

To Gain or To Lose: Students' English and Chinese Literacy Achievement in a Mandarin Language Bilingual Program

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Abstract

The present study examined the effectiveness of a Chinese-English bilingual program in enhancing children's English and Chinese language and literacy skills. Participants included an experimental group of 26 students from Junior Kindergarten (age approximately 4-5 years) to Grade 2 (age approximately 7-8 years) enrolled in a Mandarin language bilingual program in Ontario, Canada, and a comparison group of 43 Chinese-speaking students attending English-only public schools in the same region. Measures of phonological awareness, syntactic awareness, receptive vocabulary, and word reading were administered in English and Chinese. Children in the experimental group showed Chinese word reading and phonological awareness skills that were superior to those of the comparison group. The two groups were comparable in English word reading and receptive vocabulary skills. Significant correlations between measures of phonological awareness, syntactic awareness, receptive vocabulary, and word reading were found within and across languages in the experimental group. We discuss results within the context of the extant theories of bilingual development and cross-language transfer.

Résumé

La présente étude a examiné l'efficacité d'un programme bilingue chinois-anglais à améliorer les habiletés linguistiques en anglais et en chinois des enfants participant à ce programme. Dans le groupe expérimental, 26 élèves de la maternelle (4 et 5 ans) à la deuxième année (7 et 8 ans), scolarisés dans un programme bilingue mandarin en Ontario, au Canada, ont participé à l'étude. Le groupe comparatif incluait 43 élèves de langue chinoise scolarisés dans les écoles publiques anglaises de la même région. Des tâches de conscience phonologique, de conscience syntaxique, de vocabulaire réceptif et de lecture de mots ont été administrées en anglais et en chinois. Les élèves du groupe expérimental ont obtenu des résultats supérieurs que ceux du groupe comparatif sur les tâches de lecture de mots en chinois et de conscience phonologique. Les deux groupes étaient comparables dans les tâches de lecture de mots en anglais et de vocabulaire réceptif. La conscience phonologique, la conscience syntaxique, le vocabulaire réceptif et la lecture de mots étaient significativement corrélés à l'intérieur des langues et entre les langues des élèves du groupe expérimental. Nous discutons des résultats dans le contexte des théories existantes sur le développement bilingue et les transferts interlinguaux.

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Introduction

Over the last several decades, there has been a surge of children educated in their second language in Canada. According to the 2011 Census, 14.4% of Canadian children 5 to 19 years of age have a non-official language as their mother tongue. Notably, Chinese is one of the most common mother tongues reported by immigrants. Over 80% of those who identified Mandarin as their mother tongue reported that it was the language spoken most often at home (Statistics Canada, 2011). On the one hand, bilingualism brings many cognitive, social and economic benefits (e.g., Bialystok, Craik, & Luk, 2012). On the other hand, children who speak a minority language at home may have reduced exposure to the societal language, which leads to lower levels of proficiency in the societal language as compared with monolingual children who speak the societal language (e.g., Jean & Geva, 2009; U.S. Department of Education, 2013). Thus, identifying pedagogical approaches that facilitate the development of oral language proficiency and literacy in the societal language among these children without sacrificing their home language competence is critical to their academic success.

In the present study, we examined an innovative Mandarin language bilingual program at a public school in Ontario to determine whether this teaching model benefits early elementary children who are acquiring Mandarin and English simultaneously. The cross-language relations between two metalinguistic skills (i.e., phonological and syntactic awareness) and reading in Chinese and English were also evaluated as possible factors that facilitate bilingual language and literacy development among young Chinese-English bilingual children.

Immersion and Bilingual Programs

Bilingual programs aim to promote bilingual competence by providing instruction in both languages (Genesee, 2004). Currently, several types of bilingual programs are available to students in North America. These programs differ in the point of time at which the two languages are introduced, as well as the proportion of instruction time allotted to each language. One type of bilingual program is one-way total/full immersion programs, in which the immersion language is used as the primary language of instruction throughout the curriculum. The societal language is usually introduced in the upper elementary grades, but is not used for instruction for more than 50% of the time in elementary school (Genesee & Jared, 2008; Thomas, Collier, & Abbott, 1993). In one-way partial immersion programs, instruction is provided in the immersion and societal languages simultaneously from the onset, and the immersion language is used for instruction for only about 50% of the time. Finally, dual language (or "two-way immersion") programs integrate students who speak a minority language and those who speak the societal language in the same classroom with the goal of bilingual proficiency for both student groups (Christian, Montone, Lindholm, & Carranza, 1997).

French immersion is the bilingual program that has received the most support from the public school system in Canada due to the official language status of French. Past research has documented benefits of French immersion programs in developing literacy in

both English and French (for a review, see Genesee & Jared, 2008). French immersion students have superior French literacy and language skills when compared to peers in regular English programs who learn French as one of their school subjects (e.g., Genesee, 2004). Moreover, despite some initial delays in their English literacy development, French immersion students achieve parity or even surpass students in regular English programs on English literacy skills by middle and upper elementary grades (e.g., Allen, 2004; Genesee, 2004; Hermanto, Moreno, & Bialystok, 2012; Lapkin, Hart, & Turnbull, 2003; Turnbull, Lapkin, & Hart, 2001). A recent study conducted by Hipfner-Boucher, Lam, and Chen (2014) showed that French immersion students outperformed students enrolled in regular all-English programs on English language and literacy skills even in Grade 1. Taken together, there is substantial evidence that French immersion students achieve proficiency in French without sacrificing their English skills.

Over the years, the success of French immersion programs has led to the establishment of several other bilingual programs in a small number of provinces in Canada targeting different languages (e.g., German, Spanish, Arabic, Mandarin Chinese). These programs vary with respect to the age at which the child commences the bilingual instruction, as well as the proportion of instruction time devoted to English and the other language. However, bilingual programs other than French immersion receive little support by educational policies in Canada. Therefore, the program investigated in the present study represents one of the few Mandarin-English bilingual programs in the country's public school system and the only one in Ontario, despite a large Chinese population in the province.

Research on the literacy outcomes of bilingual educational programs other than French immersion is sparse within the Canadian context. However, one-way and two-way Spanish-English bilingual programs in the United States have been evaluated extensively (e.g., Barnett, Yarosz, Thomas, Jung, & Blanco, 2007; Nakamoto, Lindsey, & Manis, 2012; for meta-analyses, see Rolstad, Mahoney, & Glass, 2005; Slavin & Cheung, 2005). These programs are similar to the program examined in the present study in that they involve a minority language that does not have the official language status. Overall, this line of research reported positive effects of bilingual education in promoting Spanish-speaking students' English and/or Spanish skills when compared to Spanish-speaking students enrolled in regular, monolingual English programs. Studies of early elementary students enrolled in other one-way and two-way immersion programs (e.g., a Korean-English program in Bae, 2007; Japanese-English, French-English, and Spanish-English programs in Thomas et al., 1993) similarly concluded that students in these programs performed at least as well as their same-age counterparts enrolled in regular all-English programs in English reading and writing.

