Euh et une petit garçon qui, qui um, qui a le savon dedans ses mains. *Water, a, a glass, a chair, a small TV, the d-desk, the sink. Some soap, spoons, forks. Uh a, glasses, drawers. Uh and a little boy who, who um, who has the soap inside his hands.*

Wave 4
Rouge, blanc, vert, rouge, bleu, vert.

Researcher: Can you say that again?

Rouge, blanc, vert, noir, um violette, bleu, jaune, rouge, um blanc.

Red, white, green, red, blue, green.

Researcher: Can you say that again?

Red, white, green, black, um violet, blue, yellow, red, um white.

Wave 4
Il est, il est dedans le cuisine. Le petit garçon est dedans le cuisine. Et il fait le vaisselle. Et, et, et le vaisselle ... Et il met du savon sur ... Et il met du savon um ... Et il met du savon pour faire le vaisselle. Et il a cette chose qui, qui um, qui tu peux mettre les um, les, les verres et des, des assiettes sur um, quand, quand, quand il met pour chercher ...

Researcher: Attend, attend.

Et, et, et qui tu peux mettre les bols et les assiettes sur ... Et, et, et il a comme, c'est une bureau avec une télévision et cette chaise. Et il a une petite chose pour um, pour mettre les couteaux. Et c'est comme, comme, comme une peinture. C'est comme une peinture.

He is, he is inside the kitchen. The little boy is inside the kitchen. And he's doing the dishes. And, and, and the dishes ... And he puts soap on ... And he puts soap um ... And he puts soap to do the dishes. And he has this thing that, that um, who can you put the um, the, the glasses and the, the plates on um, when, when, when he puts to look for ...

Researcher: Wait, wait.

And, and, and who can you put the bowls and plates on ... And, and, and he has like, it's a desk with a television and this chair. And he has a little thing to um, to put the knives. And it's like, like, like a painting. It's like a painting.

Wave 5
Le garçon uh lave le uh bol. Et du lave le *spoon* et le main. Et le garçon après lave le le *cup*.

The boy uh washes the uh bowl. And some wash the spoon and the hand. And the boy after washes the the cup.

Wave 5
Um l'eau, lavabo, savon. Um garçon, chaise, télévision. Um verre et cuillère. Um c'est comme … C'est comme une peinture. Il regarde comme une peinture. Um tiroir, beaucoup de tiroirs. Um des verres. Il y a aussi une bureau. Il a ... Il y a une chose qui tient les verres et tout qui um, qui est, qui commence à être sec.

Um water, sink, soap. Um boy, chair, television. Um glass and spoon. Um it's like ... It's like a painting. He looks at like a painting. Um drawer, lots of drawers. Um glasses. There is also an office. He has ... There is a thing that holds the glasses and all that um, that is, that starts to be dry.

English description of the home picture

Student 154

Wave 1
Uh it's … He's drinking. He's putting water on something. And he's, and, and … No, he's gonna wash the dishes. And the sink is turning on so he knows when he's ready. And, and he, he's gonna ... He has a, the towel for, to dry all the mess. And, and, and he has, has the sink for not the water to drop on the floor only to, to, to dr-, dro-, drop on the sink so it, so everything will not get wet, so he will not slip.

Student 207

Wave 1
Two bowls, three bowls, a cooking spoon, soap, a sponge, water, oh, a chair, a tv, a desk, salt, pepper, forks and spoons, little cups and medium cups and big cups, bottles, a bottle of soap.

Researcher: Anything else?

And drawers.

Researcher: Anything else?

It was eight drawers.

