

Home Literacy Environments' Influence on Language and Reading Development

Xinyue Liu

University of Michigan

Abstract

Researchers have found that the home literacy environment (HLE) and the age of second language (L2) acquisition have a great impact on monolingual children's language development. The present study investigated the impact of HLE and the age of L2 acquisition on children's vocabulary and reading development in Chinese-English bilinguals. Fifty nine bilingual Chinese-English children participated in the study. Meanwhile, one parent filled out the questionnaire for child's language development history. Children completed vocabulary and reading tasks in both Chinese and English. Because of within and cross language effects, we hypothesized that parent-child reading and conversational activities were positively correlated with the vocabulary and reading development in both languages. We used partial correlations (controlling testing age) to test the hypotheses. We found that the more parents read with a child in English; the better was the child's reading development in English. In addition, the more parents talked with a child in Chinese, the better was the child's vocabulary in Chinese, but worse was the child's English vocabulary. Also, the more parents talked with a child in English, the better was the child's vocabulary and reading in English, but worse was the child's Chinese vocabulary. The results revealed that especially for vocabulary, using one language at home have positive influences on that language, but have negative influences on another language.

Home Literacy Environments' Influence on Language and Reading Development

The home literacy environment (HLE) is considered as the home literacy materials and experiences, such as exposure to storybook reading, child opportunities for verbal interaction, parental literacy teaching activities and parent's literacy habits (Peeters, et al., 2009).

Multilingualism is increasing in the US. The 2006 – 2008 Community Survey 3-Year Estimates reported that 19.6% of the population aged 5 and older speak a language other than English at home, and the rate was only 17.9% in 2000 (Shin & Bruno, 2003). Although there are many studies indicating how the HLE influences monolingual Children's language development, the research results cannot be fully applied to bilingual or multilingual children. For example, it is commonly accepted that reading to children at home can benefit children's language development (e.g. Farrant & Zubrick, 2011); however, for those parents whose native language are not English, should they read book in English or their native language to the children? HLE is critical for children's language development, and thus, the parents of the bilingual and multilingual children need clearer guides on what kind of HLE works best for their children. In this study, we measured the HLE of the English-Chinese bilingual children in three aspects: the parent-child book reading activities, the parent-child conversational activities and the age of second language acquisition. Then, we used the children's reading and vocabulary awareness of both English and Chinese to analyze how HLE impacted the bilingual children's language development.

Parent-child Book Reading Activities

How do the parent-child book reading activities influence the Chinese-English bilingual children's vocabulary development and reading acquisition? Parent-child book reading is an

ideal context for children's language development as it offers both contextual and social support for language development that matches children's needs (Vygotsky, 1978).

Additionally, parent-child reading exposes children to vocabularies that they have not encountered in daily life, and provides a context for parents' labeling of pictures and use of more sophisticated language. Therefore, it is especially effective in helping children to learn novel vocabulary words and more complex language structure (e.g. DeTemple & Snow, 2003).

For English monolinguals, numerous researches have shown that parent-child book reading is positively correlated with the children's vocabulary development (e.g. Farrant & Zubrick, 2011). In addition, the results of a meta-analytic review revealed an overall positive effect of parent joint reading on children's emergent literacy and reading achievement (Bus, van Ijzendoorn, & Pellergrini, 1995).

However, only a few studies have been done for Chinese monolinguals. An experiment at Hong Kong found that the typical parent-child book reading could benefit the children's Chinese vocabulary development; however, it failed to improve their Chinese reading skills (Chow & Chang, 2003). In addition, Chow, McBride-Chang and Cheung (2009) found that typical reading in English leads to significant improvement in monolingual Chinese children's English word reading. However, in contrast with the strong research evidence on the effects of parent-child reading in children's first-language vocabulary development (e.g. Hood et al., 2008), reading activities in English as a second language did not yield a significant improvement in the Chinese vocabulary.

Some studies have focused on the impact of L2 parent-child reading. One study showed

that there are language-specific links between parental reports of the frequency of parent-child reading and Spanish children's vocabulary size in both English and Spanish (Patterson, 2002). Also, among Portuguese preschoolers, new vocabulary skills during English storybook reading could enhance English vocabulary skills (Collins, 2005).

Previous research has shown a positive relationship between the frequency of the parental-child book reading activities and the children's vocabulary development and reading acquisition for monolingual English children (e.g. Farrant & Zubrick, 2011 & Bus, van Ijzendoorn, & Pellergrini, 1995). However, limited studies have been done for the effects of parent-child book reading activities for Chinese-English bilingual children.

Parent-Child Conversational Activities

What is the relationship between parental language usage at home and children's vocabulary development and reading acquisition?

