

English-French bilingual children's phonological awareness and vocabulary skills

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This study examined the relationship between English-speaking children's vocabulary skills in English and in French and their phonological awareness skills in both languages. Forty-four kindergarten-aged children attending French immersion programs were administered a receptive vocabulary test, an expressive vocabulary test and a phonological awareness test in English and French. Results showed that French phonological awareness was largely explained by English phonological awareness, consistent with previous findings that phonological awareness skills transfer across languages. However, there was a small unique contribution from French expressive vocabulary size to French phonological awareness. The importance of vocabulary skills to the development of phonological awareness is discussed.

Cette étude porte sur la relation entre le vocabulaire anglais, le vocabulaire français et la conscience phonologique des enfants bilingues de langue maternelle anglaise. On a administré, en anglais et en français, à 44 enfants d'âge préscolaire inscrits en immersion française un test de vocabulaire réceptif, un test de vocabulaire expressif, ainsi qu'un test mesurant leur conscience phonologique. Les résultats indiquent que la conscience phonologique de ces élèves, en anglais et en français, s'explique largement par leur conscience phonologique en anglais, confirmant ainsi les résultats d'études antérieures qui avaient démontré la transférabilité de la conscience phonologique d'une langue à l'autre. Toutefois, on a observé que le vocabulaire expressif en français contribue de façon limitée mais significative à la conscience phonologique en français. Une discussion est menée sur l'importance du vocabulaire de l'enfant dans le développement de sa conscience phonologique.

Introduction

Phonological awareness refers to the awareness of subcomponents of speech. This ability is usually indexed by a variety of tasks which require the listener to manipulate a certain subcomponent of speech. The subcomponent that is most frequently targeted by these tasks is the phoneme (e.g., Tunmer and Rohl,

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1991). However, other sub-syllabic units such as onsets and rhymes can be targeted (e.g., Treiman, 1983, 1985), and sometimes the assessment tasks target both syllabic and sub-syllabic units (Morais, 1991a, 1991b). Manipulation of these subcomponents of speech could include matching, deletion or substitution of the phoneme or the rhyme, for example. Children as young as four years old in English-speaking countries exhibit emerging phonological awareness for syllable and rhyme units (Dodd and Gillon, 2001). By the end of first grade, most seven-year-old English-speaking children can complete phoneme deletion tests (Liberman, Shankweiler, Fischer and Carter, 1974). These results demonstrate that phonological awareness begins to emerge during the preschool years. Young children tend to perceive words more globally, while older children can attend to smaller speech units such as phonemes (Liberman *et al.*, 1974; Studdert-Kennedy, 1987; Walley, 1993).

Children's vocabulary skills have been found to be correlated with the development of phonological awareness. This correlation has been reported in monolingual three-year-old (Chaney, 1992), four-year-old (Metsala, 1999; Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg and Poe, 2003), and five-year-old children (Metsala, 1999). Longitudinally, phonological awareness at three-and-a-half years of age can be predicted from receptive and expressive vocabulary skills tested between 14 and 26 months of age (Puolakanaaho, Poikkeus, Ahonen, Tolvanen and Lyytinen, 2004). These studies have shown that vocabulary skills play a role in children's developing awareness of subcomponents in speech.

A hypothesis of how vocabulary skills are related to phonological awareness is put forward by Metsala and Walley (1998), who proposed that vocabulary growth during the preschool years prompts a process of change in children's lexical representations from holistic, global representation toward finer, segmental representation of words, which leads to better awareness of phoneme-sized units in speech. Metsala (1999) studied how different word characteristics, such as lexical status and word familiarity, affect children's performance on phonological awareness tests. Four-, five-, and six-year-olds performed better at isolating the initial phoneme in real words, compared to pseudowords. They also performed better for early-acquired words, compared to late-acquired words. Three- and four-year-old children performed phoneme blending tasks better when the target words (e.g., *cat*) were selected from dense neighbourhoods, meaning that there are many similar-sounding words in the target's lexical neighbourhood (e.g., *bat, hat, kite, cop*); when the target word was selected from a sparse neighbourhood, meaning that it has few similar-sounding neighbours, the children had more difficulty with the phoneme blending task. Metsala and Walley (1998) proposed that the pressure of increasing vocabulary triggers the need to restructure global lexical representations to a

more segmentalized form in order to accommodate more and more words acquired throughout preschool years. This lexical restructuring hypothesis has been supported by correlations between vocabulary skills and phonological awareness, reported from three to five years of age mentioned previously (e.g., Chaney, 1992; Dickinson *et al.*, 2003; Puolakanaho *et al.*, 2004). However, little is known if different lexical status in late bilingual children's first and second language would affect their phonological awareness in their two languages.

