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Home Literacy Environment and Chinese-Canadian First Graders' Bilingual Vocabulary Profiles: A Mixed Methods Analysis

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Abstract: Bilingual children in the North American context significantly improve in English language proficiency, but their heritage language learning varies between different linguistic groups. This mixed methods study was designed to explore the developmental patterns in bilingual vocabulary among Chinese-Canadian first-graders' (N = 75) and to identify home factors that may have contributed to divergent bilingual developmental trajectories. Cluster analyses were conducted to identify underlying discrepancy profiles in bilingual oral lexicon. Four children with contrasting bilingual profiles were selected for qualitative analysis to explore home factors that may have contributed to the discrepancies. Thematic analyses of parental interviews revealed several family factors such as beliefs and attitudes toward bilingualism, quality literacy engagement, and sibling dynamics, that all appearing to contribute to the discrepancies.

Keywords: bilingual vocabulary; developmental differences; home literacy environment; language beliefs; language choices; sibling dynamics

Introduction

Increasing immigration has resulted in a concomitant expansion of linguistic diversity in North America [15,70]. More than 9 million people reported non-official languages as their mother tongues (also referred to as heritage languages or HL or first language or L1) in 2021, representing 21.4% of Canada's total population (Statistics Canada, 2022); however, only 4.6 million (about 12.1% of the total population) reported they speak their mother tongues — other than English or French, predominately at home — suggesting that many are not speaking their mother tongues at home. This is not surprising since studies have consistently shown that the second or third generation of immigrant families tend to lose their mother tongues by the diglossia [1,27,53]. This language shift from heritage languages to dominant or official languages often takes place as children from immigrant families start mainstream school and gain more fluency in the dominant languages. This shift often has a significant impact on how parents support and maintain their heritage languages at home [49].

Language shift is complex, with some children and families voluntarily giving up their heritage languages, while others lose them involuntarily [35,49,51]. Research shows that while children's knowledge *of* and preference *for* English is nearly universal, there are wide variations both within and between migrant groups [62] and within the same ethnolinguistic groups [50,51] in the preservation of their heritage languages. For example, Portes and Hao (1998) in their analysis of 5000 immigrants in Florida found that while the children's development in English was similar, there were wide variations in the retention of their parents' languages and only a minority remained fluent in these languages. Similarly, Li et al. (2021) in their comparison of Cantonese and Mandarin speaking children's

L1 vocabulary found that variations existed in their development across two sub-Chinese groups.

While a variety of structural, social, and political factors have been shown to contribute to generational language loss [49], the home lieracy environment (HLE) plays a crucial role. Previous studies have consistently reported the impact of HLE on early literacy development in a wide range of linguistic and cultural contexts (e.g., [4,28,30,60,68,69]). In the home literacy model elaborated by Sénéchal and LeFevre, 2002, two types of activities were identified: formal and informal literacy activities [68,69]. Formal literacy activities focus on print materials, such as alphabetic teaching and pronunciation modeling [32]. In comparison, informal literacy activities focus on messages or information conveyed by print materials, such as bedtime story reading and explanations of illustrations [68,69]. For bilinguals, the home language use and home literacy activities with family members have been found to influence the development of target languages as well as heritage languages [13,40,44,51,77].

HLE also affects children's early bilingual vocabulary development (e.g., [19,24,30,36,63]), which in turn shapes their early reading as well as later literacy development [33,61,72]. Researchers have observed that bilingual children usually have smaller vocabularies in both languages than monolinguals [2], but surpass monolinguals in total vocabulary [34,38,57]. HLE may influence bilingual children's vocabulary development differently in complex ways. For example, in a study of the relationship between HLE and 5th grade bilingual Spanish and English vocabulary development in the U.S., Duursma et al. (2007) showed that parental use of English at home did not affect English vocabulary, but home exposure in Spanish significantly impacted Spanish vocabulary development. Thus, since few studies have explored early bilingual developmental patterns of Chinese-English bilingual children in the Canadian context and the familial factors that shape the patterns. This research describes vocabulary development patterns and profiles and explore home factors that may have contributed to them by comparing and contrasting parental practices of children with divergent bilingual profiles.

