Vocabulary profiles and reading comprehension in young bilingual children

Christie Fraser
christie.fraser@utoronto.ca
OISE — UNIVERSITY OF TORONTO

Alexandra Gottardo
WILFRID LAURIER UNIVERSITY

Esther Geva
OISE — UNIVERSITY OF TORONTO

Abstract

Strong vocabulary knowledge is important for success in reading comprehension for English language learners (ELLs). The interplay between first (L1) and second language (L2) vocabulary knowledge in L2 English reading comprehension was examined to determine whether ELLs, whose command of L1 and L2 vocabulary varied across languages, differed in English reading comprehension in grades 2 and 4. ELLs ($n = 105$) were assigned to a bilingual profile group based on their L1 and L2 vocabulary knowledge and in relation to the sample: L1 dominant (strong L1), L2 dominant (strong L2), high balanced (strong in both), or low balanced (compromised in both). Relationships among L1 and L2 (English) vocabulary, nonverbal cognitive ability, word reading, and reading comprehension in English were examined. Results indicated that reading comprehension was related to bilingual profile, and that a three group model better characterized the sample when compared to the four group model that was initially hypothesized. L1 vocabulary was not uniquely predictive of L2 (English) reading comprehension. L2 vocabulary aligned better with reading comprehension concurrently in grade 2, and longitudinally in grade 4. In support of a common underlying cognitive processes perspective, individual differences in learning vocabulary may be a proxy for general language learning ability, which supports reading comprehension.

Key words: English language learners (ELLs), reading comprehension, vocabulary knowledge, language dominance, bilingualism

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Résumé

En compréhension écrite, il est important pour les apprenants de l'anglais (AA) d'avoir une connaissance solide du vocabulaire. L'interaction entre les langues première (L1) et seconde (L2) dans le cadre de la connaissance lexicale en compréhension écrite d'une L2 anglais a été examinée afin de déterminer si les AA, dont la maîtrise de la L1 et du vocabulaire de la L2 variait selon les langues des locuteurs, différaient en termes de compréhension écrite en 2e et 4e année de primaire. Les AA ($n = 105$) ont été associés à un groupe de profil bilingue selon leur connaissance du vocabulaire de leurs L1 et L2, et en fonction de l'échantillon : L1 dominante (L1 forte), L2 dominante (L2 forte), hautement équilibrée (forte dans les deux), et peu équilibrée (basse dans les deux). Nous avons étudié les liens entre le vocabulaire de la L1 et de la L2 (anglais), les capacités cognitives non-verbales, la lecture de mots, et la compréhension écrite en anglais. Les résultats ont montré que la capacité de compréhension écrite était liée au profil bilingue, et qu'un modèle groupe 3 caractérisait mieux l'échantillon que le modèle groupe 4 initialement postulé. Le niveau de vocabulaire en L1 ne prédisait pas exclusivement la compréhension écrite en L2 (anglais). Le vocabulaire en L2 correspondait mieux à la compréhension écrite de façon transversale chez les enfants de 2e année, et longitudinale chez les enfants de 4e année. En faveur d'une perspective de processus cognitifs sous-jacents communs, les différences individuelles d'apprentissage du vocabulaire pourraient jouer un rôle de médiatrices au sein de l'aptitude générale à acquérir le langage, incluant la compréhension écrite.

Mots-clés : apprenants de l'anglais (AA), compréhension écrite, connaissance du vocabulaire, dominance linguistique, bilinguisme

Many English language learners (ELLs) struggle with reading comprehension when compared to their monolingual counterparts (August, Carlo, Dressler, & Snow, 2005; Farnia & Geva, 2013). The *Simple View of Reading* (SVR) suggests that one must be able to decode words and comprehend language to read effectively (Gough & Tunmer, 1986). Prior research examining the applicability of the SVR for ELLs found that the individual differences in decoding observed in ELLs are not enough to explain difficulties in reading comprehension (Gottardo & Mueller, 2009; Lesaux & Kieffer, 2010). As a consequence, researchers have turned to the linguistic comprehension component (i.e., syntactic knowledge, morphological skills, vocabulary knowledge, etc.) of the SVR to understand why and where ELLs may be struggling. Often the query is whether the child is having literacy delays that are a result of their language learning status, or a more pervasive reading or learning difficulty (Fraser, Massey-Garrison, & Geva, 2016; Geva & Wiener, 2015).

Previous research suggests that vocabulary knowledge may be one of the strongest predictors of reading comprehension for ELLs (e.g., August et al., 2005; Farnia & Geva, 2013; Proctor, Carlo, August, & Snow, 2005), and often serves as a proxy for assessing language proficiency. This exploratory study examined whether ELLs who were classified into groups based on their first language (L1) and second language (L2) vocabulary profile, would differ in reading comprehension. To this end, vocabulary was assessed in grade 2 in L1 and L2 (English). English reading comprehension was measured concurrently in grade 2, and longitudinally in grade 4.

Vocabulary knowledge and L2 reading comprehension

The relative role of L1 and L2 vocabulary knowledge in L2 reading comprehension is complex and not fully understood (Farnia & Geva, 2011; Geva, 2014; Hutchinson, Whitely, Smith, & Connors, 2003; Ramírez, Chen, & Pasquarella, 2013; for a review see Genesee, Geva, Dressler, & Kamil, 2006).). From a theoretical perspective, the question is to what extent vocabulary knowledge in the language of the text (i.e., the L2) influences reading comprehension, and then how vocabulary knowledge in the L1 may also contribute. Several hypotheses about how L1 vocabulary might support L2 reading comprehension are presented in the literature: (1) commonalities across language typologies (Ramírez et al., 2013), and/or (2) shared semantic and strategic understandings about language (Cummins, 2012), and/or (3) common underlying cognitive processes (Geva, 2014; Geva & Ryan, 1993; for a review see Genesee et al., 2006).