Many studies have been concerned with the extent to which language and reading skills transfer from a child's first language (L1) to the child's second language (L2). For example, Durgunoglu and colleagues (Durgunoglu, Nagy and Hancin-Bhatt, 1993) studied the word reading skills of first grade Spanish-speaking children who were learning to read in English. They reported that phonological awareness and word reading in Spanish each predicted word reading in English. They suggested that L1 skills facilitate L2 reading acquisition. This finding of cross-linguistic transfer of phonological awareness skills has been replicated many times for alphabetic languages (e.g., Durgunoglu *et al.*, 1993; Cisero and Royer, 1995; Dickinson, McCabe, Clark-Chiarelli and Wolf, 2004) and between non-alphabetic and alphabetic languages (e.g., Chiang, 2002; Wang, Perfetti and Liu, 2005). Chiang (2002) reported a positive correlation between phonological awareness in Chinese and in English as assessed in Chinese-speaking kindergarten-aged children with limited experience in English. Wang *et al.* (2002) examined Chinese and English reading skills of Grade 2 and Grade 3 Chinese-speaking children who were attending primary schools in Washington, DC. They found that Chinese tone processing skills significantly predicted English pseudoword reading and that Chinese onset matching skill was correlated with English onset and rhyme matching performance.

To summarize, studies of bilingual children indicate that phonological awareness in one language predicts phonological awareness and reading skills in another language. Cross-linguistic transfer of phonological awareness abilities has been attributed to language-general elements of the phonological awareness tasks across a variety of domains including shared auditory, perceptual, cognitive, attentional and metalinguistic demands. Transfer may also be attributed to shared language-specific elements, depending on the extent to which the languages are similar in the phonological and orthographic domains (Wade-Wooley, 1999; Wade-Wooley and Geva, 2000).

Although L1 and L2 processing undoubtedly involves a number of shared skills, linguistic knowledge across the two languages obviously differs in late second language learners. From the perspective of Metsala and Walley's (1998) lexical restructuring hypothesis, these differences in linguistic knowledge should

impact phonological awareness performance in the two languages. Phonological representations for L2 words should be less mature than phonological representations for L1 words because they were acquired at a later age and are less familiar to the child. Furthermore, L2 vocabulary size is smaller and the lexical neighbourhoods for L2 words may be less dense on average in comparison with words in the L1 lexicon. Nonetheless, vocabulary size in L1 is expected to have an effect on L2 phonological awareness skills as a consequence of its role in promoting language-general skills such as the ability to attend selectively to the phonological characteristics of words. Vocabulary size in the L2 should also have an effect on L2 phonological awareness however because of the word-specific nature of the lexical restructuring process. The purpose of the present study was to assess this hypothesis in English-speaking children attending French immersion schools in Montreal, Quebec.

Method

Participants

The recruitment plan was approved first by a regional school board that services the English-speaking community in a large metropolitan area in the province of Quebec, a jurisdiction in which French is the dominant and official language. Subsequently, approval was obtained from the principals and governing boards of 11 individual schools within this school board. A notice of the study was sent home by kindergarten teachers, informing parents that they could contact the researchers if they were interested in volunteering their child's participation in a study that concerned the pre-reading skills of children in English and in French. Fifty-eight English-speaking children attending French immersion kindergartens were recruited for participation in this study. By law, children can attend schools in English school districts only if at least one parent was educated in English in Canada. Children from these schools were all exposed to English from birth, most being unilingual Anglophone but some being simultaneous bilinguals. The language of instruction in these French immersion kindergartens was, in principle, 100% French. Fourteen children were not able to complete the testing due to scheduling difficulties. The final sample comprised 20 boys and 24 girls who completed all of the required tests. These children did not have any known disabilities in hearing, motor control, language or cognition, according to parent report. The mean age of these children was 73 months, ranging from 67 months to 81 months. According to the language background questionnaire, 38 mothers and 40 fathers used English more than 75% at home. Two mothers reported that they used French more than 75% at home, but all fathers were primarily English-speaking. In order to have a wide range of vocabulary skills in English and French (as is required for valid application of the statistical analysis applied