Wave 2 The mom sent him to do the dishes. And, and the mom sent him to do the dishes. And he's doing the dishes because the mom wants the dishes clean. Because it's almost um um ... Because she needs to cook something with the pots and the spoon	Wave 2 Water, soap, a chair, a tv, a sink, a little boy washing the dishes, a cup. The whole thing is made out of squiggly lines. A towel, a bowl, more cups, a can, forks, towels, more books, cupboards. *Researcher: Anything else?* Mmm, what is that? Handles.
Wave 3 There's a guy washing the dishes. And he wants to keep the house clean because he doesn't want his mom to be mad for him, telling him to clean the whole dishes. Because he, he's gonna clean everything out. 'cause he doesn't want his mom to tell him to clean up when, when the mom comes.	Wave 3 I see bowls. I see some water coming from the dishes, a little boy who's, um, doing the dishes. And I, I see a little office place under the chair, a tv. There's stuff on it. And there is, um, some spoons, some knives on a little tray where you put the knife and also the spoons. There's lots of, um, um, uhh, little drawers. And there is ... The boy is holding soap in its hand to um wash with it. And wait, there's um a little basket where um all the dishes the boy washed, and he put them inside that place. And there's little hangers on the basket so cups could hang on it. And there's a glass that is dirty for the boy to wash too. And there's little jars of salt and pepper. Three jars: one with salt, one with pepper and one of, uhm, parmesan. And one's really big. One is medium. One is small. And a, and the boy's holding a sponge and har-, uh, and a jar with soap to pour it on the sponge. And then he could wash the dishes with it while the water's still running with little, a little bit of it coming out.

Wave 4 There's a boy washing his dishes because his um, the, his mom tell him to wash the dishes. And because he wants, the mom wants the dishes clean.	Wave 4 It looks kind of like it's a drawing because ... Drawing that, um, like, a teenager drew but he's not so so good at drawing. Because it looks kind of like, like, the hair looks, like, all sticked together. It looks like it's all sticked together, kind of. And it looks kind of like, there's a painting too. Yeah, it looks like there's a, it's a painting at, looks kind of like it's a painting and there's, like, forks. And, and there's, like, the little boy putting soap on the sponge. And the water's runing. And he's doing the dishes. And there's, like, that little office back there and with a chair and a tv. And, and there's, like, some pepper. There's a thing with knives and there's water coming out of the sink that he's using. There's, like, this dish holder that holds all the um, that holds all the um, cups and stuff that are all set to dry.
Wave 5 There's a mom that tells the little kid to, to get, to wash the dishes. And he grabbed soap and put it on a sponge so he don't have to do it with his hands, so he can clean the spoons when they eat.	Wave 5 There is a sink with water coming down and some soap with a boy. And there's bowls, a cup, a big spoon. And there's like this holder that holds a, the, like, all the spoons, the cups, and all that. You can put them inside there. And then there's like ... And behind it, behind the boy there's like, a little place where, where you can put things on it. It's kind of like a table but it's not. So ... And there's a drawer on it that can open and close like a door. And then next to right after that is um, is a desk where there's a chair and a tv there. And there's all this work stuff. And it looks kind of reddish. Right next to that there's all the stuff for the, to make food and all that. And there's a bunch, and a bunch of drawers. Right there this is, like, salt and pepper drawers, all that, like, these cups with salt and pepper in it .

English description of the school picture

Student 154	Student 207
Wave 1 There, there is a teacher talking to the kids. And there's a student with, holding an umbrella. And the teacher is talking to him. And the, the kids are looking at him so they know they have attention on him. And, and she, um um, is, is, is sitting over here so she can has a little space and to look at hi-, to look at the boy. And, and she's looking, looking at him so, so she knows that, that, that, that she, that she is talk-, that she is, he is talking.	Wave 1 A truck, little kids, a umbrella, a teacher, a rectangle, a s-, a square, a star, a diamond, a truck, toy truck, car, toy cars, a d, a g, a l, a carpet, a window, a date. It's a classroom. *Researcher: Anything else?* Uh, blocks, more blocks, boxes to put toys, a bag, the days of the week, shapes. *Researcher: Anything else?* A face, and, and, and little kids sitting on a carpet, and a teacher sitting on a chair.
Wave 2 I think that the kids went to go play. And the teacher said that playtime is over. And then the kids must sit on the rug. And someone raised their hand. And the teacher called him. And, and, and, and, and, and, and … *Researcher: Can you speak louder please?* And he wants him to, and the, and the teacher wants him to stand up and talk to all the children that's sitting on the rug.	Wave 2 A toy truck, toy cars, a bag, a umbrella, a boy holding the umbrella, shapes, and the sign thing shapes, the date, children sitting on a abc carpet, blocks. And there a cat on the carpet too, and a moon too, and three dots, the days of the week. *Researcher: Anything else?* Mmm, yeah. Carts, a window, a heater.