Studies have shown that L2 English vocabulary knowledge makes an independent contribution to reading comprehension beyond general listening comprehension in ELLs (e.g., Proctor et al., 2005). Vocabulary knowledge is also an area where ELLs exhibit large and persistent delays when compared to monolingual English speakers (Farnia & Geva, 2011, 2013; Hutchinson et al., 2003). Studies comparing ELLs to monolingual English speakers have found that ELLs have consistently lower levels of vocabulary knowledge than monolinguals, and that relatedly, low levels of vocabulary are associated with relatively lower levels of reading comprehension skill for ELLs (Farnia & Geva, 2011, 2013; Hutchinson et al., 2003). For example, Farnia and Geva (2011) in their research involving the vocabulary development of ELLs and English monolinguals, found that ELLs consistently lagged in their vocabulary development when compared to their monolingual peers. They observed a gap in vocabulary at each measurement point from grades one through six, with the gap between ELLs and EL1s (English as a first language) being larger in the early years. That said, the gap did not close even by grade 6. In their examination of children in slightly older grades, Farnia and Geva (2013) found that

this gap in vocabulary development played a substantial role in reading comprehension development in grades 4, 5, and 6 with ELLs performing below the EL1s on reading comprehension tasks. Taken together, this set of studies suggest that growth rates for vocabulary knowledge may initially be steeper for ELLs, but growth eventually plateaus resulting in a persistent and pervasive gap in vocabulary for ELLs and a barrier for reading comprehension and subsequent academic achievement (Farnia & Geva, 2011, 2013).

The role of L1 vocabulary knowledge in L2 reading comprehension is controversial. Proctor, August, Carlo, and Snow (2006) examined the contribution of Spanish (L1) vocabulary knowledge to later English (L2) reading comprehension in fourth grade Spanish-English bilingual students. Vocabulary knowledge in the L1 contributed significantly to L2 reading comprehension after controlling for language of instruction, L2 decoding, and L2 oral language skills (i.e., L2 vocabulary knowledge and listening comprehension). Manis, Lindsay, and Bailey (2004) found that L1 (Spanish) vocabulary in kindergarten significantly predicted L2 English reading comprehension two years later when children were in grade 2, after controlling for print knowledge, phonological awareness, naming speed, and expressive language also measured in kindergarten. In contrast, some studies involving young ELLs whose home language was Spanish but who were educated solely in English have shown that L1 (Spanish) vocabulary did not contribute to English reading comprehension (Gottardo & Mueller, 2009; Lesaux & Siegel, 2003). These studies suggest that individual differences in L1 vocabulary — at least when the L1 is Spanish — are more aligned with L2 reading comprehension when children are exposed to systematic instruction in the L1 *and* L2, but not when the sample involves ELLs with different L1s (that may or may not be topologically similar), and/or when formal schooling and instruction take place only in the L2.

The role of specific L1s

The quality and quantity of exposure to the L1 and L2 may play a role in understanding the relationship between L1 and L2 vocabulary knowledge and reading comprehension in the L2. Significant correlations are often found in studies involving Spanish-speaking children in the United States, but they may not be generalizable to other contexts in which the children have exposure to the L1 and L2. One reason for this caution may be that the relationships between L1 and L2 vocabulary may be understood in part by the similarities between the two languages. This is often discussed in terms of the presence of cognates across the relevant languages, as is the case of English and Spanish. "True" cognates are words that share common roots and spellings, sounds, and meanings across languages and can facilitate L2 language acquisition. For example, Spanish ELLs may be able to use their knowledge of Spanish-English

cognates to aid their English reading comprehension when encountering new and unfamiliar words in English (Ramirez, Chen, Geva, & Kiefer, 2010). Proctor and Mo (2009) explored the relationship between English and Spanish cognate vocabulary and English reading comprehension and found that bilingual children in grade 4 scored higher than their monolingual peers on reading tests that included a high percentage of cognates, providing evidence for the contribution of cognate knowledge to L2 reading comprehension. Similar findings were reported by Ramirez, Chen, and Pasquarella (2013) in a study with fourth- and seventh-grade Spanish-speaking ELLs showing that cognates made a direct contribution to English reading comprehension.

A facilitative effect of L1 vocabulary knowledge on L2 reading comprehension has also been observed in languages that do not share cognates, such as English and Chinese. In a longitudinal study involving Hong Kong Chinese-English speakers, Li, McBride-Chang, Wong, and Shu (2012) investigated the contribution of metalinguistic ability in Chinese (L1) to English (L2) reading comprehension. Results indicated that Chinese vocabulary knowledge at age eight reliably predicted English reading comprehension at age 10, after controlling for Chinese reading comprehension. This finding is interesting considering the substantial differences in the orthographic and morphological properties of the Chinese and English languages. It is possible that children who knew more words in their L1, their stronger language, had better foundational language skills for learning words in English, their L2, their weaker language.

These research findings can be interpreted in the context of the linguistic interdependence hypothesis (Cummins, 1981), which proposes that students with high levels of language proficiency in their L1 will make greater progress in acquiring their L2 thanks to a common "proficiency" in conceptual knowledge, metalinguistic understandings about how language works (Cummins, 2012). It can also be understood in terms of common underlying cognitive processes, such as working memory (Genesee et al., 2006; Geva, 2014). In other words, this facilitative effect of L1 vocabulary knowledge on L2 vocabulary acquisition can operate directly or indirectly. For example, when feasible, ELLs might use their cognate knowledge to facilitate vocabulary learning and reading comprehension in their L2. However, the mechanisms by which L1 vocabulary knowledge can facilitate L2 reading comprehension differ when orthographically and morphologically different L1 and L2 combinations are involved. Findings regarding the relationship between L1 and L2 vocabulary lead to two general hypotheses. On the one hand, research on vocabulary knowledge suggests that it could be a language-specific skill and that interrelations are based on similarities across languages. On the other hand, L1 and L2 vocabulary skills might be indirectly related in terms of individual differences in understanding how language works, semantic schemata, and memory for new

vocabulary. In this sense, vocabulary knowledge could be a proxy for language learning skill that is at least in part a language-general.