Children's Bilingual Development Patterns in the North American Context

Grosjean (1982) described a general pattern of bilingualism in migrant families across generations and argued that bilingualism in North America is short-term and transitional. To the author, while first-generation immigrants learn the target language while maintaining their heritage languages as their primary languages, the second generation usually switches from heritage languages to the mainstream language and many end up speaking English only. Those whose parents value heritage cultures and emphasize the learning of heritage languages are more likely to develop bilingual abilities. Later empirical studies exploring bilingual developmental patterns in the North American context reflect Grosjean's (1982) argument. For instance, Hoff et al. (2014) compared the expressive vocabulary development of two groups of Spanish-English bilinguals (15 children with one native Spanish-speaking parent and 11 children with two native Spanish-speaking parents) and a group of 31 English speaking monolingual children from 22 months to 48 months. Children with two native Spanish-speaking parents improved the most in total vocabulary among the three groups. Bilingual children with only one native Spanish-speaking parent showed attrition in their Spanish vocabulary after 26 months. Gagarina and Klassert (2018) further identified the role chronologial age played in the bilingual development. The increase of chronological age comes with accumulated experience with a language, and maturity of cognitive skills. It predicts children's bilingual development, but the effects could be highly associated with various factors such as the language exposure, language learning properties, as well as instrutional support in schools.

In a recent longitudinal study by Oppenheim et al. (2020), a pattern of simultaneous development in both languages was found by following 139 Spanish-English bilingual children in Austin, Texas, for two or more years. The participants were from kindergarten to grade three when their expressive vocabulary skills in both languages were tested. Information on their home and school language use was also collected from their parents

and their schoolteachers each year. Results revealed that even though all were from a home environment where Spanish was predominately used, and the youngest participants' Spanish vocabulary knowledge was significantly greater than English, they shifted from L1 dominant to the second language (L2) dominant at approximately the third grade. Their English vocabulary knowledge improved much quicker than their Spanish vocabulary knowledge, even though their Spanish vocabulary knowledge also improved significantly.

Compared with Spanish-English bilinguals, there are some unique features of Chinese-speaking bilinguals. Chinese is a non-alphabetic language, and Chinese-English bilinguals rely more on morphological than phonological awareness in acquiring bilingual ability compared with their Spanish-speaking peers [73]. In terms of bilingual development patterns, similar to the findings from Spanish-English bilinguals, researchers have observed generally optimistic outcomes with respect to their English lexical growth but a comparatively slower development regarding Chinese as a heritage language. For instance, Jia et al. (2014) conducted a cross-sectional comparison of bilingual lexical skills of 175 bilingual children aged five to 18 with Chinese or Korean as their heritage languages. By measuring their expressive lexical skills in both English and heritage languages and collecting surveys about their language environment factors, researchers found a significantly positive effect of age on both English and heritage languages. However, the participants reached the monolingual level of English lexical skills as early as age eight. In contrast, the high school participants only attained an elementary level of heritage language lexical skills compared to monolinguals.

The co-improvement pattern was not observed by Shen et al. (2011), who found a significant effect of age solely on English vocabulary but not on heritage language vocabulary. This study measured the receptive and expressive vocabulary in English and the heritage language of 35 Mandarin-English bilingual children in Texas, U.S. Participants were separated into two groups by age, with 18 children aged from three to five in the younger group and 17 children aged from six to eight in the older group. There was limited evidence of heritage language growth around preschool ages, and the heritage language expressive vocabulary was especially vulnerable to attrition.

In sum, bilingual children in the North American context are normally observed to experience a significant improvement in their English language proficiency, but their heritage language developmental trajectories vary; some researchers observed a co-improvement pattern with English language development, while others found the L1 ceased to improve. The different patterns observed in bilingual development reflect the heterogeneity among bilingual children. Further, most studies of development in North America focus mainly on Spanish-English bilingual children. The investigation of Chinese-English bilinguals, especially addressing developmental patterns and the discrepancies between English and Chinese, remains minimal.

Home Language Environment and Bilingual Development

Parents' beliefs and attitudes toward bilingual education or bilingualism play a mediating role in affecting children's language development patterns in that their beliefs and attitudes exert a foundational impact on parental linguistic choices and interaction strategies, which influence children's language development [14]. The attitudes and beliefs of immigrant parents are found to be strongly correlated to their home literacy practices and their interactions with their children [45,49]. While immigrant parents may hold positive attitudes toward their heritage languages and a desire to maintain their children's heritage language proficiency, their beliefs and attitudes towards bilingualism may vary [23,41,49]. Hwang et al. (2022) conducted a study that explored the relationships among family demographic information, parental beliefs, home language practices, and children's vocabulary knowledge. All 190 participating children were from Spanish-speaking families, and 63% of them were identified as students with limited English proficiency.

The researchers concluded that participating parents' beliefs toward dual language development were heterogeneous, and there was an indirect effect of beliefs on children's vocabulary knowledge, which was mediated by parents' home language practices.