A handful of studies have been conducted in Chinese-speaking societies (e.g., Mainland China, Hong Kong) investigating Chinese and English development among students involved in Chinese-English bilingual programs (Knell et al., 2007; Lo & Murphy, 2010; Marsh, Hau, & Kong, 2000). Of particular relevance to the current research is Knell et al.'s (2007) study focusing on students in Grades 1 to 3 in Mainland China. Half of the participants were enrolled in an English partial one-way immersion program in which they received 50% of the daily instruction in English and 50% in Mandarin Chinese; the other half of the participants were in regular Chinese school programs that included two 45-minute English sessions each week. The immersion students outperformed the non-immersion group on English oral language proficiency, word identification, and

vocabulary. However, students in the two programs did not differ in their performance on the Chinese measures. In another study, Chen, Xu, Nguyen, Hong, and Wang (2010) found that children participating in a similar English partial immersion program in China outperformed their peers who received regular English instruction not only on English phonological awareness, but also on Chinese phonological awareness over time due to cross-language transfer from English.

Taken together, the studies reviewed provide convincing evidence that early bilingual education leads to “additive bilingualism” over time (Lambert, 1987), where students are able to develop a high level of proficiency in both their first and second languages. However, the majority of the previous studies involving Chinese-English bilinguals (e.g., Chen et al., 2010; Knell et al., 2007) took place in Mainland China, where Mandarin Chinese is the dominant and official language of the society. In the present study, we examined the effectiveness of an early Chinese-English bilingual program in an English-dominant society (i.e., Ontario, Canada). As mentioned earlier, the majority of the studies conducted in Canada have focused on French immersion programs. Our results complement those reported by previous studies and provide a more comprehensive picture of the potential benefits of bilingual education in Canada.

Cross-Language Transfer of Cognitive Processing Skills

Bilingual education is founded on theories of bilingualism and language transfer, which emphasize the importance of first-language skills in supporting the development of second language competence (Uchikoshi & Maniates, 2010). Among Chinese-English bilingual children, cross-language transfer has been demonstrated across several domains of cognitive processing, particularly phonological awareness (e.g., Chen et al., 2010; Gottardo, Yan, Siegel, & Wade-Woolley, 2001; Marinova-Todd, Zhao, & Bernhardt, 2010; Yan, Yu, & Zhang, 2005). In the present study, we focused on the cross-language relations of phonological and syntactic awareness, two metalinguistic skills that have been shown to support reading (e.g., Adams, 1990; Demont & Gombert, 1996).

Phonological awareness refers to the ability to attend to and manipulate the sound structure of oral language (Wagner, Torgesen, & Rashotte, 1994). It is an important predictor of reading success in young children, both in English (e.g., Adams, 1990; Bradley & Bryant, 1983; Bruck & Treiman, 1990; Goswami & Bryant, 1990) and in Chinese (e.g., Ho & Bryant, 1997a, 1997b; Hu & Catts, 1998; McBride-Chang et al., 2008; Shu, McBride-Chang, Wu, & Liu, 2006). A substantial body of work has shown that phonological awareness is correlated across languages, and that phonological skills acquired in one language account for a significant portion of the variance in the reading of a second language (e.g., Comeau, Cormier, Grandmaison, & Lacroix, 1999; Geva, Wade-Woolley, & Shany, 1997; Haigh, Savage, Erdos, & Genesee, 2011). In particular, several studies have documented cross-language transfer of phonological awareness among Mandarin-English bilinguals (Chen et al., 2010; Gottardo et al. 2001; Marinova-Todd et al., 2010; Yan et al., 2005). For example, Marinova-Todd et al. (2010) found that among 5- and 6-year-old Canadian children who spoke Mandarin as their first language, measures of Chinese and English phonological awareness were significantly correlated. In the present study, we sought to determine whether similar cross-language relations of phonological awareness and reading could be observed among early elementary bilingual children receiving formal Mandarin and English instruction in Canada.

Syntactic awareness refers to the ability to “notice the internal grammatical structure of sentences” (Durgunoğlu, 2002, p. 194). Chinese and English share the basic subject-verb-object (SVO) sentence pattern, for example, *我读过这本书* [I have read this book]. They differ significantly, however, in other aspects of syntactic structures. For instance, in Chinese, adverbial modifications always precede the main verb, for example, *小明很开心地吃了汉堡* [*Ming happily ate the burger*]. By contrast, in English, adverbial modifications can either precede or follow the main verb, for example, *Ming happily ate the burger* or *Ming ate the burger happily* (for more comparisons, see Lin, 2006). Despite the differences, the important role of syntactic awareness in reading development has been documented among monolingual English-speaking children (e.g., Cain, 2007; Demont & Gombert, 1996; Nation & Snowling, 2000) as well as monolingual Chinese-speaking children (e.g., Chen, Lau, & Yung, 1993; Chik et al., 2012; Chung, Ho, Chan, Tsang, & Lee, 2013).

To our knowledge, cross-language correlations of syntactic awareness have only been examined directly in two studies (i.e., Durgunoğlu, Mir, & Ariño-Martí, 2002; Lam, Hipfner-Boucher, Selvachandran, & Chen, 2012). Durgunoğlu et al. (2002) found that measures of syntactic awareness in English and Spanish were correlated among Grade 4 Spanish-English bilingual children (not enrolled in a bilingual program). Lam et al. (2012) observed that syntactic awareness in English and French were significantly correlated among Grade 1 children enrolled in a French immersion program. Further, English syntactic awareness contributed across languages to French reading comprehension. Notably, both studies examined language pairs that have considerable overlap in syntactic structure. In the present study, we examined transfer of syntactic awareness between Chinese and English, a language pair with many differences in syntactic structure. Accordingly, findings of cross-language relations between syntactic awareness and reading outcomes would provide evidence supporting the transfer of a general sensitivity to syntactic structures across languages, and not merely knowledge of the shared syntactic features.