Vocabulary knowledge is essential because of its pivotal role in reading comprehension (August et al., 2005; Droop & Verhoeven, 2003; Farnia & Geva, 2011; Geva, 2006; Hutchinson et al., 2003; Proctor et al., 2005). Although there is a growing body of literature examining levels of bilingualism (as measured through vocabulary) in ELL children alone, no studies could be located to date that specifically examined varying levels of L1 and L2 vocabulary in relation to reading comprehension in young ELL children. Given the importance of vocabulary in reading comprehension combined with the observed delay in vocabulary growth experienced by ELLs when compared to monolingual children, a further understanding of vocabulary development in ELLs is necessary for supporting the reading development of these children.

The present study

The present study was designed to explore the relationships between L1 and L2 vocabulary knowledge, and L2 reading comprehension. Specifically we were interested in whether ELLs with differing relative command of their L1 and L2 vocabulary also differ in their L2 reading comprehension. The participants were classified into one of four bilingual profiles based on their L1 and L2 vocabulary knowledge in grade 2. Because there is no standardized method for profiling ELLs by their differing levels of oral language (Bedore et al., 2012), we used a dimensional approach that allowed for children's vocabulary to be conceptualized in a two-dimensional space accommodating both languages of the participant (see Figure 1; Bishop & Snowling, 2004).

In this study, participants with higher levels of vocabulary in their L1 than in their L2 were categorized as *L1 Dominant*. Participants with higher levels of vocabulary in their L2 than in their L1 were categorized as *L2 Dominant*. Participants with similar levels of vocabulary across their L1 and L2 were categorized as balanced. When the balanced levels were higher than the means in both the L1 and L2, participants were categorized as *High Balanced*. When the vocabulary knowledge was lower than the means in both languages, participants were categorized as *Low Balanced*. Further details and the results of this classification are discussed in the method and results sections.

Research questions and hypotheses

The following overarching research question framed our investigation: What is the effect of bilingual profile, as defined by relative command of L1 and L2 vocabulary, on L2 (English) reading comprehension in grades 2 and 4? We made two broad hypotheses based on our review of the literature:

1. Children with L2 Dominant and High Balanced profiles would perform better on English reading comprehension than children with L1 Dominant and Low Balanced profiles because children with good vocabulary knowledge in English would have strong lexical skills regardless of their command of L1 vocabulary and would demonstrate skills cognitive ability for learning vocabulary (Geva, 2014).
2. Children with an L1 Dominant profile would perform better than children with a Low Balanced profile on English reading comprehension, but not as well as children with L2 Dominant and High Balanced profiles, because of their greater metalinguistic understanding (Cummins, 2012), as well as their potential knowledge of shared-words, that is cognates, across languages (Ramírez, Chen, & Pasquarella, 2013).

Method

Participants

Participants were recruited from 22 schools in a large metropolitan city in Canada. Data collected for this study were part of a larger, longitudinal research project where children were followed from kindergarten to grade 4 and assessed on a range of cognitive, linguistic, and reading skills. Only participants with complete data in grades 2 and 4, on the variables of interest, were included in this study. The final sample consisted of 128 ELLs (59 males

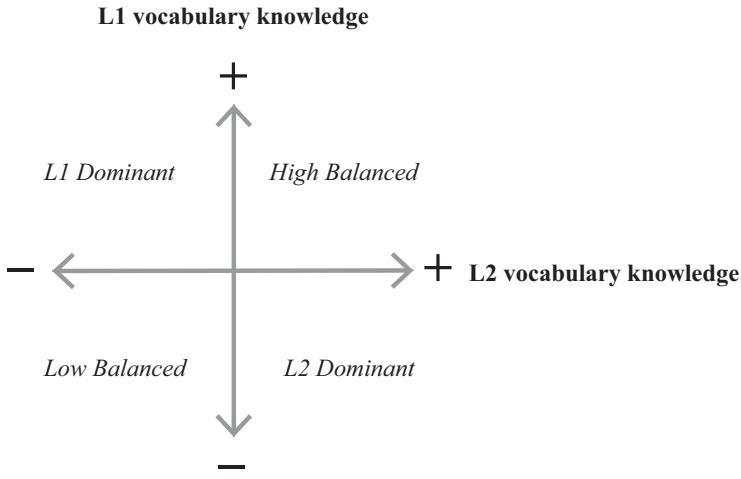

FIGURE 1

A two-dimensional model for conceptualizing bilingualism and the relationship between L1 and L2 vocabulary knowledge

and 69 females); 63 were Chinese-speaking (19 Mandarin-speakers and 44 Cantonese-speakers) and 65 were Spanish-speaking. The mean age of the participants was 7 years 8 months ($SD = 4.2$ months) in grade 2, and 9 years 8 months ($SD = 4.5$ months) in grade 4. Attrition ($n = 48$) occurred from grade 2 to grade 4 because some children moved away from the school board where data collection took place. The attrited students did not differ statistically from the remaining participants on any of the variables under study. The final sample sizes were $n = 128$ in grade 2, and $n = 80$ in grade 4. ELL status of the participants was determined by the school board, and confirmed by their teachers. The children's first (home) language was also corroborated by parental report. Initial recruitment criteria required that participants spoke either Spanish or Chinese as their first language. All the participants in the study had begun learning English formally upon school entry in kindergarten.