Wave 3
The teacher's teaching. And the teacher's teaching. And the guy, the guy, the guy raise, raised, raises hand. And the teacher told him to came up. And he wanted to say a question. And… And he's holding a umbrella because, because, um, outside was, was stormy.

Wave 3
Here's the second picture. On the second picture there's um, thirteen people wi-, inside the classroom. One boy's standing up. And the teacher's sitting down on a on her chair. And the rest of the kids are on the carpet with a b c d e f g h i j k l m n o p q r s t u v w x y and z letters on it. And the next one there's, like, a shelf where the kids play. There's this um truck. There's blocks. There's cars. And there i- … In the background there is um, uh, another toy for the teacher. And, and um, and those are the little back skits on the drawer. and there's um … And the kids who's standing up, there's a grocery bag at his feet. And, and he's holding a umbrella. And there is the days of the weeks: Sunday, Monday, Tuesday, Wednesday, day of the week, day of the week. There's Sunday. And there's Monday . There's Tuesday. And there's Wednesday. There's Thursday. And there's Friday. And then comes Saturday. There's, um, those, um, days of the week on a little chart. And there's shapes: a rectangle, a triangle, a square, a diamond, a star, a oval, and other shapes. And there is, like, this heater.

Wave 4 Kids, alphabet carpet, blocks and drawers. And folders in the back, shapes. Teacher and kids. A kid with an umbrella for show and tell. And a palm tree bag, and palm tree basket.	Wave 4 There is, like, this carpet with kids at school sitting on it. And there's a teachers talking to this boy with a umbrella. And you know how on a computer there's, like, the screen when you're like a little far away. It looks, like, blackish. Well, the, the picture's kind of like that. And there's, like, this um board. And there's um a heater. And there's, like, these blocks that you can play with and a shelf. And on top of the shelf there's, like, these cars next to the carpet with the boy and umbrella. And next to the boy and the umbrella there's, like, this grocery bag. And there's, like, a window at the back. And there's, like, this cooking shelf game. And there's, like, all these drawes. And the ... There's, like, their handprints on the top of the board. And there's the days of the week. And, and it's, like, on a computer when you're, like, far away .
Wave 5 There's little kids. Their mom brought them to school so they can learn and do their homework so when they get bigger they get to know everything like big people. And then the other little boy wanted to say something so he said something.	Wave 5 There's a boy with umbrella talking to the teacher. And there's a mat that has the a b c d e f g song on it with all the alphabets. And there's a bunch of kids sitting on it. And then there's this board. And there's, and there's shapes with shapes on the bottom of the same things shapes. And there's Sunday, Monday, Tuesday, Wednesday going down the line. And then right next to those there is this tablet marking the calendar. And then right next to that there's all these toys. Right there is a window pretend kitchen stuff. There's a bunch of cars, toy cars. And there's a bunch of drawers there to put things in it.

Appendix K – Longitudinal models

Note. For some of the predictors, Stata returned an error message indicating that the standard-error calculation had failed. In such cases, the random slope was dropped from the model.
Note. *= $p < .05$, ** = $p < .01$, ***= $p < .001$. Standard Deviations appear in parentheses.