The complexity of the relationships between HLE and bilingual children's literacy development is also reflected by the influence of literacy practices at home. Research has shown that language exposure at home is more related to children's heritage language development [7,64] than to children's English language development (e.g., [19,30,70]). Some argue that more exposure to English at home is negatively associated with heritage language proficiency (e.g., [30,38,64]). However, high-quality literacy activities such as parent-child shared reading [6,9], and the number of books at home [24] are positively correlated with children's development in both languages. These findings highlight the necessity to consider the quality of language and literacy activities at home in exploring the relationships between HLE and children's bilingual literacy development.

In a study conducted by Chen and Ren (2019), the relationship between home-related factors and bilingual vocabulary abilities was explored by measuring 84 Chinese-English bilingual preschoolers' receptive and also productive vocabulary knowledge and collecting home-related information from their parents. All 84 preschoolers were from immigrant, low-income families in the United States. It was found that the frequency of parental book reading in English or in a combination of English and Chinese was positively correlated to preschoolers' English expressive vocabulary. The frequency of parental book reading in Chinese or in a combination of Chinese and English was positively correlated to preschoolers' Chinese receptive vocabulary. Similar results were found by Goodrich et al. (2021), who conducted a longitudinal study investigating the influence of HLE on Spanish and English vocabulary skills of 944 Spanish-speaking preschoolers from regions across the United States. The productive vocabulary and conceptual knowledge in both Spanish and English were assessed in two school years four times (at the beginning and the end of each academic year). The HLE information was collected by surveys filled out by participating parents. Results showed that participating children's average English vocabulary size surpassed their average Spanish vocabulary size in a short period of time (within three months). The quantity of language input at home was positively related to growth of Spanish vocabulary but not to English vocabulary. However, literacy-related activities, such as parental reading frequency and the number of books at home, significantly predicted the growth of participants' English vocabulary knowledge.

Most studies of HLE focus on parents, with little or no attention to siblings, whose influence has been documented as an important and unique component of HLE (e.g., [9,63]). Among the limited studies focused solely on siblings (e.g., [25,26,56,67]), it has been found that they uniquely improve home literacy interactions and support emergent literacy development [67]. This is especially the case in bilingual or multicultural families, where older siblings usually act as mediators between parents and younger siblings, and between heritage and target language use [67]. Cheung et al. (2019) studied the effects of home language input on bilingual children's vocabulary knowledge. Researchers measured the expressive and receptive vocabulary in Cantonese and English of 92 preschoolers from low-SES Cantonese-speaking households in California. They collected home language input information from parents. Results highlighted older siblings as the family members whose language input significantly predicted participating preschoolers' conceptual knowledge. Based on these findings, a follow-up study was conducted by Taylor and Kan (2021) to explore the influence of older siblings on vocabulary knowledge learning. The sample shared the same background as Cheung et al. (2019) but included only 27 preschoolers and their older siblings. Vocabulary knowledge in Cantonese and English and the fast-mapping skills of preschoolers were measured. Participants were divided into two groups which were the "Mostly L1" group (N = 13), in which older siblings talked with participants with more than 80% in Cantonese, and the "Equal L1/L2" group, in which older siblings talked with participants in Cantonese and English in balance. Researchers found no significant difference in preschoolers' vocabulary knowledge between

the two groups but a significant difference in Cantonese fast mapping task scores in favor of the "mostly L1" group.

HLE in bilingual or multicultural families is complex and diverse. The influence of HLE on heritage language and target language development varies relative to parents' beliefs and attitudes toward bilingualism, the quantity of home language input, and the quality of home language activities. The vocabulary skills, found to be related to long-term literacy development [72], have been employed as a significant measurement of early literacy development. However, little is known about how HLE contributes to the diversity among some cultural and linguistic groups besides the often studied Spanish-English groups. This mixed methods study addresses this gap by investigating the bilingual vocabulary developmental patterns among Chinese-Canadian bilingual first graders in Canada and potential home literacy factors contributing to early discrepancies. Specifically, the study was anchored by the following research questions:

1. What are the patterns of achievement in bilingual oral receptive vocabulary among Chinese-English first graders?
2. What are the underlying profiles of the children's Chinese-English bilingual vocabulary achievement?
3. What are the home-related factors that account for the children's variations in their bilingual English and Chinese receptive vocabulary?

Methods

This mixed-methods study followed an explanatory sequential design [10] which included two phases. In Phase I, participating Chinese-Canadian children's oral receptive vocabulary knowledge in both English and Chinese was measured, followed by a cluster analysis to understand the general patterns of bilingual oral receptive vocabulary knowledge in English and Chinese and to identify the underlying profiles of potential bilingual vocabulary knowledge heterogeneity. Focal participants with contrasting vocabulary knowledge of Chinese and English were selected to understand further home literacy factors contributing to their disparate achievement in oral receptive vocabulary in the two languages. In Phase II, interviews of the four focal children's parents were conducted and analyzed using thematic analysis to understand possible home-related factors that contributed to the divergent achievements in the two languages. Integration of findings from both analyses provides an in-depth explanation of the bilingual vocabulary knowledge gap.