Measures

L2 English vocabulary

The Peabody Picture Vocabulary Test Third Edition — Form B (PPVT III; Dunn & Dunn, 1997) was used to measure English receptive vocabulary in grade 2. The participants chose the picture from a selection of four pictures that best matched the orally presented word (maximum 228 items). Cronbach's alpha for the sample was .85.

L1 vocabulary

The Test de Vocabulario en Imagenes Peabody (TVIP; Dunn, Padilla, Lugo, & Dunn, 1986) was used to measure Spanish receptive vocabulary in grade 2 (maximum 125 items). It is the standardized equivalent of the English Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981) therefore items are not equivalent across languages. The Cronbach's alpha for the Spanish-speaking sample was .97.

There was no standardized measure of Chinese vocabulary, thus an experimental vocabulary task (Lu & Lui, 1998) was used to measure Chinese receptive vocabulary in grade 2 for participants with Chinese as their L1. The items on this task are not the same as the Spanish or English version although items from the PPVT-R (Dunn & Dunn, 1981) are included (maximum 175 items). Items were translated and back-translated. Items with no Chinese equivalent were deleted. The Cronbach's alpha was .98 for the grade 2 Chinese-speaking ELLs in this study.

Word reading

The Word Identification subtest of the Woodcock Reading Mastery Test — Revised (WRMT-R; Woodcock, 1987) was administered to measure word reading accuracy in grade 2. Participants were asked to read aloud a list of words that increase in length and difficulty. Testing was discontinued when 6 items in a row for a given page were read incorrectly (maximum 106 items). The reported reliability for this task for children aged 7 is .97 (Woodcock, 1987).

Nonverbal cognitive ability

The Matrix Analogies Test (MAT — Expanded Form; Naglieri, 1985) was used to measure nonverbal cognitive ability in grade 2. This measure is popular in second language research as it is considered to be relatively culture- and language-free. Cognitive ability is not confounded with language proficiency or reading skill. For each item in this task, participants were presented with an incomplete pattern and asked to select one of six options to complete the pattern. Each subtest had 16 items for a total of 64 items. The reported reliability for this task for children aged 7 is .94 (Naglieri, 1985).

Reading comprehension

The Gray Oral Reading Test-4 (GORT-4; Wiederholt & Bryant, 2001) measured reading comprehension in grade 2. This test required children to read out loud short passages of increasing difficulty and then orally answer multiple-choice questions read by the tester. There are 14 passages in this task, each with five multiple-choice questions (maximum 30 items). The reported Cronbach's alpha for children aged 7 is .95 (Wiederholt & Bryant, 2001).

The Neale Analysis of Reading Ability — Reading Comprehension subtest (NARA; Neale, 1989) assessed participants' English reading comprehension in grade 4. The reading comprehension measure was changed from grade 2 to grade 4. In this task, participants read out loud a series of short narrative passages in English and then orally answered open-ended comprehension questions asked by the research assistant. There are 6 passages of increasing length and complexity (maximum 44 items). The Cronbach's alpha was .97 for the grade 4 ELLs in this study.

Results

Preparatory analyses

Two steps were taken to prepare the data for analyses. First, to increase power in analyses, participants from differing home language backgrounds were amalgamated into one L1 sample. Second, participants were assigned to a bilingual profile group based on their L1 and L2 vocabulary knowledge.

Amalgamation of participants from different home language backgrounds

Analyses were conducted to examine whether there was statistical support for merging the home language groups into one sample as a way of increasing power in analyses. Table 1 presents mean differences across the two home language backgrounds (i.e., Chinese and Spanish) for the variables under study. To evaluate differences between the two home language groups, we conducted multiple t-tests using our six variables of interest (i.e., reading comprehension in grades 2 and 4, L1 and L2 vocabulary, word reading, and nonverbal cognitive ability). We used a Bonferroni-corrected p-value of .0083 to indicate significance (i.e., $p = .05$ divided by 6 variables). The two groups did not perform significantly differently on five of the six variables (see Table 1). A significant difference was, however, observed on L1 vocabulary. The Spanish-speaking ELLs outperformed the Chinese-speaking ELLs in terms of their command of their L1 vocabulary, $t(126) = 2.94$, $p = .004$.

A Box's M test, used to determine whether two or more covariance matrices are equal, was conducted using the grade 2 and 4 variables to confirm that any observed differences across the home language groups were typical variations occurring as a result of immigration, demographic, and cultural differences, etc., and that the groups were not qualitatively different from each other on the cognitive, reading, and language skills that mattered for this research. This test was not significant, Box's $M = 25.28$, $p = .33$; there were no significant differences in covariance matrices between the Spanish- and Chinese-speaking groups. Based on this observation and given that the groups did not differ on 5 of the 6 variables of interest, we felt confident that the amalgamation of Spanish- and Chinese-speaking participants to create one sample to increase power was warranted. All results reported from this point forward are for the amalgamated sample.

Assignment of ELL participants to groups based on bilingual profile

This study used vocabulary as a proxy for oral language proficiency and to define levels of bilingualism. Participants were assigned to a bilingual profile based on performance on general vocabulary measures. Separate L1 and L2 vocabulary z-scores were used for profiling participants based on positive and negative z-scores. Participants were assigned to one of four L1-L2 bilingual profiles:

- *L1 Dominant*
- *Low Balanced*
- *High Balanced*
- *L2 Dominant*

TABLE 1

The effect of home language (Chinese or Spanish) on reading comprehension, vocabulary, word reading, and cognitive ability: Descriptive statistics and post hoc comparisons