Context of the Study

The present study focused on a Mandarin language bilingual program in a public school in Ontario, Canada. This program was established in 2008 with strong support from the local Chinese community and the Literacy and Numeracy Secretariat of the Ontario Ministry of Education. The program provided approximately equal amounts of instruction in Mandarin and English each day for students in all grades, and was designed to help students “access curriculum content effectively by using Mandarin to clarify concepts and develop increased proficiency in English” (Hamilton-Wentworth District School Board, 2013, n.p.). The pedagogical approach adopted by the program was one that integrated language learning with academic instruction, taking advantage of children’s natural ability to learn language within authentic and meaningful contexts (Genesee, 2004; Wesche, 2002). Enrolment in the bilingual Chinese-English program was entirely voluntary. All families living within the school attendance boundaries had the choice of enrolling their children in the program regardless of their ethnic/language background. At the time of the present study, the program was at the end of its second year of operation and was offering enrolment from Junior Kindergarten (JK, age approximately 4-5 years) to Grade 2 (age

approximately 7-8 years). While most students in the program came from Chinese families, several of the students were of Chinese descent but were adopted by non-Chinese families. In addition, one child came from a non-Chinese family. These demographic variations afforded us a unique opportunity to evaluate the benefits of the program for children who are exposed to a minimal amount of Chinese outside the classroom.

Research Questions

The present study was designed to answer four research questions:

1. Are there significant differences between students attending the Mandarin language bilingual program and Chinese-English bilingual children attending regular all-English programs with respect to their phonological awareness, oral vocabulary, and word reading skills in English and Mandarin?
2. For students who have been enrolled in the bilingual program for two years, is there evidence of growth in their English and Mandarin proficiency over time?
3. How well do students who do not have a Mandarin-speaking family background perform in the bilingual program? Do they improve in Chinese and English skills over time?
4. Is there a positive relationship between the phonological awareness and syntactic awareness skills in English and Mandarin among students in the bilingual program? In other words, is there evidence of cross-language relations between the two metalinguistic skills that may facilitate bilingual and biliteracy development?

Method

Participants

Experimental group. Participants in our experimental group comprised 26 students from JK, Senior Kindergarten (SK, age approximately 5-6 years), Grade 1 (age approximately 6-7 years), and Grade 2 in the Mandarin language bilingual program (JK, $N = 8$, six girls, two boys; SK, $N = 5$, four girls, one boy; Grade 1, $N = 4$, two girls, two boys; Grade 2, $N = 9$, six girls, three boys).¹ Among these students, five girls were of Chinese heritage but were adopted by parents who spoke only English at home. One female student was not of Chinese ethnic origin and did not have a Mandarin-speaking family background. The remainder of the group had at least one parent who spoke Mandarin as their mother tongue. Their average age was 79.78 months ($SD = 15.89$ months). Out of the 26 students, a subgroup of 14 students (three of whom did not have a Mandarin-speaking family background) were returning students that were assessed one year earlier as part of a pilot study associated with the current project. Data collected from the pilot study for these students were used to answer the second research question and part of the third research question.

Information given by parents in responses to the family questionnaire indicated that 12 out of 26 students were born in Canada or the United States. Ten students were born in China or Taiwan but had been in Canada for at least one year; their average age of immigration was 30.70 months ($SD = 22.22$ months). Four families did not complete the questionnaire. The average maternal education level was an undergraduate degree. The

family questionnaire also showed that in addition to receiving daily academic instruction in Chinese, 75% of the students in the bilingual program attended Chinese heritage language classes offered by the International Languages Program for 2.5 hours weekly. Approximately 60% of the students reported using Mandarin at least sometimes at home, and 75% of mothers and 65% of fathers spoke Mandarin to their child at least sometimes.

Comparison group. To investigate the effects of the bilingual program, we drew a comparison group from a large-scale project conducted previously in a different school district within the same region in Ontario. The students in the comparison group were between the ages of 4 years 6 months and 8 years 3 months (approximately the age range of the children in the experimental group) and had an average parental education level of college and above. The similarities between the public educational systems in the two school districts, as well as the considerable overlap in the measures administered in the two projects led us to believe that the selection of this comparison group was appropriate. At the time of the present study, it was not feasible to recruit a comparison group from the same school district as the bilingual program because the number of Chinese-speaking students was very small in any given school.

The comparison group consisted of 43 students ranging from JK to Grade 2 (JK, $N = 9$, four girls, five boys; SK, $N = 4$, one girl, three boys; Grade 1, $N = 12$, five girls, seven boys; Grade 2, $N = 18$, eight girls, 10 boys). The mean age of the students was 78.19 months ($SD = 13.52$ months). Eighteen of the students were born in Canada. For the remaining 25 students who were born outside of Canada, their average age of immigration was 27.76 months ($SD = 23.33$ months). All of them had been in Canada for at least one year. The average maternal education level was an undergraduate degree. Approximately 70% of the students reported using Mandarin at least sometimes at home, and approximately 86% of mothers and 86% of fathers spoke Mandarin to their child at least sometimes at home. All children in the comparison group attended English-only public schools. In addition, they attended Chinese heritage language classes for 2.5 hours each week to receive instruction in both oral language and literacy skills.

Measures

Because the experimental and comparison groups were involved in different projects, only measures relevant to the purposes of the present study are described here. The experimental group received measures of receptive vocabulary, phonological awareness, syntactic awareness, and word reading in both English and Chinese. The comparison group received measures of phonological awareness and word reading in both English and Chinese, and receptive vocabulary in Chinese only. The subgroup of 14 students in the experimental group (described above) were administered the same measures of receptive vocabulary, phonological awareness, and word reading in English and Chinese in the pilot study one year prior.

Receptive vocabulary. The Peabody Picture Vocabulary Test, Fourth Edition, Form A (PPVT-IV A, Dunn & Dunn, 2007) was administered to the experimental group only, in order to measure English receptive vocabulary. In this task, the experimenter read a word and asked the student to point to one of the four pictures that best reflected the

meaning of the word just read. Testing was discontinued when the child made eight or more errors in a set of 12 items.

Chinese receptive vocabulary was assessed in both the experimental and comparison groups. To construct the Chinese receptive vocabulary task, every third item was selected from the Peabody Picture Vocabulary Test, Third Edition, Form III A (PPVT-III A, Dunn & Dunn, 1997), with 60 items in total. The items were then translated into Chinese. Children were given two practice items prior to the testing items. All items were administered to each child regardless of their performance. The reliability (Cronbach's alpha) for this measure was .84.

Phonological awareness. For both the experimental and comparison groups, English phonological awareness was measured using the Elision subtest of the Complete Test of Phonological Processing (CTOPP, Wagner, Torgesen, & Rashotte, 1999). Students were asked to delete a syllable from a multisyllable word or a phoneme from a syllable (e.g., "say *cat*, now say *cat* without saying /k/"). This test contained six practice items and 20 test items. Testing was discontinued when the child had failed three consecutive items.