Phrase I Cluster Analysis

Participants

A total of 75 first-grade Chinese-English bilingual students from Vancouver, Canada, were included: 41 boys, and 34 girls, with 59 Canadian-born and 16 new immigrants. The average age of participants at the time of testing was 77.25 months. Sixty-five students attended public school, and ten attended private school. Thirty-nine attended extra-curricular heritage language classes.

Table 1. Demographic Information of Participating Children.

Demographic Categories	Total (*N* = 75)
Gender	
Female	34
Male	41
Mean age (months)	77.25
School types	
Public school	65
Private school	10
Canadian-born	59
New Immigrants	16
Attending heritage language classes	39

Receptive Vocabulary Knowledge Measures

The Peabody Picture Vocabulary Test (PPVT-5) [18] was administered to assess English receptive vocabulary knowledge. The test contains 240 items designed for individuals from 2.5 to 90+ years. It has been normed in the Canadian context with an overall reliability of .97 (Dunn & Dunn, 2019). The Chinese version Peabody Vocabulary Test (C-PPVT-R) [52] was adapted from PPVT-R [17]. It contained 125 items and was originally designed for individuals aged from 3 to 16 to assess Chinese receptive vocabulary proficiency. High measurement reliability has been found in previous studies (e.g., [8,37]). The Item Response Theory (IRT) scaled scores, which were fixed to a standard normal distribution with a mean of zero and variance of 1, were used for the present study.

Cluster Analysis

The R package NbClust [5] was used for cluster analysis, which provides 30 indices for researchers to determine the final number of clusters that are relevant within the study context. Specifically, the K-means clustering technique was performed in software R-4.2.1 to identify the underlying profiles of the Chinese-English bilingual vocabulary knowledge. In this type of clustering method, individuals or cases with similar features were partitioned into the same subgroups (within-cluster) with high internal homogeneity, while between-cluster exhibited high external heterogeneity. The essential steps of this algorithm include (1) Establish an initial partitioning solution based on the predetermined number of clusters. (2) Move each case from one cluster to another, then calculate the change of clustering criterion. (3) Identify the "moving" that maximizes the improvement in the clustering criterion. (4) Iterate steps 2 and 3 till no improvement appears in the clustering criterion [20]. At the end of the cluster analysis, we identified outliers of each cluster for in-depth investigation. As the outliers were recognized as children with the most contrasting lexicon knowledge in English and Chinese, who would most likely provide information to understand the achievement gap in the two languages. We added a 95% confidence ellipse on each cluster center to identify outliers, and those outliers were selected as focal children for Phase II qualitative analysis.

Phase II Qualitative Analysis

Participants

Four children with contrasting profiles were identified as focal children from Phase I. Parents' questionnaires, and interviews of the four focal children's parents on their beliefs and attitudes toward bilingualism and home literacy practices, were analyzed thematically to understand factors that contributed to their contrasting performance in English and Chinese receptive vocabulary. Among the four focal children (Table 3), all spoke Mandarin as their home language, two girls and two boys. Their average age was 80.75 months. Child A012 is the only new immigrant, he had lived in Canada for 13 months at the time of the interview. Their receptive vocabulary levels were categorized based on their PPVT standard scores, with level 1 for "Well Below Expected", level 2 for "Below Expected", level 3 for "Expected", level 4 for "Above Expected", and level 5 for "Well Above Expected".

A012 was the family' s only child, and his mother had limited English oral communication abilities. A024 was born in Canada, and had a 17-year-old brother whose English proficiency was native-like. Her mother was able to converse in English but needed extra support in English writing. A101 was the youngest child of three in his family. He was designated as a gifted child by local school district personnel. His father worked in China, so his mother was the sole parent. His mother could only manage daily conversations. A102 had an older brother who was highly proficient in English, but her mother had very limited English proficiency.

Table 3. Focal Participants for Qualitative Analysis.