Measure (/total)	Chinese (C) ($n = 63$)				Spanish (S) ($n = 65$)				t statistic	Effect size (Cohen's d)	Post hoc comparisons
	Min	Max	Mean	SD	Min	Max	Mean	SD			
English reading comprehension G4 (/44)	10	38	23.66	8.05	1	41	20.90	8.80	−1.47	.32	C = S
English reading comprehension G2 (/30)	1	26	13.19	6.89	0	27	11.86	7.50	−1.04	.19	C = S
L1 vocabulary G2 (%)	4.6	97.7	29.73	20.62	4	72	38.83	13.58	2.94*	−.52	S > C
L1 vocabulary G2 (z-score)	−1.7	3.5	−0.26	1.15	−1.7	2.1	0.25	0.76	2.94*	−.52	S > C
L2 English vocabulary G2 (/228)	60	135	99.16	21.02	40	146	92.48	18.24	−1.92	.34	C = S
L2 English vocabulary G2 (z-score)	−1.8	2.0	.17	1.06	−2.8	2.5	−0.17	0.92	−1.92	.34	C = S
Word reading G2 (/106)	18	89	52.30	14.72	1	81	46.62	17.45	−1.99	.35	C = S
Nonverbal cognitive ability G2 (/64)	5	58	27.90	11.84	3	49	22.94	9.71	−2.60	.46	C = S

Notes: G = grade; $n = 128$; *$p < .0083$

Participants were assigned to the L1 Dominant profile if their z-scores were above zero for L1 vocabulary and below zero for L2 vocabulary. Participants were assigned to the L2 Dominant profile if their z-scores were above zero for L2 vocabulary, and below zero for L1 vocabulary. Participants were assigned to the High Balanced profile if their z-scores were above zero for both their L1 and L2 vocabulary. Participants were assigned to the Low Balanced profile if their z-scores were below zero for both their L1 and L2 vocabulary. In order to form discrete profiles independent of one another, a "buffer zone" of 0:05 z-score units above and below the mean (i.e., 0.1 z-score unit around the mean in total) was created. Participants whose L1 or L2 vocabulary fell within this buffer zone were removed from the analysis ($n = 23$). Therefore, subsequent analyses are based on a sample of 105 children in grade 2, and 64 children in grade 4 (see earlier discussion of attrition related analyses in the *Participants* section). Final sample sizes for each bilingual profile were as follows: L1 Dominant ($n = 27$), L2 Dominant ($n = 18$), High Balanced ($n = 25$), and Low Balanced ($n = 35$).

To answer our broad research question of whether bilingual profile, as defined by relative command of L1 and L2 vocabulary, would affect L2 (English) reading comprehension in grades 2 and 4, we organized our results under several specific questions:

1. How do participants in the four bilingual groups differ in their reading skills in grades 2 and 4?
2. Can bilingual group membership be predicted using performance on word reading and reading comprehension measures?

Given the innovative nature of this research design and dearth of research in the literature related specifically to levels of bilingualism and reading comprehension, we also wanted to think broadly about the types of groups that might be represented in the sample. The literature review revealed that sometimes L1 matters for L2 reading comprehension, and sometimes it does not. For this reason we speculated upon a three model group that would be informed by results from the 4 model group if necessary. In consideration of a three bilingual group model, we questioned:

3. Does a three bilingual group model better represent the sample under consideration?
4. How do participants classified in a three bilingual group model differ in their reading skills?

Question 1: How do participants in the four bilingual groups differ in their reading skills in grades 2 and 4?

A MANCOVA was conducted to determine differences among the four bilingual profiles on grade 2 reading comprehension and English word reading using grade 2 nonverbal cognitive ability as a covariate. The overall MANCOVA was significant, Wilks' $\Lambda = .68$, $F(6, 196) = 6.90$, $p < .001$, partial $\eta^2 = .17$ indicating a moderate effect size (Gamst, Meyers, & Guarino, 2008). Bonferroni-corrected analyses of variance (ANOVA) were conducted on each dependent variable to determine on which variable(s) the bilingual groups were different from each other. Significant differences were observed on both dependent variables: grade 2 reading comprehension, $F(3.99) = 10.42$, $p < .001$, $\eta^2 = .24$; and grade 2 English word reading, $F(3.99) = 9.07$, $p < .001$, $\eta^2 = .22$. Post hoc analyses revealed that the performance of the L2 Dominant and High Balanced profiles on grade 2 reading comprehension was similar, and was significantly better than the L1 Dominant and Low Balanced profiles. A similar pattern was noted for English word reading skills in grade 2. The L1 Dominant and Low Balanced profiles did not perform significantly differently from each other on reading comprehension or English word reading. Table 2 presents descriptive statistics and details about the post hoc comparisons for this MANCOVA.

A second MANCOVA was conducted to determine differences among the bilingual profiles and reading comprehension in grade 4 using nonverbal cognitive ability in grade 2 as a covariate. Significant differences were found among the four bilingual profiles, Wilks' $\Lambda = .742$, $F(6, 116) = 3.12$, $p < .01$ with partial $\eta^2 = .14$ indicating a moderate effect (Gamst et al., 2008). Again, Bonferroni-corrected ANOVAs were conducted on each dependent variable to determine on which variable(s) the bilingual groups were different from each other. The ANOVAs on reading comprehension in grade 4 and English word reading in grade 2 were significant, $F(3.59) = 6.12$, $p < .001$, $\eta^2 = .24$, and $F(3.59) = 5.19$, $p < .01$, $\eta^2 = .21$, respectively. Post hoc analyses revealed that the L2 Dominant and High Balanced profiles performed similarly to each other, and significantly better than the L1 Dominant and Low Balanced profiles on reading comprehension in grade 4. With regard to word reading, the L2 Dominant and High Balanced profiles had the highest English word reading means, followed by L1 Dominant; the Low Balanced profile was the weakest on English word reading in grade 2. Table 2 presents descriptive statistics and details about the post hoc comparisons for this MANCOVA.