The Chinese phonological awareness measure was administered to all participants in the current study except for the second graders in the comparison group. Chinese phonological awareness was assessed with a deletion task designed by the researchers. Similar to the English task, children were required to delete a syllable from a multisyllable word or a phoneme from a syllable (e.g., "say /se4/, now say /se4/ without saying /s/"). The task included six practice items and 24 testing items. The practice and test items consisted of both real and pseudo syllables. The reliability (Cronbach's alpha) for this measure was .94.

Syntactic awareness. The syntactic awareness measures were administered to only the experimental group. In both English and Chinese, syntactic awareness was tested using an error detection task developed by the research team. Syntactic errors included word order, preposition, verb tense, and phrasal verb. For each item, students were presented orally and in written form a sentence that contained one syntactic error. They were then asked to report the correct sentence to the examiner. For example, an item in the English syntactic awareness task was *I red like the most (I like red the most)*. In both languages, the syntactic awareness task comprised two practice trials and 16 test items. The reliability (Cronbach's alpha) was .87 for the English measure and .93 for the Chinese measure.

Word and character reading. The word reading measures were administered to the experimental and control groups. English word reading skills were measured using the Letter-Word Identification Subtest from the Woodcock Language Proficiency Battery (WLPB, Woodcock, 1984). This test required children to identify 14 letters and to read 62 words of increasing difficulty. The test was discontinued if the child read six consecutive words incorrectly.

Given that there was no standardized reading test available in Chinese, an experimental measure with a total of 125 characters was administered. This task has been successfully used in previous research involving Chinese children (e.g., Luo, Chen, Deacon, Zhang, & Yin, 2013). The task started with the most frequent characters (e.g., 三, 口) and moved to the less frequent ones (e.g., 擒, 蹶). Testing was discontinued when 10

characters were misread consecutively. The reliability (Cronbach's alpha) for this measure was .98.

Procedure

Graduate and undergraduate research assistants who were proficient in the testing languages administered the measures to the participants individually in a quiet classroom during school hours. The English and Chinese measures were administered in two separate sessions. The order of the two sessions was counterbalanced across the participants.

Results

The means and standard deviations for all measures are reported by grade in Tables 1 to 4 for the two groups. Due to the fact that the adopted children and those who were not ethnically Chinese encountered a very different linguistic environment from the rest of the group, the performance of these six students is not included in the main analysis but is reported separately. For the two main groups, skewness and kurtosis values fell within the acceptable range (i.e., $statistic/SE < \pm 3.09$) for all measures across all grades. There were no observed floor or ceiling effects for either group. Independent sample *t* tests revealed that there was no difference in age between the experimental and comparison groups at all grade levels except for Grade 2. For the Grade 2 students, the experimental group was significantly older than the comparison group, $t(22) = 6.15, p < .001$. When the amount of time in Canada was compared across the two groups, there was no significant difference found for any grade.

Table 1

Descriptive Statistics of the Measures for the Experimental and Comparison Groups in Junior Kindergarten

	Possible High Score	Experimental Group				Comparison Group			
		<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Junior Kindergarten (JK)		(N = 8)				(N = 9)			
Age in Months	N/A	57.80	2.95	56	63	55.78	1.48	54	58
Time in Canada	N/A	56.60	0.55	56	57	53.11	7.67	33	58
Maternal Education	6	4.25	2.22	1	6	5.22	0.67	4	6
Chinese Vocabulary	60	25.00	7.45	13	36	30.33	4.80	21	37
Chinese Phonological Awareness	24	12.14	4.78	3	18	5.22	4.58	0	15
Chinese Syntactic Awareness	16	2.00	2.52	0	6	--	--	--	--
Chinese Character Reading	125	16.00	17.43	0	48	8.78	9.03	0	25
English Vocabulary	228	76.00	28.85	26	113	--	--	--	--
English Vocabulary (Standard Scores)	N/A	97.00	25.86	61	119	--	--	--	--
English Phonological Awareness	20	3.57	2.64	0	6	2.12	2.90	0	7
English Phonological Awareness (Scaled Scores) ^a	N/A	--	--	--	--	--	--	--	--
English Syntactic Awareness	16	2.33	2.42	0	6	--	--	--	--
English Word Reading	76	19.14	7.76	8	31	19.89	10.40	9	44
English Word Reading (Standard Scores)	N/A	121.75	20.48	101	147	--	--	--	--

^aThe scale scores achieved by the JK students could not be determined because all but one of the students in this group were younger than the lowest age range (i.e., 5:0-5:3) for which standardized scores were available.

Table 2

Descriptive Statistics of the Measures for the Experimental and Comparison Groups in Senior Kindergarten

	Possible High Score	Experimental Group				Comparison Group			
		<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Senior Kindergarten (SK)		(<i>N</i> = 3)				(<i>N</i> = 4)			
Time in Canada	N/A	61.67	13.80	46	72	62.00	14.07	41	70
Maternal Education	6	5.33	0.58	5	6	5.50	.58	5	6
Chinese Vocabulary	60	31.33	11.93	18	41	27.00	2.94	24	30
Chinese Phonological Awareness	24	14.00	1.00	13	15	12.75	5.74	5	18
Chinese Syntactic Awareness	16	4.67	5.03	0	10	--	--	--	--
Chinese Character Reading	125	43.67	33.56	9	76	12.25	6.85	6	22
English Vocabulary	228	86.33	13.20	72	98	--	--	--	--
English Vocabulary (Standard Scores)	N/A	94.00	10.44	82	101	--	--	--	--
English Phonological Awareness	20	9.33	5.86	5	16	3.75	2.22	1	6
English Phonological Awareness (Scaled Scores)	N/A	13.00	3.61	10	17	--	--	--	--
English Syntactic Awareness	16	6.67	1.53	5	8	--	--	--	--
English Word Reading	76	32.00	9.00	23	41	24.50	7.59	14	31
English Word Reading (Standard Scores)	N/A	130.00	18.52	112	149	--	--	--	--

Table 3
Descriptive Statistics of the Measures for the Experimental and Comparison Groups in Grade 1

	Possible High Score	Experimental Group				Comparison Group			
		<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Grade 1		(<i>N</i> = 3)				(<i>N</i> = 12)			
Time in Canada	N/A	83.33	4.04	81	88	77.33	4.77	65	82
Maternal Education	6	5.67	0.57	5	6	5.17	0.58	4	6
Chinese Vocabulary	60	41.33	3.79	37	44	33.91	7.04	23	43
Chinese Phonological Awareness	24	21.67	2.52	19	24	18.33	6.49	1	23
Chinese Syntactic Awareness	16	12.00	1.73	11	14	--	--	--	--
Chinese Character Reading	125	50.67	5.03	46	56	26.00	15.53	5	47
English Vocabulary	228	120.00	28.00	88	140	--	--	--	--
English Vocabulary (Standard Scores)	N/A	106.00	18.19	85	117	--	--	--	--
English Phonological Awareness	20	16.33	3.22	14	20	10.82	5.95	3	18
English Phonological Awareness (Scaled Scores)	N/A	14.00	5.00	9	19	--	--	--	--
English Syntactic Awareness	16	10.00	5.29	6	16	--	--	--	--
English Word Reading	76	40.33	10.69	28	47	36.27	12.38	18	54
English Word Reading (Standard Scores)	N/A	118.67	12.66	105	130	--	--	--	--