Participant Code	Age in Months	Gender	Immigration Status (Months in Canada)	PPVT EN Level (Score)	PPVT CH Level (Score)
A012	78	M	New Immigrant (13)	1 (48)	3 (99)
A024	73	F	Born in Canada (73)	3 (94)	1 (55)
A101	87	M	Born in Canada (87)	5 (142)	2 (81)
A102	85	F	Born in Canada (85)	2 (81)	4 (125)

Home Literacy Environment Measures

These focal children's basic home language environmental information was collected utilizing the Chinese version of the Alberta Language Environment Questionnaire (ALEQ) [59]. Parental beliefs and practices and home bi-literacy engagement information were elicited through semi-structured interviews. During each interview, one parent of each assessed child participated face-to-face with one of the project research assistants for roughly one hour and in the language of the parent's choice (English, Mandarin, or Cantonese). All interviews were audio-recorded and later transcribed.

Thematic Analysis

A thematic analysis following the protocol introduced by Saldaña (2016) was conducted on parental interviews. First, all interview content related to parental beliefs and attitudes and home literacy practices were extracted for coding. Then the project research assistants made the first round of analysis by using codes such as "parent-child reading+Chinese/English", "beliefs and attitudes+Chinese/English", and "number of books/print +Chinese/English". In the second round of analysis, small topics were classified into seven big categories which were (a) parent's language attitude or ideology, (b) sibling/cousin influence on home language practice, (c) importance of home reading to early literacy development, (d) importance of parental investment on children' s (CN/EN) literacy development, (e) language exposure in language acquisition and development (English/Chinese), (f) parent English proficiency and child's English development, and (g) challenges in maintaining Chinese.

Findings

Chinese-Canadian Children's Profiles in Bilingual Vocabulary Development

Following the majority rule for cluster analysis [5], two clusters were determined as the greatest number of optimal cluster solutions (Table 2). Cluster I (N = 34) exhibits a lower average Chinese PPVT score (M = -0.63, SD=0.74), and higher English PPVT-5 score (M = 0.53, SD = 0.79). Conversely, Cluster II (N = 41) poses a higher average Chinese PPVT score (M = 0.56, SD = 0.75), but lower average English PPVT score (M = -0.45, SD = 0.92). Put simply, compared with Cluster II, students in Cluster I exhibit advantages in English receptive vocabulary knowledge, $t(73) = 4.81$, $p < .001$, $d = 1.12$, 95% CIs [0.62, 1.60], but disadvantages in Chinese receptive vocabulary knowledge, $t(73) = -6.84$, $p < .0001$, $d = -1.59$, 95% CIs [-2.11, -1.06]. The cluster analysis results are displayed in Figure 1. The analysis showed significant variations in bilingual vocabulary development with more children having a higher Chinese vocabulary than English vocabulary.

Table 2. Profiles Identified by K-means Cluster Analysis.

	CN PPVT	EN PPVT
Profile I (N = 34)	M = -0.63, SD = 0.74	M = 0.53, SD = 0.79
Profile II (N = 41)	M = 0.56, SD = 0.75	M = -0.45, SD = 0.92