TABLE 2

The effect of bilingual profile on reading comprehension, word reading, and cognitive ability in grades 2 and 4: Descriptive statistics and post hoc comparisons

Measure (/total)	L1 Dominant (a)		Low Balanced (b)		High Balanced (c)		L2 Dominant (d)		F statistic	Effect size η^2	Post hoc comparisons
	Mean	SD	Mean	SD	Mean	SD	Mean	SD			
Grade 2 ($n = 104$)											
English reading comprehension G2 (/30)	11.04	6.79	8.51	5.06	17.48	5.94	16.28	7.04	10.42***	.24	c = d > b = a
Word reading G2 (/106)	43.54	14.24	43.74	13.79	57.28	10.79	63.11	14.70	9.07***	.22	c = d > b = a
Nonverbal cognitive ability G2 (/64)	23.50	11.17	22.51	10.21	27.56	10.77	32.94	10.54	covariate		*ns*
Grade 4 ($n = 64$)											
English reading comprehension G4 (/44)	18.82	7.65	18.13	6.80	26.13	8.00	28.36	7.24	6.13***	.24	c = d > b = a
Word reading G2 (/106)	44.64	16.03	43.74	13.96	56.69	11.92	62.57	14.27	5.19**	.21	c = d > a> b
Nonverbal cognitive ability G2 (/64)	25.18	11.41	21.52	10.21	26.31	10.14	31.07	10.04	covariate		*ns*

Notes: G = grade; ***$p < .001$, **$p < .01$; *ns* = not statistically significant

Question 2: Can bilingual group membership be predicted using performance on word reading and reading comprehension measures?

A discriminant analysis was conducted to determine whether the grade 2 predictor variables — reading comprehension, word reading, and nonverbal ability in grade 2 — would predict bilingual profile. The analysis yielded one significant discriminant function, Wilk's $\Lambda = .61$, $\chi^2(9, N = 104) = 50.61$, $p < .001$, indicating that in combination, the three predictor variables significantly differentiated the four bilingual groups. No tests of statistical significance are provided for these coefficients (Warner, 2008), but a standardized discriminant coefficient cut-off value of $d = \pm.30$ is commonly considered meaningful. We chose a more conservative cut-off value of $d = \pm.50$ (Warner, 2008). The standardized coefficients indicated that reading comprehension ($d = .53$) and word reading ($d = .50$) demonstrated the strongest relationship with the discriminant function. The prediction of bilingual profile in the grade 2 model was moderate (Gamst et al., 2008) with 39% of the variance in discriminant scores being attributed to between-profile differences, and 51% (i.e., $n = 53$ of 105) of participants classified correctly: three in the L1 Dominant profile, 27 in the Low Balanced profile, 15 in the High Balanced profile, and eight in the L2 Dominant profile.

A second discriminant analysis was conducted to determine whether reading comprehension in grade 4, and word reading and nonverbal cognitive ability in grade 2, were related to bilingual profile longitudinally when grade 4 reading comprehension was used. The analysis again revealed one significant discriminant function, Wilk's $\Lambda = .66$, $\chi^2(9, N = 64) = 24.83$, $p < .01$, indicating that in combination, the three predictor variables significantly differentiated the four bilingual groups. The standardized coefficients indicated that grade 4 reading comprehension ($d = .58$) demonstrated the strongest relationship with the discriminant function, followed by word reading showing a much weaker relationship ($d = .39$). The prediction of bilingual profile in the longitudinal model was moderate (Gamst et al., 2008) with 34% of the variance in discriminant scores being due to between-profile differences and 55% (i.e., $n = 35$ of 64) of participants classified correctly: zero in the L1 Dominant profile, 20 in the Low Balanced profile, seven in the High Balanced profile, and eight in the L2 Dominant profile.

Consideration of a three bilingual group model

Classification was poorest for the L1 Dominant bilingual profile using grade 2 and grade 4 reading comprehension in the four group model with three cases correctly classified in grade 2 and zero cases correctly classified in grade 4. Both the L1 Dominant and Low Balanced profiles had low L2 vocabulary

and differed from the other profiles. Therefore a 3-group model with the L1 Dominant bilingual profile merged with the Low Balanced profile was also tested. Pair-wise comparisons were conducted to examine mean differences in the L1 and L2 vocabulary of the newly created low vocabulary bilingual profile in relation to the High Balanced and L2 Dominant profiles, and to ensure distinctions among the groups for further analyses. The newly created low vocabulary bilingual profile (L1: $M = 30.89$, $SD = 15.67$; L2: $M = 81.08$, $SD = 11.56$) performed significantly below the High Balanced profile on both L1 vocabulary, $t(85) = -5.79$, $p > .001$, and L2 vocabulary, $t(85) = -12.54$, $p > .001$. The same was true when compared with the L2 Dominant profile on L1 vocabulary, $t(78) = 2.35$, $p > .05$, and L2 vocabulary, $t(78) = -12.92$, $p > .001$. Thus, this new bilingual profile was labelled *Low Vocabulary* ($n = 62$). Descriptive statistics and post hoc comparisons for the new three group bilingual model are presented in Table 3. Further analyses were conducted to determine if the predictor variables would better predict a model with three bilingual profiles versus our originally hypothesized four group model.

Question 3: Does a three bilingual group model better represent the sample under consideration?