below), these two simultaneous bilingual children with French-speaking mothers were not excluded from the study. The average of maternal education was 15.64 years, ranging from 11 to 22 years. The children were tested at the end of the kindergarten year, from April to August before they entered Grade 1. This means that the children had attended French immersion kindergarten five full days per week for eight to ten months prior to testing. Some of the children had also attended French immersion preschools.

Materials

Two vocabulary tests and one phonological awareness test in English and in French were administered to the children. The three English tests were the Peabody Picture Vocabulary Test Third Edition (PPVT-III; Dunn and Dunn, 1997), the Expressive One Word Picture Vocabulary Test (EOWPVT-II; Gardner, 1990), and the Auditory Analysis Test (AAT; Rosner and Simon, 1971). The PPVT-III is a standardized test measuring receptive vocabulary size. It requires the children to point to the corresponding picture while the target word is given. The EOWPVT is also a standardized test in which the child has to name the picture. The 1990 version of the EOWPVT in English was used because the most current French version was adapted from this older version of the English test. The AAT test is composed of 40 items in which the subject has to delete a certain phoneme or syllable from a word. Due to the young age of the children and the difficulty level of the final items, only the first 24 items were administered. Among these 24 items, two required deletion of a syllable, 20 required deletion of a singleton phoneme and two required deletion of a whole cluster. Deletions were required from the beginning, middle or end of the word. These items were recorded by a female English native speaker and presented one at a time with PowerPoint slides on a laptop.

On a separate day, the French versions of these three tests were administered. They were respectively the Échelle de Vocabulaire Image Peabody (ÉVIP; Dunn, Theriault-Whalen and Dunn, 1993), a French version of the Expressive One Word Picture Vocabulary Test (EOWPVT-F), and the Test d'Analyse Auditive en Français (TAAF; Cormier, MacDonald, Grandmaison and Ouellet-Lebel, 1995). The TAAF items, including 10 deletions of a syllable and 14 deletions of a phoneme from a word, were recorded by a female native speaker of French and presented one at a time with PowerPoint slides on a laptop. Formal normative data are available for the ÉVIP and the TAAF. The EOWPVT-F was administered using the original visual stimuli for the English version as published in 1990, but reordered to reflect item difficulty data for Quebec Francophone children. Normative data by grade level were obtained from the Ordre des Orthophonistes et Audiologistes du Québec.

Procedures

Participants were assessed in a quiet room by a graduate student who spoke both English and French. Parents were given the consent form and a questionnaire about their language background and language uses at home. Participants then completed three English tests, with the order being the PPVT-III, EOWPVT and AAT. The examiner gave all the instructions in English. The PPVT-III and the EOWPVT were administered by the examiner in accordance with the published test manuals. The PPVT-III responses were recorded live by the examiner in the test booklet while responses to the EOWPVT were audio-recorded. For the last test, the AAT, the child was asked to sit comfortably in front of a laptop while wearing headphones. The child was instructed to respond according to the computer's instructions. A new PowerPoint slide with two audio files was presented for each test item. The examiner would present the first audio file, which instructed, for example, "Say the word block." The child was expected to say the required word. Then, the examiner would present the second audio file, which instructed, for example, "Say the word again without /b/." The examiner transcribed the child's response phonetically in the test booklet and then provided verbal praise for responding but no information about the accuracy of the child's response. The PowerPoint slides were used to present audio files as well as visual information to the child about the number of items that had been completed and the number of items remaining. The child's responses to the AAT were also audio-recorded. The session lasted about 45 to 60 minutes.

About one week later, the three French tests were administered in another session lasting approximately 30 to 45 minutes. Greetings and instructions were all given in French. However, if the child failed to understand the instructions in French, English instructions would be given. The three French tests were administered using the same procedures as described above for the English test session. A report of the child's performance on these tests was given to the parent and the child received a certificate (a "Child Scientist Degree") and a toy.