ÉVIP for `frspoken=1`

	age	collegedegree	engliteracy	ethnicity	frliteracy	frexposure	gender	grade	income
Fixed effects – Initial status (π_{0i})									
Intercept	31.51***	23.63*	29.36***	31.58***	29.35***	54.61***	24.5***	17.53**	29.47***
	(5.46)	(10.02)	(5.3)	(8.05)	(5.01)	(11.77)	(7.31)	(5.81)	(5.9)
age	2.79 *ns*								
	(4.81)								
collegedegree		8.64 *ns*							
		(12.27)							
engliteracy			-.77 *ns*						
			(.41)						
engonly									

ethnicity – Black				37.34 *ns* (22.78)					
ethnicity – Other				-10.23 *ns* (11.4)					
frliteracy					1.01* (.43)				
frexposure						1.66* (.69)			
gender							12.06 *ns* (11.54)		
grade – 1st								29.69*** (9.15)	
income									-.98 *ns* (3.52)
Fixed effects – Rate of change (π_{1i})									
Intercept	.25 *ns* (.72)	2.38 *ns* (.75)	1.52*** (.45)	1.41* (.64)	1.53*** (.44)	1.66 *ns* (.99)	1.23* (.57)	1.04 *ns* (.57)	1.57*** (.43)
age	1.24 *ns* (.76)								
collegedegree		-1.3 *ns* (.93)							

engliteracy			.01 *ns* (.03)						
engonly									
ethnicity – Black				.1 *ns* (1.89)					
ethnicity – Other				.26 *ns* (.91)					
frliteracy					.02 *ns* (.04)				
frexposure						.01 *ns* (.06)			
gender							.77 *ns* (.9)		
grade – 1st								1.2 *ns* (.88)	
income									-.47 (.26)
Variance components									
Level 1 – Residual	166.71 (31.32)	160.27 (29.26)	164.77	167.86 (30.65)	166.14 (30.33)	168.06 (30.68)	165.15 (30.15)	162.68 (29.7)	159.97 (30.76)

Level 2 - Intercept	337.78 (181.18)	411.21 (181.05)	327.97	359.6 (143.7)	281.97 (134.6)	321.51 (129.82)	386.21 (172.57)	209.95 (106.56)	428.31 (173.76)
monthselapsed	.01 (.13)	.16 (.36)	.2		.1 (.28)		.06 (.22)	.01 (.11)	.04 (.06)
Covariance	2.3 (9.07)	8.18 (8.6)	8.06		5.23 (7.11)		4.81 (8.44)	-1.81 (6.68)	3.93 (3.32)
-2LL	633.56	635.52	634.62	633.98	632.32	632.53	635.55	623.81	634.25
AIC	649.56	651.52	642.62	649.98	648.32	644.53	651.55	639.81	620.25
BIC	668.1	670.06	651.89	668.52	666.86	658.43	670.09	658.35	668.79

Number of different French words for ***frspoken=1***

	age	college degree	englite racy	ethnici ty	frliter acy	frexpos ure	gender	grad e	income
Fixed effects – Initial status (π_{0i})									
Intercept	18.45*** (3)	18.2*** (5.45)	17.91*** (3.04)	21.74*** (4.39)	17.9*** (3.13)	37.12*** (4.29)	14.32*** (3.8)	14.42*** (3.81)	18.15*** (3.05)

age	1.97 *ns* (2.64)						
college degree		-.43 *ns* (6.67)					
englite racy			-.24 *ns* (.24)				
engonly							
ethnici ty– Black				-5.63 *ns* (12.41)			
ethnici ty– Other				-7.44 *ns* (6.21)			
frliter acy					.09 *ns* (.04)		
frexpos ure						1.27*** (.25)	
gender							8.9 *ns* (6.01)
grade – 1st							

								(6.01)	
income									-1.88 *ns* (1.82)
Fixed effects – Rate of change (π_{1i})									
Intercept	.26 *ns* (.53)	.71 *ns* (.73)	.59 *ns* (.42)	.37 *ns* (.62)	.59 *ns* (.42)	.63 *ns* (.88)	1.25** (.48)	.1 *ns* (.51)	.63 *ns* (.41)
age	.19 *ns* (.51)								
college degree		-.18 *ns* (.9)							
englite racy			.02 *ns* (.03)						
engonly									
ethnici ty– Black				.01 *ns* (1.76)					
ethnici ty– Other				.47 *ns* (.87)					