The grade 2 analysis using reading comprehension, word reading, and nonverbal cognitive ability in grade 2, revealed two discriminant functions: the overall Wilk's lambda was significant, $\Lambda = .62$, $\chi^2(6,\text{N} = 104) = 47.13$, $p < .001$; and the residual Wilk's lambda was also significant, $\Lambda = .94$, $\chi^2(2, N = 104) = 6.06$, $p = .05$. Two discriminant functions suggest that two combinations of variables significantly differentiated the three bilingual profiles in the new 3-group model. The standardized coefficients indicated that word reading and reading comprehension demonstrated the strongest relationship with the first discriminant function, $d = .55$ and $d = .48$, respectively; nonverbal cognitive ability showed the strongest relationship with the second function, $d = .54$. An evaluation of the profile centroid values on the first function indicated that word reading and reading comprehension distinguished the High Balanced (.71) and L2 Dominant (.99) profiles from the Low Vocabulary profile. On the second function, profile centroid values indicated that the High Balanced and L2 Dominant profiles were distinguished from each other by nonverbal cognitive ability (.03). It should be noted, however, that although the second discriminant function was significant ($p = .05$ on the residual Wilk's lambda), this significance may not be meaningful as indicated by the very low profile centroid value (.03). This interpretation is supported by the results of the MANCOVA described in the previous paragraph, where nonverbal cognitive ability was not significant.

TABLE 3

Descriptive statistics and post hoc comparisons for the new three group bilingual model

Measure (/total)	Low Vocabulary (a)		High Balanced (b)		L2 Dominant (c)		F statistic	Effect size η^2	Post hoc comparisons
	Mean	SD	Mean	SD	Mean	SD			
Grade 2 ($n = 104$)									
English reading comprehension G2 (/30)	9.59	5.94	17.48	5.92	16.28	7.04	14.34***	.22	c = b > a
Word reading G2 (/106)	43.66	13.87	57.28	10.79	63.11	14.70	13.73***	.22	c = b > a
Nonverbal cognitive ability G2 (/64)	22.93	10.55	27.56	10.77	32.94	10.54	covariate		*ns*
Grade 4 ($n = 64$)									
English reading comprehension G4 (/44)	18.35	6.98	26.13	8.00	28.36	7.24	9.33***	.24	c = b > a
Word reading G2 (/106)	44.03	14.42	56.69	11.92	62.57	14.27	7.91***	.21	c = b > a
Nonverbal cognitive ability G2 (/64)	22.71	10.60	26.31	10.14	31.07	10.04	covariate		*ns*

Notes: n = 128; G = grade; *$p < .0083$

The prediction of profile in the grade 2, three-group model, was moderate but improved over the four group model (Gamst et al., 2008), with 38% of the variance in discriminant scores being due to between-profile differences, and 73% (i.e., $n = 76$ of 104) of participants classified correctly. This represented a 22% increase in classification accuracy over the four group model with: 56 in the Low Vocabulary profile, 14 in the High Balanced profile, and 6 in the L2 Dominant profile.

Question 4: How do participants classified in a three bilingual group model differ in their reading skills?

A MANCOVA was conducted to determine whether the bilingual profiles in the three-group model were different from each other longitudinally using grade 4 reading comprehension, grade 2 word reading, controlling for nonverbal cognitive ability. Significant differences were found among the three bilingual profiles, Wilks' $\Lambda = .74$, $F(4, 118) = 4.75$, $p < .001$ with partial $\eta^2 = .14$ indicating a moderate effect size (Gamst et al., 2008). Bonferonni-corrected ANOVAs were conducted to evaluate mean differences on the dependent variables. The ANOVAs for grade 4 reading comprehension and grade 2 English word reading were significant, $F(2, 60) = 9.33$, $p < .001$, $\eta^2 = .24$ and $F(2, 60) = 7.91$, $p < .001$, $\eta^2 = .21$, respectively. Post hoc analyses revealed that the High Balanced and L2 Dominant profiles performed similarly to each other and significantly better than the Low Vocabulary profile on reading comprehension in grade 4 and English word reading in grade 2. Table 3 displays descriptive statistics and the details of these post hoc comparisons.

The longitudinal analysis, using grade 4 reading comprehension and grade 2 word reading and nonverbal cognitive ability, revealed one significant discriminant function. The Wilk's lambda was significant, $\Lambda = .67$, $\chi^2(6, N = 64) = 24.10$, $p < .001$, indicating that in combination, the predictor variables significantly differentiated the three bilingual profiles in the new three-group model. The standardized coefficients were the same as for the four group model on grade 4 reading comprehension (also based on the smaller sample), and indicated that reading comprehension demonstrated the strongest relationship with the discriminant function ($d = .59$), followed by word reading ($d = .39$), which showed a weaker relationship. The prediction of bilingual profile in grade 4 using the three-group model was moderate but improved (Gamst et al., 2008), over the four group model, with 33% of the variance in discriminant scores being due to between-profile differences, and 66% (i.e., $n = 42$ of 64) of participants classified correctly. This represented an 11% increase in classification over the 4-group model with: 29 in the Low Vocabulary profile, five in the High Balanced profile, and eight in the L2 Dominant profile.

Discussion

The goal of this study was to explore whether bilingual profiles formed according to a joint consideration of command of L1 and L2 vocabulary skills would shed light on the oral language predictors of L2 reading comprehension. Similar to previous research in the area, we found that reading comprehension was significantly correlated with L1 and L2 vocabulary, and that L1 and L2 vocabulary correlated significantly with each other, suggesting that vocabulary in either language might support English reading comprehension for ELL children (e.g., August, Carlo, Dressler, & Snow, 2005; Geva, 2006). Initially, we reasoned that a four group model of bilingualism, which accounted for high and low levels of L1 and L2 vocabulary (i.e., High Balanced and Low Balanced), would best characterize the bilingual profiles, and that strong vocabulary in either or both languages would be helpful in L2 English reading comprehension. This was not the case in this sample of mixed L1 background students educated in their L2 (English); a three-group model with the Low Balanced and L1 Dominant profiles merged yielded better classification results on the reading outcomes. Contrary to arguments that relatively good command of L1 is an important consideration for understanding what learners can do in their L2 (e.g., Cummins, 1981), relatively stronger L1 vocabulary was not uniquely predictive of L2 English reading comprehension and did not contribute to L2 reading comprehension over and above the contribution of L2 vocabulary.