Results

The children obtained similar raw scores on the English (AAT) and the French (TAAF) phonological awareness tests. Among vocabulary measures, the children's PPVT-III standard scores ranged from 91 to 131, indicating L1 receptive vocabulary abilities within or above normal limits for all children. In contrast, the standard scores on the ÉVIP ranged from 49 to 141, with 82% of this sample scoring below the normal limits for receptive vocabulary size, in relation to the published norms for monolingual French-speaking children. Percentile ranks obtained on the EOWPVT-E ranged from 34 to 99, excepting a percentile

Table 1: Mean (M) and standard deviation (SD) of raw and standard scores by test

Tests ^a	Raw Scores		Standard Scores ^b	
	M	SD	M	SD
AAT ^c	10.31	6.09	1.94	1.75
TAAF	10.70	4.83	0.71	0.90
PPVT-III	95.11	12.80	111.32	9.81
ÉVIP	35.02	21.46	73.52	21.00
EOWPVT-E	69.77	10.79	71.95	22.30
EOWPVT-F	15.07	15.17	10.04	20.44

Notes:^a*N* = 44^bStandard scores are based on a mean of 100 and a standard deviation of 15 for all tests except the EOWPVT-E and EOWPVT-F for which percentile ranks and their SD are reported in the corresponding columns.^cAAT = Auditory Analysis Test; TAAF = French version of Auditory Analysis Test; PPVT-III = Peabody Picture Vocabulary Test — Third Edition; ÉVIP = French version of Peabody Picture Vocabulary Test; EOWPVT-E = Expressive One Word Picture Vocabulary Test — English; EOWPVT-F = Expressive One Word Picture Vocabulary Test — French

rank of 10 from one child who scored below normal limits on this expressive vocabulary test. Percentile ranks for French expressive vocabulary ranged from below the fourth percentile to the ninetieth percentile, with 89% of the sample scoring below normal limits on this test when compared to the performance of children who speak French as their first language. The mean and standard deviation of the children's standard scores and raw scores on all six tests are shown in Table 1.

The role of vocabulary skills in the development of phonological awareness in English and in French was examined using two kinds of analyses, hierarchical multiple regression analysis and path analysis. Prior to performing these analyses, the distributions of raw scores for each measure were examined for normality. Log transformation of the scores for the French expressive vocabulary measure was required to ensure normality but the raw scores were normally distributed for the remaining measures. Furthermore, two of the 264 scores obtained were removed from the analyses because they were more than three standard deviations from the mean for the variable in question. All analyses below were conducted with the raw scores for the AAT, TAAF, PPVT-III, ÉVIP, and EOWPVT-English tests and the log transformed scores for the

Table 2: Correlations among age (1) and measures of phonological awareness (2. AAT, 3. TAAF), receptive vocabulary (4. PPVT-III, 5. ÉVIP), and expressive vocabulary (6. EOWPVT-E, 7. EOWPVT-F)

	1	2	3	4	5	6	7
1. age ^a	—	.38	.28	.10	.39	.15	.51
2. AAT ^b		—	.73** ^c	.28	.21	.38* ^d	.11
3. TAAF			—	.32	.20	.27	.32*
4. PPVT-III				—	-.24	.56**	-.12
5. ÉVIP					—	-.05	.60**
6. EOWPVT-E						—	-.24
7. EOWPVT-F							—

Notes:

^a*N* = 44

^bAAT = Auditory Analysis Test; TAAF = French version of Auditory Analysis Test; PPVT-III = Peabody Picture Vocabulary Test — Third Edition; ÉVIP = French version of Peabody Picture Vocabulary Test; EOWPVT-E = Expressive One Word Picture Vocabulary Test — English; EOWPVT-F = Expressive One Word Picture Vocabulary Test — French

^c***p* < .01, two-tailed.

^d**p* < .05, two-tailed.

EOWPVT-French. The sample size is 43 for the ÉVIP and the EOWPVT-English, and 44 for the remaining variables.