Table 4
Descriptive Statistics of the Measures for the Experimental and Comparison Groups in Grade 2

	Possible High Score	Experimental Group				Comparison Group			
		<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
Grade 2		(N = 6)				(N = 18)			
Age in Months	N/A	97.17	2.79	92	100	89.89	2.42	86	93
Time in Canada	N/A	71.17	30.58	26	100	56.33	25.37	20	93
Maternal Education	6	5.00	1.27	3	6	5.06	0.54	4	6
Chinese Vocabulary	60	40.67	9.61	22	47	37.88	5.81	25	49
Chinese Phonological Awareness	24	20.33	3.45	15	23	--	--	--	--
Chinese Syntactic Awareness	16	9.33	5.09	1	16	--	--	--	--
Chinese Character Reading	125	53.83	22.27	27	82	35.50	17.49	7	72
English Vocabulary	228	137.00	20.47	103	154	--	--	--	--
English Vocabulary (Standard Scores)	N/A	108.75	11.41	95	120	--	--	--	--
English Phonological Awareness	20	16.50	2.17	13	19	13.61	4.75	6	19
English Phonological Awareness (Scaled Scores)	N/A	13.00	1.63	11	15	--	--	--	--
English Syntactic Awareness	16	10.50	3.33	7	16	--	--	--	--
English Word Reading	76	48.83	5.74	38	53	48.22	7.50	34	58
English Word Reading (Standard Scores)	N/A	114.00	2.16	111	121	--	--	--	--

Research Question 1: Comparing Experimental and Comparison Groups on Chinese and English Measures

Because of the small sample sizes, we combined JK and SK students (henceforth, the “kindergarten division”), and first and second graders (the “early elementary division”) together in examining the differences in Chinese and English language and literacy skills between the experimental and comparison groups. This division of grades reflects the class combinations in the bilingual program, in which students were taught in JK/SK and Grade 1/Grade 2 split classes.

We first compared the Chinese language and literacy skills between the two groups to determine whether there were significant differences in their Chinese learning as a function of the program they attended. A series of independent sample *t* tests were performed on Chinese phonological awareness, character reading, and vocabulary. For the kindergarten division, the experimental group attained significantly higher scores than the comparison group on Chinese phonological awareness, $t(21) = 2.36, p = .028$. There were no significant differences between the two groups on Chinese character reading or on vocabulary. For the early elementary division, the experimental group performed significantly better than the comparison group on Chinese character reading, $t(37) = 3.21, p = .003$. The experimental group also scored higher on the Chinese vocabulary task; this difference approached statistical significance, $t(35) = 1.75, p = .090$. Because the Grade 2 students in the comparison group did not complete a Chinese phonological awareness task, group difference on this task was only examined among the Grade 1 students. Analyses revealed no significant differences between the groups, possibly due to the small sample size.

Next, we compared the two groups on measures of English phonological awareness and word reading using independent samples *t* tests. For the kindergarten division, there was no significant difference between the two groups on either English phonological awareness or English word reading. For the early elementary division, the experimental group outperformed the comparison group on English phonological awareness, $t(31.13) = 3.09, p = .004$. The two groups did not differ on English word reading.

Three of the English measures (i.e., CTOPP Elision for phonological awareness, WLPB for word reading, and PPVT-IV for receptive vocabulary) were standardized tasks, which allowed us to evaluate the performance of the students in the bilingual program against the norms established with the monolingual English-speaking population. The scale and standard scores of the three measures achieved by the students in the bilingual program are displayed in Table 1. As indicated by the standard scores, the experimental group’s development of English phonological awareness, word reading, and receptive vocabulary appeared to be keeping pace with their monolingual English counterparts, as suggested by their average to above average scores on the standardized English tasks.

Research Question 2: Development in English and Chinese Proficiency Over One Year

As mentioned above, 11 of the 20 students with a Mandarin-speaking family background in the experimental group (three in SK, two in Grade 1, and six in Grade 2) were returning students to the bilingual program who had been assessed one year earlier in a pilot study. For these students, we were interested in determining whether they had made

significant gains in their language and literacy abilities over one year. The descriptive statistics for all measures that are the same across two years are summarized in Table 5.² The comparisons between students' performance in Year 1 and Year 2 were based on the language and literacy measures administered at both time points (i.e., phonological awareness, word/character reading, and receptive vocabulary) in both English and Chinese. Because the sample size was small and our main focus was their overall language development over one year, we combined students from all three grades for the analysis.

We first examined changes in Chinese language and literacy skills. Paired sample *t* tests indicated that students made significant gains over one year on both Chinese character reading [$t(10) = 6.72, p < .001$] and Chinese vocabulary [$t(9) = 4.07, p = .003$]. By contrast, minimal improvement on Chinese phonological awareness was observed [$t(10) = -.851, p = .415$]. With respect to English language and literacy skills, students made statistically significant progress over one year on all three English measures [$t(10) = 4.43, p = .001$ for English phonological awareness; $t(10) = 6.39, p < .001$ for English word reading; and $t(9) = 12.13, p < .001$ for English vocabulary]. Taken together, our results indicate that students who have enrolled in the bilingual program for two consecutive years made significant progress in both English and Chinese.

Table 5

Descriptive Statistics of the Measures for the Senior Kindergarten and Grade 1 Returning Students in the Experimental Group

	Possible High Score	Year 1				Year 2			
		<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
		<i>(N = 11)</i>				<i>(N = 11)</i>			
Chinese Vocabulary	60	32.00	9.10	16	42	37.50	10.11	18	47
Chinese Phonological Awareness	24	19.64	4.99	7	24	18.64	3.93	13	23
Chinese Character Reading	125	37.91	20.88	6	75	50.91	22.29	9	82
English Vocabulary	228	83.30	26.64	39	112	119.00	29.98	72	154
English Phonological Awareness	20	9.18	5.17	0	18	14.18	4.42	5	19
English Word Reading	76	32.55	11.99	16	49	42.18	10.62	23	53

Research Question 3: Performance of Students From Non-Mandarin-Speaking Families

The six children who did not have a Mandarin-speaking family background formed a unique subgroup within the bilingual program. Five of them (one in SK, one in Grade 1, three in Grade 2) were adopted. The average age of adoption was 13.40 months (range = 12-16 months, $SD = 1.67$). These children were of Chinese ethnic heritage but had adoptive parents who spoke only English at home. The remaining SK student was not of Chinese ethnic origin and did not have a Mandarin-speaking family background. It is important to compare the Chinese and English language and literacy skills of these students to their peers to determine whether the bilingual program was an appropriate option for these students. Figures 1 to 3 display their performance on the Chinese and English measures by grade, in comparison to their same-age peers.