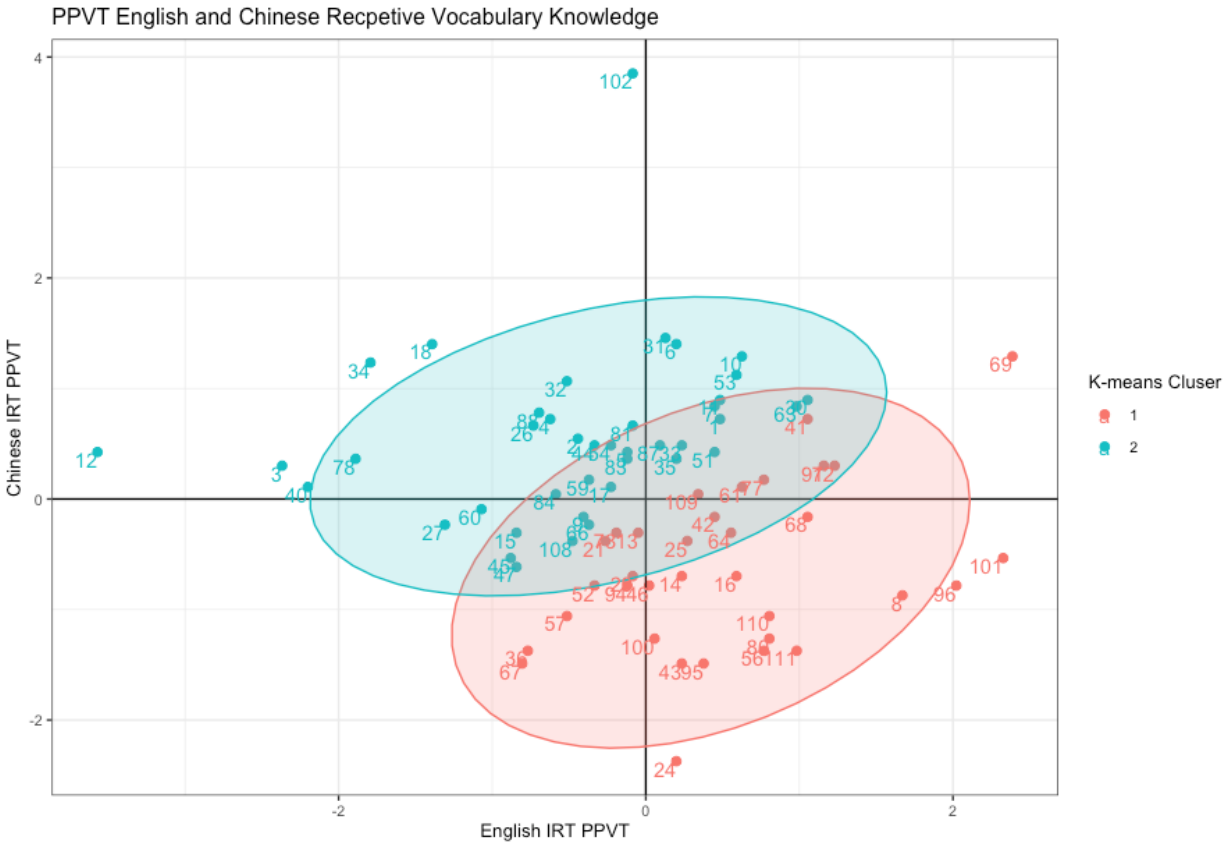


Figure 1. Children' s Patterns of Bilingual Vocabulary Achievement in English and Chinese.

Home Factors that Contributed to the Divergent Profiles

Analysis of questionnaires and interview transcripts of the four focal children with contrasting proficiency in English and Chinese revealed several home factors that may have shaped their discrepancy profiles. To begin with, while parents all believed in the importance of bilingualism or multilingualism, their attitudes toward the heritage language were different, which shaped their home literacy practices and outcomes.

The mother of child A101 (English receptive vocabulary level 5 and Chinese receptive vocabulary level 2) emphasized the importance of English over Chinese and believed that since English was an advantage, her son would not need Chinese in the future.

> Chinese is not that important to him, because his English is really good, and he does not need that [Chinese language ability] to find a job. I am not saying he does not need Chinese, but he probably will find a job by just taking advantage of his native-alike English proficiency. (Child A101, EN-5/CN-2)

In contrast, the mother of A102 (English receptive vocabulary level 2 and Chinese receptive vocabulary level 4) emphasized that as a descendant of Chinese, her daughter must master Chinese. She further recognized the importance of speaking Chinese to communicate with relatives and friends in China.

> First of all, as they are Chinese descendants, I think it is necessary for them to learn the Chinese language. And if they would like to travel back to China, they cannot communicate with their grandpa, grandma, and other relatives or friends in English, right? And my English is not that good, and if I communicate with them in English, I might not be able to understand them perfectly. So, I ask them to speak Chinese only at home. Furthermore, as I usually do story-telling with them in Chinese, she [the daughter] acquired Chinese naturally, and she is willing to learn Chinese, so I

> took her to learn. I think there is nothing bad about learning Chinese. (Child A102, EN-2/CN-4)

In line with these different language ideologies, analyses revealed different language input patterns at home, which, in turn, were related to their language ideologies. Parents who emphasized the importance of heritage language encouraged their children to speak Chinese at home. For instance, the mother of child A102 (English receptive vocabulary level 2 and Chinese receptive vocabulary level 4) mentioned that her daughter was more proficient in Chinese even though her daughter was born in Canada, as she kept communicating with her daughter in Chinese. In addition, she encouraged her children to speak Chinese at home by not replying to them in English.

> When she talks to me in English, I never say she can't speak English. I would just not respond when she talks with me in English, and she is fully aware of that and she is used to it. (Child A102, EN-2/CN-4)

The mother attributed this Chinese-response only practice to her poor English proficiency, "First of all, as my English is not good, I provide more Chinese input ever since they were little. So, I think now my daughter's Chinese is better than her English. Even though she was born here [in Canada], I think her Chinese is better because I do not speak English at home" (A102, EN-2/CN-4). Similarly, the mother of child A012 (English receptive vocabulary level 1 and Chinese receptive vocabulary level 3) mentioned that her son acquired new Chinese words by just listening to parents' conversations in Chinese.