Table 2 shows the Pearson correlation coefficients for the six measures. This table indicates that raw scores on the English and French phonological awareness tests were significantly correlated with each other. However, receptive vocabulary scores on the English and French tests were not significantly correlated. Similarly, expressive vocabulary scores on the English and French tests were not significantly correlated. English receptive vocabulary scores were significantly correlated with English expressive vocabulary as was French receptive and expressive vocabulary performance.

All analyses below were conducted with the raw scores for the AAT, TAAF, PPVT-III, ÉVIP and EOWPVT-English tests, and the log transformed scores for the EOWPVT-French. The sample size is 43 for the ÉVIP and the EOWPVT-English, and 44 for the remaining variables. None of these variables was significantly correlated with age, and thus age was not partialled from these scores before performing the hierarchical multiple regression analyses or the path analysis that is reported on below.

The results of the regression analyses are shown in Table 3. Regression 1 indicates that English expressive vocabulary explained 14% of variance in English phonological awareness [$F(1,41) = 6.71, p = .013$] while the English receptive vocabulary score did not explain additional unique variance

Table 3: Summary of hierarchical regression analyses for predicting English (AAT) and French (TAAF) phonological awareness

Dependent Variable and Step	R^a	ΔR^2	ΔF	P
Regression 1: AAT ^b				
EOWPVT-E	.38	.14	6.71	.01* ^c
PPVT-III	.40	.02	.81	.38
Regression 2: TAAF				
EOWPVT-F	.32	.10	4.56	.04*
ÉVIP	.32	.00	.01	.93
Regression 3: TAAF				
EOWPVT-E	.73	.53	47.59	.00*
EOWPVT-F	.77	.06	5.58	.02*

Notes:

^a R = correlation coefficient; ΔR^2 = change of R square; ΔF^2 = change of F.

^bAAT = Auditory Analysis Test; TAAF = French version of Auditory Analysis Test; PPVT-III = Peabody Picture Vocabulary Test — Third Edition; ÉVIP = French version of Peabody Picture Vocabulary Test; EOWPVT-E = Expressive One Word Picture Vocabulary Test — English; EOWPVT-F = Expressive One Word Picture Vocabulary Test — French

^c* $p < .05$, two-tailed.

in English phonological awareness. Regression 2 shown in Table 3 reveals that French expressive vocabulary explained 10% of variance in French phonological awareness [$F(1,41) = 4.56, p = .039$], but French receptive vocabulary did not explain additional unique variance. In the final regression analysis, Regression 3, English phonological awareness explained a significant 53.1% of the variance in French phonological awareness [$F(1,42) = 47.59, p < .001$], and the French expressive vocabulary score explained another small but significant 5.6% of variance [$F(1,41) = 5.58, p = .023$]. French expressive vocabulary is the only variable that explains variance in French phonological awareness over and above the variance explained by English phonological awareness.

The relationships among these variables are further illustrated by the path model shown in Figure 1. AMOS 5 (Arbuckle, 1999) was used to assess the fit of the path model to the observed covariances among variables. The input was in the form of raw data and the method of estimation was maximum likelihood. Two fit statistics are reported: the chi-square statistic with the associated degrees of freedom and probability value (larger p values indicate better fit) and the Comparative Fit Index (CFI; values closest to 1.00 indicate the best fit). The model shown in Figure 1 explains 57% of the variance in French phonological awareness and has good fit ($\chi^2(10) = 13.06, p = .220$; CFI = .96). All beta weights (β) shown are statistically significant at the .05