The current study suggests that L2 English vocabulary may be more closely tied to subsequent reading comprehension in young ELLs. Yet, having relatively high command of L1 vocabulary is not a liability provided that students have well-developed L2 vocabulary as well. High balanced bilinguals performed as well on L2 reading comprehension as did L2 dominant bilinguals. This observation underscores the theoretical argument that individual differences in learning vocabulary in the L1, L2, L3 etc., might be a proxy for general language learning ability, which further supports their reading comprehension in the L2 (Geva, 2014). ELLs who, under similar contextual and educational conditions, are able to acquire more vocabulary in the languages to which they are exposed are at an advantage; knowing more vocabulary, in turn, enhances their L2 reading comprehension (which in turn contributes to more vocabulary learning). It is likely that this advantage would also be noted when reading for comprehension in the L1, but in this study we were unable to assess L1 reading comprehension. In comparison with their peers who are good language learners, learners with low general vocabulary skills and difficultly learning vocabulary in the L2, might have global language and academic difficulties, which are reflected in poorer reading comprehension. From a theoretical perspective, these findings align most closely with an underlying cognitive processes perspective of the relationship between L1 and L2 vocabulary

(for review see Geva, 2014). Further research is needed to investigate the source of such processes, and the extent to which these findings apply to older L2 learners, and other educational and demographic contexts. Another issue to consider would be the quantity and quality of exposure to the L1 and L2, as some research suggests that L1 and L2 vocabulary skills develop somewhat separately and are driven by exposure to a given language (Cobo-Lewis, Eilers, Pearson, & Umbel, 2002).

Based on careful statistical analyses we amalgamated the Chinese- and Spanish-speaking home language groups into one sample for analyses. That said, it is noteworthy that home language groups (i.e., Spanish and Chinese) were not evenly represented across the four bilingual profiles. Possibly due to cultural language-learning practices and attitudes, the Chinese-speakers were weaker in their L1 vocabulary (and stronger in their L2) than the Spanish-speakers. Thus, the Chinese-speaking group was underrepresented in the L1 Dominant and High Balanced bilingual profiles, while the Spanish-speaking group was underrepresented in the L2 Dominant profile and overrepresented in the L1 Dominant profile. These differences may have translated into differences on reading comprehension in grades 2 and 4 by home language group, but we were unable to analyze these differences due to small group sample sizes. The Chinese group represented the majority in the highest performing bilingual profile, L2 Dominant, despite obvious differences between the structures of Chinese and English oral and written language and the potential linguistic benefits for speakers of Spanish, whose L1 is typologically closer to English. L1 metalinguistic ability or general language learning ability could explain the higher skills of the L2 dominant or High Balanced bilinguals (Li et al., 2012). Additional possible explanatory mechanisms for the better vocabulary skills of the Chinese speakers are higher socioeconomic status (SES), or inclusion in language activities outside formal schooling (i.e., tutoring, heritage programs, etc.). Detailed information about SES, educational activities outside of school, and the children's language experiences were not available. Specific measures of the quality and quantity of L1 language exposure could elucidate their influence on the children's L1 and L2 vocabulary knowledge. Larger sample sizes and additional information about contextual factors such as SES, cultural attitudes toward maintaining L1, parental command of the L1 and L2, and language learning activities outside of school would be useful factors to consider in further studies.

Vocabulary knowledge is a powerful predictor of reading comprehension and subsequent academic success (Cummins, 2012). Our exploratory study found that having command of the L1 is not a liability for learning L2 vocabulary, nor do the results suggest that having high command of the L1 alone provides an advantage in terms of L2 reading comprehension. Rather, what

matters most in this context is fostering a high command of L2 vocabulary; ELLs with underdeveloped vocabulary in English or in both English and their L1 experienced significant difficulties with their reading comprehension in English. The important role of L2 vocabulary knowledge, regardless of command of L1 vocabulary, underscores the importance of enhancing L2 lexical knowledge and especially of developing techniques for enhancing vocabulary development in those who could benefit from a "boost" (e.g., teaching a selection of vocabulary words intensively across several lessons using a variety of instructional activities; Baker at al., 2014).

Final thoughts

Examining the contribution of L1 and L2 vocabulary to reading comprehension is not new. What is unique about this study is that we took a different stance on the command of L1-L2 vocabulary, one that considers jointly the levels of command of vocabulary in the L1 and L2. This approach allowed us to acknowledge that some L2 learners show relative strength or weakness, while some are strong in either one but not both languages. These profiles provide a more comprehensive picture of vocabulary skills that cannot be ignored by researchers and practitioners.

The present study focused on young ELLs whose schooling took place in English, the societal language. Our results directly support the importance of explicit instruction of English vocabulary for ELL children (Baker et al., 2014). Further, our results support the potential benefits of the intense instruction of English academic vocabulary (Baker et al. 2014) as what matters for English reading comprehension is English vocabulary. A focus on oral English language instruction more broadly is warranted as this not only improves vocabulary but also can enhance reading comprehension and academic achievement among ELLs (Baker et al., 2014). From an applied standpoint, although assessments of L1 vocabulary may be useful at indicating initial difficulties with reading and/or language development in ELLs, language assessments which include L2 vocabulary are advisable, and are likely more prudent and practical in leading to the identification of children experiencing real problems with reading that are not a result of their developing language skill.

Vocabulary is clearly an essential skill for reading. In this study we explored the effect of varying levels of vocabulary dominance on current and later reading comprehension. Our findings suggest that ELLs who have high levels of English vocabulary whether coupled with strong command of vocabulary in their L1 or not, can comprehend texts better than their peers who have a poorer command of the L2, whether coupled with L1 vocabulary skills or not.

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