frliteracy					.01 *ns* (.04)				
frexposure						-.08 *ns* (.05)			
gender							-1.63* (.76)		
grade – 1st								1.24 *ns* (.81)	
income									-.27 *ns* (.25)
Variance components									
Level 1 – Residual	34.18 (7.39)	33.19 (6.99)	33.2 (7)	33.2 (7)	33.18 (6.99)	33.34 (7.06)	33.13 (6.97)	33.18 (6.99)	33.18 (6.99)
Level 2 - Intercept	111.25 (50.95)	129.49 (54.33)	119.86 (50.81)	116 (49.56)	128.58 (54.01)	36.5 (20.56)	111.3 (47.59)	111.22 (47.63)	119.63 (50.69)
monthselapsed	2 (.99)	2.15 (.99)	2.1 (.98)	2.1 (.98)	2.14 (.99)	1.74 (.85)	1.52 (.76)	1.78 (.86)	1.95 (.92)

Covariance	.6 (4.83)	.61 (5.24)	1.31 (5.03)	1.44 (4.95)	.51 (5.23)	6.67 (3.16)	4.05 (4.3)	-1.99 (4.71)	-.81 (4.94)
-2LL	543.89	545.25	544.1	543.69	545.11	526.43	539.31	540.19	542.7
AIC	559.89	561.25	560.1	563.69	561.11	542.43	555.31	556.19	558.7
BIC	578.43	579.79	578.64	586.86	579.65	560.97	573.85	574.73	577.24

ÉVIP for `frspoken=0`

	age	collegedegree	englitera cy	engonly	ethnicity	frlitera cy	frexposure	gender	grade	income
Fixed effects – Initial status (π_{0i})										
Intercept	4.96*** (.89)	3.82 *ns* (2.08)	5.32*** (1.27)	4.65*** (1.31)	6.02*** (1.19)	5.4*** (.85)	5.33*** (1.27)	4.81*** (1.24)	4.59*** (1.21)	5.4*** (.85)
age	2.09* (1.04)									
collegedegree		1.9 *ns* (2.27)								

engliteracy	.02 *ns* (.13)				
engonly		1.29 *ns* (1.71)			
ethnicity–Hispanic			-2.2 *ns* (2.65)		
ethnicity–Black			2.32 *ns* (4.37)		
ethnicity–Asian			-1.48 *ns* (2.67)		
ethnicity–Other			-1.15 *ns* (2.18)		
frliteracy				-.06 *ns* (.06)	
frexposure					-.04 *ns* (.13)
gender					1.11 *ns* (1.69)

grade – TK									-2.74 *ns* (3.02)	
grade – 1st									2.3 *ns* (1.69)	
income										.23 *ns* (.66)
Fixed effects – Rate of change (π_{1i})										
Intercept	.55 *ns* (.28)	.65 *ns* (.49)	.46** (.15)	.45 *ns* (.31)	.34 *ns* (.28)	.44* (.19)	.45** (.15)	.47 *ns* (.29)	.16 *ns* (.28)	.44* (.2)
age	-.31 *ns* (.24)									
collegedegree		-.26 *ns* (.53)								
engliteracy			-.03* (.02)							
engonly				-.03 *ns* (.4)						

ethnicity–Hispanic	.52 *ns* (.62)					
ethnicity–Black	.05 *ns* (1.01)					
ethnicity–Asian	-.21 *ns* (.63)					
ethnicity–Other	.27 *ns* (.51)					
frliteracy		.02 *ns* (.01)				
frexposure			.03* (.02)			
gender				-.06 *ns* (.4)		
grade – TK					.21 *ns* (.72)	
grade – 1st					.56 *ns* (.4)	
income						-.008 *ns*