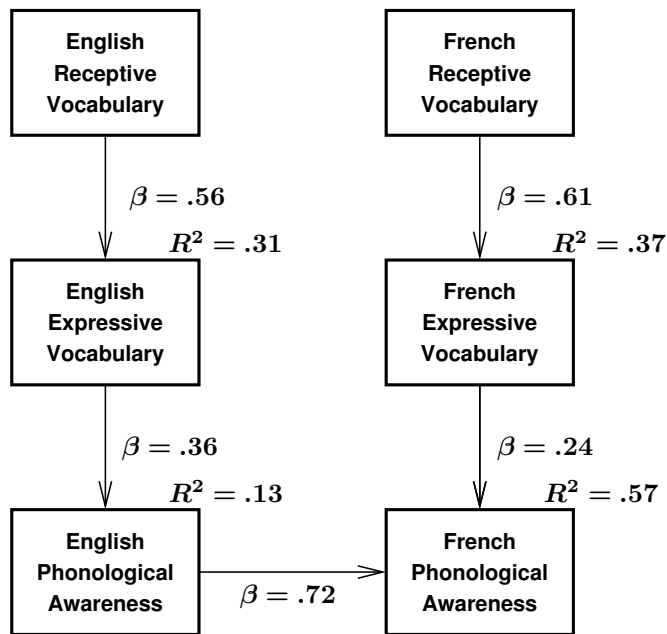


Figure 1: A path-analytic model: Relationships among receptive vocabulary, expressive vocabulary and phonological awareness in English and in French

level. In this model, English receptive vocabulary explains 31% of variance in English expressive vocabulary, which accounts for 13% of variance in English phonological awareness. French receptive vocabulary explains 37% of variance in French expressive vocabulary. French expressive vocabulary along with English phonological awareness together explain 57% of variance in French phonological awareness. No other linkages among variables yield statistically significant beta weights.

Discussion

The purpose of this study was to examine the cross-linguistic relationships between vocabulary skills and phonological awareness skills in English-speaking children who were learning French in French immersion kindergartens. The results replicated previous reports of transfer of phonological awareness skills from the L1 to the L2. On the basis of the lexical restructuring hypothesis, it was further expected that L2 vocabulary size would also contribute to the acquisition of L2 phonological awareness. The results of the study were consistent with these expectations. English phonological awareness explained the

largest part of variance in French phonological awareness skills, but the children's expressive vocabulary size in French explained additional unique variance in French phonological awareness.

The findings support the lexical restructuring hypothesis and underscore the importance of vocabulary development to the development of phonological awareness skills, which has been found as a strong predictor to early reading ability (Gillon, 2004 for a review). Research with monolingual children indicates that oral language skills impact on reading acquisition via two distinct paths. In the early stages, oral language skills support phonological awareness which in turn has a direct effect on the acquisition of decoding abilities. When decoding skills are established, oral language skills take on a primary role in Grade 3 and Grade 4 children's comprehension of text (Storch and Whitehurst, 2002).

The results indicate that expressive vocabulary skills explained unique variance in phonological awareness performance, over and above that explained by receptive vocabulary size. This may be because expressive vocabulary size reflects both the size of the child's lexicon as measured by the receptive vocabulary test and the child's ability to produce words in the lexicon. The phonological awareness tasks used in this study required that the child articulate parts of words after mentally deleting phonemes or syllables from the complete word representation. Many researchers (e.g., Studdert-Kennedy, 1987; Locke, 1988; Stemberger, 1992) suggest that a child's own speech production helps the child to analyze and organize speech sounds more explicitly. Empirical studies demonstrating a link between articulation and phonological awareness may serve as evidence as to how articulation and phonological awareness are correlated (Webster and Plante, 1995; Thomas, 1997; Carroll, Snowling, Hulme and Stevenson, 2003). Thomas (1997) investigated the articulation and phoneme awareness of the phoneme /r/ in three-year-old typically developing children longitudinally and presented a model linking articulation and phonological representation. Similarly, Webster and Plante (1995) assessed the productive phonological ability of three-year-old children, and they found that children with more impaired productive phonology scored lower in phonological awareness than those with more standard articulation patterns. Carroll *et al.* (2003) also reported that accuracy of articulation obtained from children aged four years old predicted a unique variance in the phonological awareness measured at the end of four years of age. These results imply that a child's effort in making the expressive vocabulary as correct as possible may help their phonological representations become more mature and segmentalized, thus improving their phonological awareness scores.

Implications

The results of this study demonstrate that phonological awareness in the second language is largely explained by the maturity of phonological awareness in the first language. This result highlights the importance of home literacy development for children who are learning a second language, such as non-English speaking children learning English in North America or English-speaking children learning French in Quebec, Canada. There is a general consensus in bilingual education that parents and children be encouraged to use their first language at home, which is usually a minority language in the larger community (e.g., Light, 1997 for a review). Many studies in North America have shown that oral language skills in a minority language are closely related to oral language and reading skills in English (e.g., Cummins, 1991). The consistent finding of cross-language transfer of phonological awareness and decoding skills further suggests that parents should be encouraged to promote their child's language and literacy skills at home even when they are not fluent in the language of instruction at their children's schools. Many studies have shown that shared reading by parents and children contributes to both oral language and phonological awareness skills even before school entry (e.g., Senechal and LeFevre, 2002).