Considering the small number of students with a non-Mandarin-speaking family background, no statistical analyses were performed to examine group differences. An examination of the graphs suggests that despite the same school experience, students from non-Mandarin speaking families performed lower on the Chinese measures than those from Mandarin-speaking families. On the other hand, the two groups of students appeared to be on a par with each other on most of the English language and literacy measures.

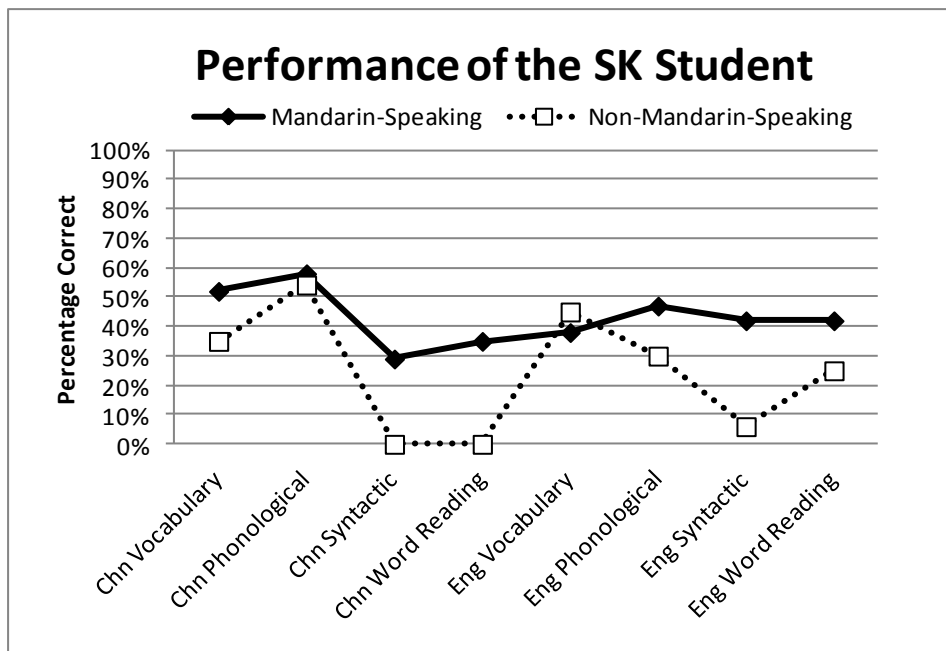


Figure 1. Performance of the SK student from a non-Mandarin-speaking family background.

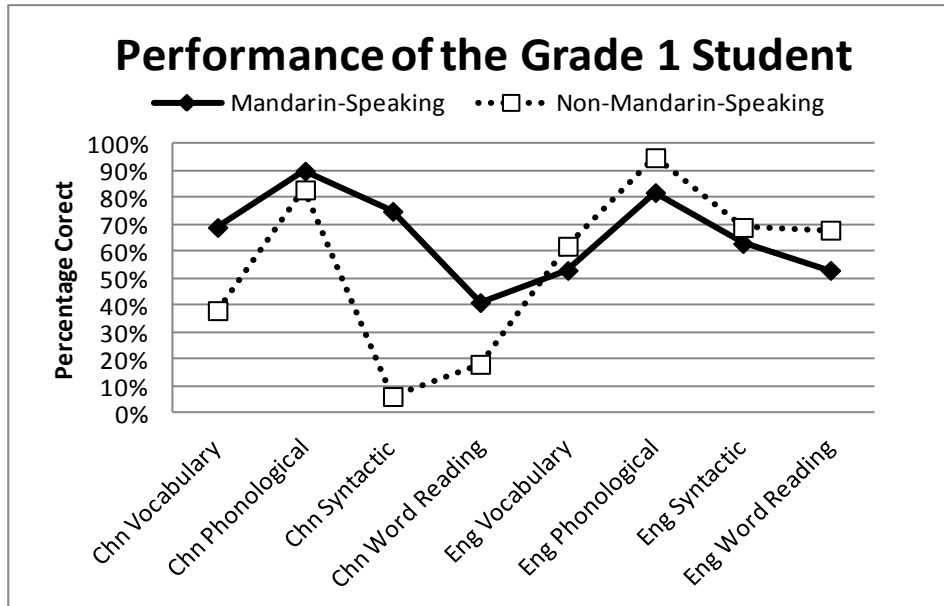


Figure 2. Performance of the Grade 1 student from a non-Mandarin-speaking family background.

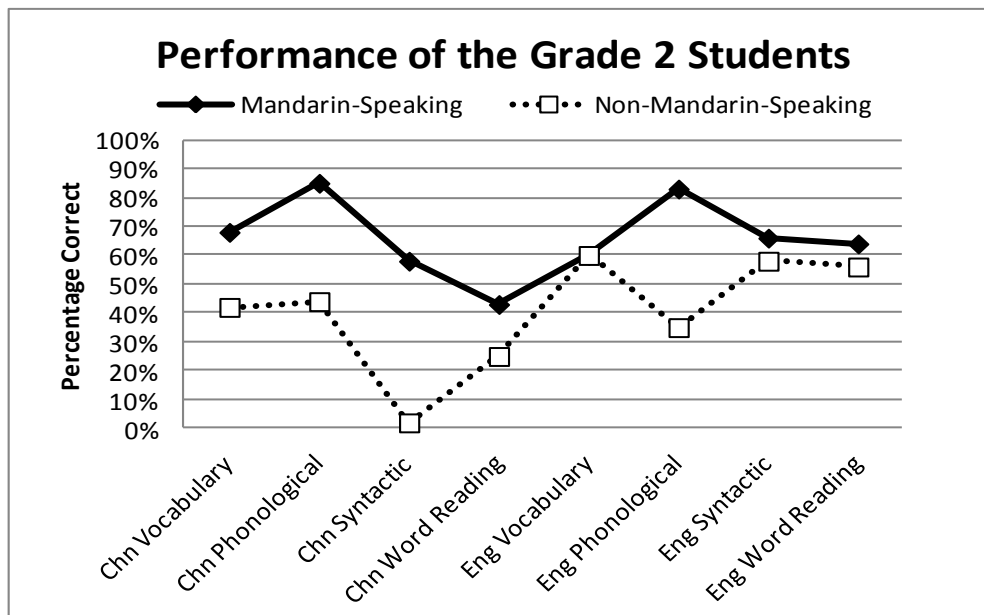


Figure 3. Performance of the Grade 2 students from a non-Mandarin-speaking family background.