										(.16)
Variance components										
Level 1 – Residual	24.64 (3.6)	25.35 (3.66)	32.55 (4.7)	25.45 (3.67)	25.15 (3.63)	24.94 (3.6)	32.57 (4.7)	25.46 (3.67)	25.16 (3.63)	25.53 (3.68)
Level 2 - Intercept	1.04 (1.69)	2.18 (2.41)	19.32 (7.51)	2.08 (2.36)	2.12 (2.37)	2.74 (2.7)	19.6 (7.6)	2.12 (2.39)	.9 (1.52)	2.19 (2.44)
monthselapsed	.61 (.29)	.51 (.24)		.51 (.24)	.49 (.23)	.45 (.22)		.51 (.24)	.44 (.22)	.51 (.24)
Covariance	-.8 (.58)	1.05 (.52)		1.03 (.52)	1.02 (.5)	1.11 (.49)		1.04 (.53)	.63 (.47)	1.05 (.52)
-2LL	771.61	774.49	791.57	774.67	772.85	772.24	791.89	774.83	767.86	775.14
AIC	787.61	790.49	803.57	790.67	800.85	788.24	803.89	790.83	787.86	791.14
BIC	809.9	812.79	820.29	812.97	839.87	810.54	820.62	813.13	815.73	813.44

Number of different French words for ***frspoken=0***

	age	collegedegree	englitera cy	engonly	ethnicity	frlitera cy	frexposure	gender	grade	income
Fixed effects – Initial status (π_{0i})										
Intercept	5.68*** (1.01)	2.98 *ns* (2.71)	6.21*** (1.13)	4.81** (1.72)	7.05*** (1.48)	6.2*** (1.08)	6.2*** (1.1)	9.37*** (1.45)	4.89** (1.56)	6.19*** (1.11)
age	3.63** (1.26)									
collegedegree		3.85 *ns* (2.97)								
engliteracy			.01 *ns* (.12)							
engonly				2.38 *ns* (2.24)						
ethnicity–Hispanic					-4.51 *ns* (3.31)					

ethnicity–Black	-3.53 *ns* (5.43)					
ethnicity–Asian	-4.24 *ns* (3.33)					
ethnicity–Other	1.86 *ns* (2.73)					
frliteracy		-.12 *ns* (.08)				
frexposure			-.14 *ns* (.11)			
gender				-5.86** (1.98)		
grade – TK					-3.08 *ns* (3.9)	
grade – 1st					3.4 *ns* (2.18)	
income						.89 *ns* (.87)

Fixed effects – Rate of change (π_{1i})

Intercept	.7***	1.54***	.64***	.74**	.5*	.64***	.64***	.2 *ns*	.77**	.65***
	(.22)	(.41)	(.18)	(.27)	(.23)	(.17)	(.17)	(.23)	(.26)	(.17)
age	-.4 *ns*									
	(.22)									
collegedegree		-1.07*								
		(.45)								
engliteracy			.01 *ns*							
			(.02)							
engonly				-.17 *ns*						
				(.36)						
ethnicity–Hispanic					1.43**					
					(.51)					
ethnicity–Black					.85 *ns*					
					(.83)					
ethnicity–Asian					.27 *ns*					
					(.52)					
ethnicity–Other					-.49 *ns*					
					(.42)					

frliteracy						.02* (.01)				
frexposure							.03 *ns* (.02)			
gender								.81* (.32)		
grade – TK									.09 *ns* (.64)	
grade – 1st									-.3 *ns* (.36)	
income										-.24 *ns* (.13)
Variance components										
Level 1 – Residual	37.02 (4.78)	34.02 (4.9)	35.7 (5.13)	36.24 (5.21)	31.04 (4.46)	35.29 (5.08)	35.3 (5.08)	35.66 (5.13)	35.87 (5.15)	35.13 (5.05)
Level 2 - Intercept	1.66e -15 (1.46e -14)	9.12 (8.28)	9.61 (9.02)	7.94 (8.68)	8.09 (7.41)	7.41 (8)	8.35 (8.37)	2.34 (5.89)	4.97 (7.96)	8.83 (8.52)

monthselapsed		.08 (.13)	.13 (.18)	.11 (.18)	.08 (.11)	.06 (.12)	.08 (.13)	.01 (.06)	.09 (.18)	.09 (.14)
Covariance		-.87 (1.01)	-1.1 (1.22)	-.92 (1.2)	-.8 (.87)	-.67 (.98)	-.81 (1.06)	-.15 (.65)	-.67 (1.15)	-.88 (1.08)
-2LL	773.92	774.16	779.06	779.3	762.75	776.97	777.53	773.25	775.21	777.26
AIC	785.92	790.16	795.06	795.3	790.75	792.97	793.53	789.25	795.21	793.26
BIC	802.65	812.46	817.36	817.6	829.77	815.27	815.83	811.55	823.09	815.56