> Because he did not lose his Chinese, he speaks Chinese to us after he comes back home from school every day. Once home, he continues to speak Chinese but during that time, his Chinese has not changed much. He can speak Chinese very well, and it was puzzling to me as there was no Chinese-learning environment in this country. It is strange that he could speak many new Chinese words. He probably picked up those words by listening to us adults speaking them. (Child A012, EN1/CN-3)

In family A102, they enforced Chinese at home and the children would speak only Chinese. The mother explained,

> I just told him [the older brother] that my English is not good, so he just speaks Chinese at home. And the stories I told him, TV shows, books I bought for them are all in Chinese. Like I said, I do not know how to pick English [books], basically he just did for himself, and I would pick Chinese books for him. And the story-telling is also, if I want to tell a good story, I tell them Chinese stories. (Child A102, EN-2/CN-4)

In contrast, the mother of child A101 (English receptive vocabulary level 5 and Chinese receptive vocabulary level 2) mentioned that her three children spoke English only and it was not useful even if the parents required them not to.

> because the three of them would talk to each other in English, so basically, among them three it is definitely English. When they speak to me, they are doing so well [in language choice] as they all basically like to use English. Then I usually reply in Chinese. This is a challenge we are facing at the moment. (Child A101, EN-5/CN-2)

She attributed this challenge in maintaining Chinese to their lack of ability and energy:

> Actually, I think if parents have time and energy, we should help kids learn to read and write in Chinese as well. But there are many practical issues, like the lack of time, or our energy, and the lack of cooperation from kids. Therefore, if you cannot help kids learn reading and writing [in Chinese], then you can only help them learn to listen and speak [in Chinese]. Many families make the compromise, including ours (Child A101, EN-5/CN-2)

In addition to differential language choices and input at home, there were also qualitative differences in their literacy activities. For children with more English vocabulary knowledge (A024, A101), parents reported that they engaged in more regular, self-directed English reading on a daily basis, compared to Chinese. The parents also regulated their reading practices by establishing a routine for home reading and creating a literacy-rich home environment by buying books or frequently borrowing books from the local library. The mother explained in detail how they fostered a reading routine by making books available and making reading a pastime,

> We read almost every day. On the stairs from the first floor in our house, there are all books placed there. When she walks up the stairs, she would flip the books. When she gets bored, she would go and read. When there is only one kid at home and she has no playmates, she would feel bored. She has nothing else to do when she comes back from school. During the weekend, she would ask to play on my cellphone, but if I refuse to give her, she would just play with her dog and then sit downstairs and read books. (Child A024, EN-3/CN-1)

Similarly, mother of Child A101 (EN-5/CN-2) also shared how they fostered a habit of English reading at home, "They usually read books when I cook. Because all my three kids like reading, especially the oldest kid and the youngest kid. So basically, they make a habit of reading, that is when there is nothing important, they would sit on the couch and read [English] books". The mother of Child A101 also maintained a bedtime reading routine and tried to read both Chinese and English books.

Compared to these active parental engagements in reading, parents of A024 and A 102 noted that they were unable to spare time or energy to supervise or support their children's reading in either Chinese or English (A012, A101). For parents of Child A024, their limited English proficiency restricted their abilities to provide high-quality literacy activities in English and their busy schedule did not allow any reading time. As she explained,

> I have to be very honest. There is no companion or supervision on my son's studying. This kid needs someone to accompany him, but I have no time for that. I am too busy minding my own things. He spends most of his time playing on his tablet. Or sometimes I gave him two tablets and he would just play games on his tablets, from day to night, as I have no spare time to read books with him. (ChildA012, EN1/CN-3)

She explained that even though they had many books at home, her son would never read them if no one was with him, he would not read them himself. Similarly, the mother of ChildA024 also felt their own language ability was the issue, "I think we parents' limited language proficiency [of English] restricted us, and we just moved to a new place, having very little educational resources to provided. So sometimes we are not able to help too much, children can only rely on themselves." (Child A024, EN-3/CN-1)

Finally, sibling dynamics were an important influence on the families' divergent literacy practices, especially the role of older siblings in influencing the younger children's language choice. In the case of A101, for example, older siblings preferred the use of English at home, and hence all sibling interactions turned to English despite parents' effort toward a Chinese family language policy [76]. In contrast, in the family of A102, the older brother always used Chinese to communicate with parents and helped his younger sister (the focal child) to use Chinese at home. The mother of Child A101 explained how her older son influenced the younger brother's language choices and practices,

> I did [encourage them to speak Chinese], but it was not very effective, because the elder bother became proficient in English very quickly, and basically became very stubborn [in speaking English]. Because of that, he had the influence on his younger brother [to speak English at home]. So, we never find a good solution on that. (Child A101, EN-5/CN-2)