Table 6

Descriptive Statistics of the Measures for the Returning Students From a Non-Mandarin-Speaking Family Background

	Year 1					Year 2			
	Possible High Score	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
			(<i>N</i> = 3)				(<i>N</i> = 3)		
Chinese Vocabulary	60	21.67	3.51	18	25	25.33	6.81	20	33
Chinese Phonological Awareness	24	17.00	6.00	11	23	10.67	9.29	3	21
Chinese Character Reading	125	15.33	14.43	7	32	31.33	14.43	23	48
English Vocabulary	228	113.00	2.00	111	115	136.00	11.53	125	148
English Phonological Awareness	20	8.00	6.56	2	15	7.00	1.73	5	8
English Word Reading	76	34.67	9.29	24	41	42.33	9.02	33	51

We also sought to determine the extent to which the students from non-Mandarin-speaking families were able to make gains in their Chinese and English skills over time. Three of the Grade 2 students with a non-Mandarin-speaking family background were returning students who had been assessed one year earlier. Their performance on the phonological awareness, word reading, and vocabulary tasks in Chinese and English are summarized in Table 6. An examination of the means indicates that the three students improved on measures of word reading and vocabulary in Chinese and English. Conversely, their performance on the Chinese and English phonological awareness tasks appears to be similar across the two years.

Research Question 4: Cross-Language Relationships Between English and Chinese Skills

In order to determine which skills were related across Chinese and English, we examined the correlations between the Chinese and English measures. Because the sample size was relatively small and our main interest was the cross-language relations between constructs rather than grade differences, all four grades were combined for the correlational analyses. Table 7 summarizes the correlation matrix.³

As shown in Table 7, Chinese measures were positively correlated with each other to varying extents. All English measures were positively and significantly correlated with each other ($p < .01$ for all measures). There are several noteworthy cross-language correlations. First, Chinese phonological awareness was significantly correlated with English word reading and vocabulary; there were also significant correlations between English phonological awareness and Chinese vocabulary. Second, Chinese and English syntactic awareness were significantly correlated with each other. Moreover, English syntactic awareness was positively correlated with Chinese vocabulary, phonological awareness, and syntactic awareness.

Table 7
Correlation Matrix of Chinese and English Measures

	1	2	3	4	5	6	7
1. Chinese Vocabulary	-						
2. Chinese Phonological Awareness	.43 [~]	-					
3. Chinese Syntactic Awareness	.87**	.64**	-				
4. Chinese Character Reading	.85**	.35	.77**	-			
5. English Vocabulary	.50*	.68**	.39	.18	-		
6. English Phonological Awareness	.56*	.75**	.52*	.35	.85**	-	
7. English Syntactic Awareness	.59*	.79**	.66**	.44 [~]	.75**	.82**	-
8. English Word Reading	.62**	.70**	.47*	.45 [~]	.92**	.89**	.81**

Note. Cross-language correlations are presented in grey highlight.

[~] $p < .10$. * $p < .05$. ** $p < .01$.

Discussion

The primary goal of this study was to explore the potential benefits of a Mandarin-English bilingual program on children's language and literacy development in the two languages in comparison to Chinese-English speaking students enrolled in regular all-

English programs in Canada. Our secondary goal was to determine whether there is evidence of cross-language transfer between English and Chinese language and literacy skills. To our knowledge, the present study represents one of the first studies to evaluate the outcomes of a Chinese-English bilingual program within the Canadian context.

Effectiveness of the Mandarin Language Bilingual Program

The first question we asked in the present study concerned whether there were significant differences between the students in the bilingual program and the comparison group on measures of Chinese and English language and literacy skills. With respect to Chinese language and literacy skills, our results indicated that the children in the bilingual program had significantly better character reading skills than the comparison group in the early elementary grades. The children in the bilingual program also achieved higher vocabulary scores, though the group difference was not significant for the kindergarten group and only approached significance for the early elementary group. Thus, it appears that receiving daily instruction in Chinese had a greater effect on character reading than receptive vocabulary for children with a Mandarin-speaking family background. Given that the students in the experimental and comparison groups had similar levels of exposure to spoken Chinese at home, additional exposure at school may not be as critical for vocabulary development. On the other hand, the students in the bilingual program received a greater amount of formal literacy instruction at school than those in regular all-English programs (50% of instructional time everyday vs. 2.5 hours weekly in Chinese heritage language classes), which in turn led to better character recognition. In light of the current findings, future research should explore the interaction between children's home literacy environment and school instruction.

With respect to English language and literacy skills, our results showed similar English word reading abilities across the experimental and comparison groups. Moreover, when compared with monolingual English-speaking students using the standardized scores of the English measures, the children in the bilingual program scored approximately one standard deviation above the age expectations on English phonological awareness and English word reading, and within the average range on English vocabulary. These findings suggest that although the bilingual program provided less academic instruction in English than an all-English program, the students in the bilingual program demonstrated English abilities that are similar to, and at times better than, their monolingual English-speaking counterparts.

We found that the kindergarten students in the bilingual program outperformed their peers on Chinese phonological awareness, while the early elementary students in the bilingual program exhibited stronger English phonological awareness than their comparison group. These findings are consonant with those reported by Chen et al. (2010), who demonstrated that the students in a Chinese-English bilingual program in China developed phonological awareness in both languages more quickly than the students who received instruction primarily in Chinese. Taken together, the results suggest that Chinese children's development of phonological awareness is accelerated through cross-language transfer between Chinese and English (e.g., Bruck & Genesee, 1995; Chen et al., 2010; Kuo & Anderson, 2010).

To address our second research question, we explored the developmental changes over one year for the returning students in the bilingual program. Overall, these students

demonstrated growth in both Chinese and English language and literacy skills. This finding, convergent with the findings described above, indicates that the bilingual program was effective in developing students' skills in both languages. The only exception was the performance on the Chinese phonological awareness task, which did not improve over one year. However, this is likely due to the fact that the average score on phonological awareness in Year 1 was already approaching ceiling (82%).

Taken as a whole, our findings suggest that students in the Mandarin language bilingual program were able to make greater gains in their Chinese skills than the comparison group, without detriment to their English skills. This is consistent with research examining other bilingual programs (e.g., Bae, 2007; Genesee, 2004; Slavin & Cheung, 2005; Thomas et al., 1993), and adds to the current literature supporting the benefits of bilingual instruction. Moreover, the finding that the children were able to develop strong language skills over time through the bilingual program endorses the pedagogical approach of integrating language and academic instruction, where language learning is fostered through completing authentic tasks in addition to direct instruction of language skills (Genesee, 2004; Wesche, 2002).