PPVT

	age	collegedegree	englitera cy	engon ly	ethnici ty	frlitera cy	frexposu re	gende r	grade	incom e
Fixed effects – Initial status (π_{0i})										
Intercept	151.64***	143.09*** (4.5)	151.3*** (2.26)	149.6** *	154.73*** (3.07)	158.22*** (3.61)	153.31*** (3.11)	150.06***	146.56***	151.21***

	(2.26)			(2.81)			(3.16)	(2.82)	(2.25)
age	.85 *ns*							
	(1.38)							
collegedegree		10.66*						
		(5.13)						
engliteracy			.56 *ns*					
			(.66)					
engonly				4.73 *ns*				
				(4.69)				
ethnicity–Hispanic					-2.81 *ns*			
					(8.33)			
ethnicity–Black					3.93 *ns*			
					(9.96)			
ethnicity–Asian					-15.35 *ns*			
					(8.32)			
ethnicity–Other					-7.28 *ns*			
					(4.94)			

frliteracy						-1.38* (.58)				
frexposure							-.25 *ns* (.27)			
gender								2.54 *ns* (4.54)		
grade – TK									-8.78 *ns* (9.36)	
grade – 1st									11.92** (4.16)	
income										1.58 *ns* (1.56)
Fixed effects – Rate of change (π_{1i})										
Intercept	.99*** (.17)	1.6*** (.23)	1.25*** (.11)	1.33*** (.14)	1.1*** (.15)	1.13*** (.19)	1.17*** (.15)	1.33*** (.15)	1.24*** (.16)	1.26*** (.11)
age	.2 *ns* (.16)									
collegedegree		-.46 *ns* (.26)								

engliteracy	-.02 *ns* (.03)					
engonly		-.21 *ns* (.23)				
ethnicity–Hispanic			-.05 *ns* (.43)			
ethnicity–Black			-.28 *ns* (.52)			
ethnicity–Asian			.53 *ns* (.42)			
ethnicity–Other			.43 *ns* (.25)			
frliteracy				.02 *ns* (.03)		
frexposure					.01 *ns* (.01)	
gender						-.16 *ns* (.22)
grade – TK						

									(.52)	
grade – 1st									-.004 *ns* (.23)	
income										-.17* (.08)
Variance components										
Level 1 – Residual	25.54 (3.8)	25.26 (2.86)	25.5 (2.89)	25.45 (2.88)	25.02 (2.83)	25.52 (2.89)	25.48 (2.88)	25.46 (2.88)	25.3 (2.86)	24.77 (2.8)
Level 2 - Intercept	183.24 (38.43)	167.57 (41.24)	184.06 (44.98)	182.61 (44.65)	164.94 (40.58)	162.13 (40.04)	183.13 (44.78)	185.88 (45.41)	144.88 (36.13)	183.52 (44.76)
monthselapsed	.1 (.08)	.03 (.04)	.05 (.05)	.05 (.05)	.03 (.04)	.04 (.05)	.05 (.05)	.05 (.05)	.07 (.06)	.04 (.04)
Covariance	-4.25 (1.75)	-2.29 (1.58)	-3 (1.72)	-2.91 (1.7)	-2.23 (1.55)	-2.68 (1.62)	-2.94 (1.71)	-3.01 (1.73)	-3.11 (1.61)	-2.73 (1.67)
-2LL	1317.55	1315.96	1320.02	1319.56	1313.85	1315.29	1319.78	1320.19	1307.9	1315.86
AIC	1333.55	1331.96	1336.02	1335.56	1341.85	1331.3	1335.78	1336.19	1327.9	1331.86