In the household of Child A102, the older sibling's influence on the younger ones was similar but in a different language. Her older son spoke to the younger brother in Chinese only,

> As [my daughter] has an older brother, and she was born when her older brother was five years old. And when the older brother went to kindergarten, I just told him, I did not force him it would be better if you talk in Chinese at home, because Mom's English is not good. Then he has been talking in Chinese ever since, so she is used to speak Chinese at home. (Child A102, EN-2/CN-4)

Discussion

Two patterns of bilingual development with distinct underlying profiles were identified. Two clusters were identified: Cluster I (N = 34) with an advantage in English lexicon knowledge and Cluster II (N = 41) with an advantage in Chinese lexicon knowledge. The results reflect a heterogeneity among bilinguals which has been recorded in previous studies in different cultural contexts (e.g., [34,36,58,73]). Bilingual families confront different challenges in bi-literacy development as some struggle to improve their children's English proficiency while others have issues maintaining their children's heritage language.

The in-depth qualitative analysis of the focal children with contrasting vocabulary knowledge in English and Chinese describes the heterogeneity in bilingual HLE. Bilingual parents held different language ideologies and attitudes toward bilingualism, as some parents emphasized the importance of maintaining heritage language ability while others focused more on English proficiency. As reflected by previous studies (e.g., [14,36,49]), the differences in parental beliefs and attitudes influenced children's language development by directly affecting language input and literacy practices at home.

In line with previous studies (e.g., [7,19,63]), our results revealed that home language input is related to children's heritage language development but improving children's English proficiency does not require parents' use of English at home. However, high-quality literacy activities such as parent-child shared reading and the number of books in the home were positively related to English development. The discrepancy in bilingual vocabulary knowledge may be perpetuated by the differences in home literacy practices. Children with higher English vocabulary knowledge (Child A024, Child A101) were more engaged in English book reading but had less heritage language input in the home. In contrast, parents of children with higher Chinese vocabulary knowledge (Child A012, Child A102) held a strict Chinese-only policy in the home but had few literacy activities in English due to their limited English proficiency. For most immigrant families, the limited English proficiency of parents restricted the quality of home literacy practices as they are less capable of reading English books to their children or selecting content-appropriate English books. Schools and teachers could provide more support for immigrant children struggling in English learning by assigning extra reading in English or providing book-selection advice.

The study results underscore the influence of siblings, which has received increasing attention in bilingual home literacy environment investigations [74]. Parents emphasized the important role elder siblings played at home as not just moderators of language use between parents and younger children but also as the influencer of younger siblings' language choice and literacy learning, especially in developing reading routines and habits. This is likely because they interact with their siblings more than with their parents, as parents are occupied by their daily work or housework. Furthermore, based on Vygotsky's sociocultural perspective (1978), language learning outcomes are more likely to be maximized when language learners are learning within the zone of proximal development. Compared with their parents, elder siblings are more likely to scaffold younger children in their zone of proximal development as they are more capable than younger children but not far beyond younger children's developmental levels.

Implications

Among the few studies investigating the relationships between HLE and bilingual children's language discrepancy between English and heritage language, this study revealed a heterogeneity among bilingual children in their early ages. Some struggle to learn English, while others have difficulties maintaining their heritage language proficiency. So, in supporting the bilingual development of immigrant families, it is a mistake to ignore this diversity and assume the challenges confronted by immigrant families are similar. Understanding their challenges requires a cautious examination of family situations. Future longitudinal studies are needed to track children's development for the long term to provide a more comprehensive understanding of their bilingual developmental patterns.

This study investigated the relationships between parental beliefs and attitudes toward bilingualism but did not examine their attitudes toward heritage cultures. As Grosjean (1982) argued, for the second generation of immigrants, parents' attitudes toward heritage cultures and heritage languages are crucial to their children's bilingual abilities. However, it is also worth noting that most of the parents consented to participate in this study are mothers of the children, the missing of the voice from fathers could be a limitation of our study. Future studies could include parental understanding of and attitudes toward heritage cultures in explaining the discrepancy in development in two languages, and have the perspectives of both mothers and fathers investigated.

Additionally, this study explored the relationship between HLE and first-graders' vocabulary knowledge gaps between two languages. We collected and analyzed data about home literacy practices; however, other home-related factors, such as parents' educational backgrounds and family SES were not included. Future studies could explore such factors.

Finally, we found that older siblings play essential roles in home literacy practices because they are more likely to affect younger children's' home language use and home literacy activities; therefore, it is important to take siblings into consideration if there is more than one child at home. Further research is needed to understand the influence of siblings in shaping HLE by designing studies specifically addressing this important home factor.

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