Students From Non-Mandarin-Speaking Families

The third goal of this study was to determine whether the bilingual program was a viable teaching model for students who did not speak Chinese at home. Results suggest that their English skills were in general at par with the students from Chinese-speaking families, but that they were progressing more slowly in Chinese skills. The differences in Chinese language proficiency are expected, considering that the students from English-speaking families did not have exposure to Chinese outside of school. These findings also concur with those reported in studies of two-way immersion programs, whereby students tend to demonstrate a “native language effect”—in other words, despite being proficient in both languages taught in the program, students are generally stronger in their first language than in their second language (e.g., Howard, Christian, & Genesee, 2004; Lindholm-Leary, 2001). The encouraging finding in the present study was that the students from English-speaking families were making significant gains in Chinese as well as in English over time. Therefore, the Mandarin language bilingual program appears to be an appropriate option for students who do not speak Chinese at home.

Cross-Language Relations

Our last research goal concerned the cross-language relations between phonological awareness, syntactic awareness, and literacy skills in English and Chinese. Several important cross-language correlations were found in the present study. Chinese and English phonological awareness were significantly correlated. In addition, Chinese phonological awareness was associated with English word reading. These results concur with those from previous studies of Chinese-English bilingual children (e.g., Chen et al., 2010; Gottardo et al., 2001; Marinova-Todd et al., 2010; Yan et al., 2005), and add to the corpus of literature substantiating that phonological awareness is a universal construct that transfers across languages (e.g., Genesee, Geva, Dressler, & Kamil, 2006; Koda, 2007).

On the other hand, the correlation between English phonological awareness and Chinese character reading was not statistically significant. While this may suggest that the

transfer of phonological awareness is unidirectional, it is important to note that Chinese character reading also was not significantly correlated with Chinese phonological awareness. In fact, findings on the association between phonological awareness and Chinese character reading have been mixed. While a number of previous studies have demonstrated significant relations between the two constructs (e.g., Ho & Bryant, 1997a, 1997b; Hu & Catts, 1998; McBride-Chang et al., 2008), there is some evidence that other skills, such as morphological awareness and visual-orthographic skills, play more important roles in Chinese reading due to the logographic nature of the Chinese writing system (e.g., Luo, 2013; Tong & McBride-Chang, 2010). Therefore, our findings need to be replicated by future studies that adopt a more extensive reading model.

A novel finding in our study is that Chinese and English syntactic awareness were significantly correlated with each other. This cross-language relation is similar to those reported among Spanish-English and French-English bilinguals (i.e., Durgunoğlu et al., 2002; Lam et al., 2012), thus providing converging evidence for the transfer of syntactic awareness. More importantly, because the syntactic structures of Chinese and English are substantially different, our current findings lend preliminary support to the hypothesis that children's awareness of the internal syntactic structure of sentences is related across languages at the metalinguistic level, beyond an overgeneralization of syntactic rules (Foursha-Stevenson & Nicoladis, 2011; Lado, 1957). In other words, students who are sensitive to the sentence structures in one language may demonstrate similar sensitivity in their other language.

In the present study, we additionally found that Chinese syntactic awareness was significantly associated with English word reading, whereas the link between English syntactic awareness and Chinese word reading approached significance. English syntactic awareness was also significantly correlated with Chinese receptive vocabulary. To the extent that these findings suggest a cross-language relation between syntactic awareness and reading skills they should be interpreted with caution, as relations between syntactic awareness and reading skills may be mediated by other reading-related skills such as phonological awareness and vocabulary (e.g., Cain, 2007; Gottardo, Stanovich, & Siegel, 1996). Unfortunately, the small sample size in the present study did not allow us to test the unique contribution of syntactic awareness to reading. As a result, future research examining cross-language relations between syntactic awareness and reading outcomes needs to take into account the effects of other related skills.

Directions for Future Research

The present study represents a first step in understanding the literacy development of children enrolled in a Chinese-English bilingual program in the Canadian context. As the Mandarin language bilingual program was still at its early stage when the present study was conducted, the sample size was small despite the fact that all children in the program participated in the study. Given our modest sample size, care should be taken to interpret non-significant findings, as they may not provide strong evidence for no difference. Additional research with larger samples is essential to examine the benefits of Chinese-English bilingual programs in the Canadian context. It is also important to replicate our findings with regard to cross-language associations through more complex statistical models such as hierarchical linear regressions or structural equation modeling.

At the time of the present study, the bilingual program only offered programming until Grade 2, thus precluding us from examining the language and literacy development of students in higher grades. Future studies should involve students from middle and upper elementary grades to gain a better understanding of the program's effectiveness over time. Our results also need to be replicated with bilingual programs of other language combinations (e.g., Arabic-English, German-English). Lastly, because the participants of the current study came from high socioeconomic status (SES) families, it remains to be seen whether the current findings can be generalized to children from low SES families. Future studies should therefore examine students from a wide range of SES family backgrounds.

Conclusion

In summary, our analyses yielded several noteworthy findings that contribute to our understanding of the benefits of bilingual programs for children in Canada. First, the students in the Chinese-English bilingual program were able to achieve higher levels of Chinese language and literacy proficiency than the students in regular all-English programs. Thus, the Chinese instruction provided in the bilingual program is effective and beneficial for Chinese development. Second, the students in the bilingual program had comparable and sometimes slightly higher levels of English proficiency than those in the comparison group. This finding suggests that increasing Chinese instruction poses no cost to bilingual children's English development. In fact, it may even facilitate English development through cross-language transfer. Another important finding was that students who did not speak Chinese at home made significant progress in both languages over time, suggesting that the bilingual program is beneficial for students regardless of their home language backgrounds. Lastly, the many positive correlations between the Chinese and English measures suggest that learning two languages simultaneously may facilitate the development of both through cross-language transfer. Thus, it appears to be a win-win situation for students to participate in the Mandarin language bilingual program with respect to literacy achievement. In view of the rapidly increasing number of immigrant students in Canada with Mandarin-speaking backgrounds, our findings indicate that Chinese-English bilingual programs are a viable education option for students and families who wish to maintain their heritage language while gaining competence in English.

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Notes

¹ At the time of the present study, there were only 26 students enrolled in the Mandarin language bilingual program. In other words, all children from the program participated in the present study.

² The data of the three children who have been in the program for two consecutive years but did not have a Mandarin-speaking family background are excluded from Table 2 but are reported separately under Research Question 3.

³ The six students who do not have a Mandarin-speaking family background were excluded due to the systematic difference between them and students with a Mandarin-speaking family background.

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