BIC	1359.73	1358.14	1362.2	1361.74	1387.68	1357.48	1361.96	1362.38	1360.63	1358.05

Number of different English words

	age	collegedegree	engliteracy	engonly	ethnicity	frliteracy	frexposure	gender	grade	income
Fixed effects – Initial status (π_{0i})										
Intercept	38.29*** (3.1)	42.39*** (6.39)	38.01*** (3.09)	40.86*** (3.79)	37.18*** (4.08)	41.22*** (5.21)	37.62*** (4.26)	39.83*** (4.3)	36.25*** (4.31)	38.15*** (3.03)
age	2.34 *ns* (3.11)									
collegedegree		-5.72 *ns* (7.29)								
engliteracy			-.19 *ns* (.9)							

engonly	-7.99 *ns* (6.33)					
ethnicity–Hispanic		-2.86 *ns* (11.12)				
ethnicity–Black		-7.51 *ns* (13.28)				
ethnicity–Asian		-18.81 *ns* (11.04)				
ethnicity–Other		9.36 *ns* (6.56)				
frliteracy			-.64 *ns* (.84)			
frexposure				.05 *ns* (.37)		
gender					3.79 *ns* (6.17)	
grade – TK						2.92 *ns* (14.26)

grade – 1st									3.74 *ns* (6.34)	
income										-2.77 *ns* (2.09)
Fixed effects – Rate of change (π_{1i})										
Intercept	-.39 *ns* (.44)	-.86 *ns* (.61)	-.07 *ns* (.3)	-.24 *ns* (.37)	.4 *ns* (.4)	-.65 *ns* (.5)	-.33 *ns* (.41)	-.31 *ns* (.41)	-.45 *ns* (.41)	-.07 *ns* (.3)
age	.13 *ns* (.44)									
collegedegree		1.03 *ns* (.69)								
engliteracy			.04 *ns* (.09)							
engonly				.48 *ns* (.62)						
ethnicity–Hispanic					-.36 *ns* (1.12)					

ethnicity–Black	-.24 *ns*					
	(1.35)					
ethnicity–Asian	.1 *ns*					
	(1.1)					
ethnicity–Other	-1.42*					
	(.65)					
frliteracy		.12				
		(.08)				
frexposure			.03 *ns*			
			(.03)			
gender				.52 *ns*		
				(.6)		
grade – TK					-.39 *ns*	
					(1.34)	
grade – 1st					.91 *ns*	
					(.6)	
income						.12 *ns*
						(.21)

Variance components

Level 1 – Residual	165.36 (21.59)	164.5 (21.4)	164.49 (21.4)	164.65 (21.44)	164.52 (21.4)	164.78 (21.47)	164.72 (21.46)	164.47 (21.39)	164.62 (21.44)	164.62 (21.43)
Level 2 - Intercept	267.11 (83.61)	273.44 (84.14)	278.61 (85.36)	263.99 (82.12)	222.08 (72.69)	272.88 (84.15)	277.99 (85.28)	275.85 (84.69)	274.87 (84.63)	262.42 (81.83)
monthselapsed	.68 (.87)	.5 (.82)	.67 (.86)	.62 (.85)	.27 (.78)	.49 (.83)	.6 (.85)	.63 (.85)	.46 (.82)	.65 (.86)
Covariance	-4.28 (6.65)	-2.99 (6.42)	-3.92 (6.64)	-3.07 (6.48)	-.36 (5.72)	-2.95 (6.43)	-4.05 (6.62)	-3.59 (6.56)	-4.73 (6.55)	-3.28 (6.51)
-2LL	1640.36	1639.52	1641.43	1640.1	1632.24	1639.66	1640.42	1640.9	1636.7	1639.99
AIC	1656.36	1655.52	1657.44	1656.1	1660.24	1655.66	1656.42	1656.9	1656.7	1655.99
BIC	1682.54	1681.71	1683.62	1682.28	1706.06	1681.84	1682.6	1683.09	1689.43	1682.17

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