Second, the finding that expressive vocabulary size in the second language contributes to the development of L2 phonological awareness skills points to the importance of directly addressing vocabulary development in kindergarten classrooms. Chiappe, Siegel and Wade-Wooley (2002) pointed out that minority language children quickly catch up to the majority in areas that are targeted in the curriculum, specifically letter knowledge, decoding and spelling. However, these children's ability to speak and comprehend the second language learned at school lags behind their peers for many years. They suggest that children who are learning English as a second language at school may benefit from more formal instruction in vocabulary and syntax. Biemiller and Boote (2006) emphasize the importance of teaching vocabulary for disadvantaged children regardless of their language background. Furthermore, these authors demonstrated that repeated readings of storybooks can be used to improve vocabulary knowledge of children in the primary grades, especially when teachers provide explanations of the meanings of new words. Although not investigated as an outcome in the Biemiller and Boote (2006) study, it seems likely that effective vocabulary teaching might also serve to improve phonological awareness and decoding skills in the early grades and reading comprehension in the later primary grades.

Limitations of the study

The primary limitation of the study is the small sample size. Replication of the results would enhance confidence in the findings. The generalizability of the results is also limited by the particular nature of the sample. Specifically, the sample was comprised of English-speaking children attending French immersion schools located in relatively high-income neighbourhoods. Replication of the results in different contexts would enhance confidence in the validity of the findings. In particular, it would be interesting to investigate the contribution of L2 vocabulary knowledge to L1 phonological awareness when the L1 and L2 are less similar with respect to phonological structure than is the case for English and French. It seems possible that the child's developing L2 vocabulary knowledge might play an even greater role in these circumstances.

The validity of studies that employ regression analyses are fully dependent upon the reliability and validity of the measures employed. In this study we had access to valid and parallel measures of receptive vocabulary in both English and French (the PPVT-III and the ÉVIP). On the other hand, we were forced to rely on an adaptation of an outdated version of an English expressive vocabulary test in order to test expressive vocabulary skills in French. Consequently, we also used the older version of the English expressive vocabulary test from which the French version was adapted in order to test English expressive vocabulary. These tests may have underestimated vocabulary knowledge due to unfamiliarity with some of the items (e.g., typewriter). Our results suggest that expressive vocabulary is more closely related to phonological awareness skills than receptive vocabulary but replication of this finding would increase confidence in the result. Further study of the language and literacy development of children attending French immersion schools requires the development of new measures of French language acquisition that have been normed and validated in Canadian schools (Desrocher and Saint-Aubin, 2003). In the meantime, the respective roles of receptive vocabulary knowledge versus expressive vocabulary knowledge could be investigated further in Spanish-English contexts given the increasing availability of valid test materials for the North American Spanish-speaking population.

Finally, it is noted that while LSE modeling allows the investigator to identify the most likely causal models of relationships among variables, causality is best determined through experimental investigations. The model shown in this study to have good fit to the data suggests that increases in the size of the L2 lexicon have a direct causal impact on the child's emerging phonological awareness skills in the second language. Bilingual education offers an opportunity to test this proposed causal pathway directly, by randomly assigning children in French immersion classrooms to receive an intervention that focuses either on the development of expressive vocabulary skills or on the

teaching of explicit L2 code-related skills, comparing outcomes for each intervention to outcomes for a control group that receives the regular kindergarten curriculum.

Conclusion

In this study, L2 phonological awareness skills were jointly predicted by L1 phonological awareness and L2 expressive vocabulary skills. The results suggest that efforts by families to support the acquisition of L1 vocabulary and phonological awareness skills might facilitate their child's phonological awareness in L2. The results also suggest that L2 oral language skills should be targeted at school alongside specific teaching of code-related skills such as letter knowledge and phonological awareness. Intervention studies are required to test these hypotheses. Similar investigations with other language groups, especially languages that are less similar in their phonetic characteristics than English and French, would also be a valuable direction for future research.

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