For monolingual English children, there is abundant evidence showing that parental communication with children relates to child vocabulary development. Large amount of research on the role of parental communication input in child vocabulary development emphasized the importance of the quantity of input. Researchers found that the amount of parental language input is positively associated with the rate of vocabulary growth in young infants (Huttenlocher et al., 1991). Also, Hart and Risley (1995) documented a strong, positive association between the size of the children's lexicon at each age and the number of words addressed to them by their caretakers.

In terms of bilinguals, one study on the language input for Spanish-English bilingual children concluded that there is a substantial relationship between the quantity of input in a

given language and the amount of vocabulary learning in that language (Pearson et al., 1997). Additionally, another study which investigated Spanish-Catalan bilinguals found that the language usage affects the pattern of brain activation in bilingual even if both languages are acquired early.

Previous studies have found that the more parents talk to their child in language one, the better are the child's vocabulary in that language (e.g. Huttenlocher et al., 1991). However, limited researches have been done in Chinese-English bilingual populations in the US. In addition, the relationship between language input and reading acquisition remains unknown.

Age of L2 Acquisition

How does the age of language acquisition (AoA) impact the children's vocabulary development and reading acquisition?

There is increasing behavioral evidence that the age at which words are learned is an important variable for language development. In this paper, the term "age of second language (L2) acquisition" referred to the age when a bilingual child first began receiving intensive, systematic and maintained exposure to his/her second language. It is common in the US that some bilingual children are not systematically exposed to the mainstream language for their first couple of years.

One review, which reported the findings of more than 140 behavioral and computational studies on AoA, found that words acquired earlier in childhood are processed more quickly or accurately than words acquired later in life (Juhasz, 2005). Additionally, a large literature suggested that linguistic abilities are sensitive to the age of exposure to language. People, who learn a language later, particularly after late infancy or puberty, do not generally achieve

the same level of proficiency as young learners (Birdsong, 1999).

In terms of age of L2 exposure, previous studies have found a critical period effects in L2 learning as well. Johnson and Newport (1989) tested English grammar development of 46 native Korean or Chinese speakers who had arrived in the US between 3 and 39 years old, and found that test performance was linearly related to the age of arrival up to puberty.

In addition, there is evidence indicating that for bilinguals, even if L2 is acquired early enough, the children's language proficiencies are affected. An fMRI study investigated Spanish-Catalan bilinguals indicated that AoA affects the pattern of brain activation in bilingual even if both languages are acquired early and with a comparable level of proficiency (Perani et al, 2003). Additionally, another research found that the Spanish-English bilinguals' age of L2 exposure predicts their reading success or lack of success later. Also, bilinguals who exposed to L2 early can be expected to perform just as well as their monolingual peers on various reading tasks (Kovelman, Baker & Petitto, 2008).

Previous studies have found a positive link between the AoA and the children's vocabulary development & reading acquisition (e.g. Perani et al, 2003). However, limited studies have been done for Chinese-English bilinguals' language and reading development. In addition, previous studies did not test children who acquired L2 at a young age.

Taken together, many previous researches have addressed on several aspects of HLE's influences on monolingual English children's vocabulary development and reading acquisition, whereas relatively few studies have focused on the Chinese-English bilingual children. Chinese is very different from other alphabetic languages and there is increasing population of Chinese-English bilinguals in the US. As a result, the parents of

Chinese-English bilinguals need clearer guidance in creating HLE for their children.

The Present Study

The goal of the present study was to investigate how HLE (parent-child book reading activities and conversational activities) and the age of L2 acquisition might impact Chinese-English bilingual children's vocabulary development and reading acquisition in both Chinese and English. One of our hypotheses was that due to within-language effects, the more parents-children use one language, the better language that language would be (e.g., more Chinese, better Chinese). We also hypothesized that due to cross-language effects (positive transfer) the learning experience of one language could benefit the learning of another language. In order to investigate these questions, we studied 59 Chinese-English bilingual children. We measured the HLE and the age of L2 acquisition by the bilingual environment questionnaire, and then we assessed their vocabulary knowledge and reading acquisition in both English and Chinese. In order to test the hypotheses, we used the Pearson Partial Correlation test (controlling testing age).

Method

Participants

The participants were Chinese-English bilingual children. The sample contained 59 participants, 18 males and 41 females. Participants' age at testing ranged from 5.98 years old to 12.75 years old ($M = 8.65$, $SD = 1.78$). In addition, 94.9% of the participants were born in the English speaking countries, while only 5.10% of them were born in China. Also, 93.20% of the children had formal instruction of Chinese and only 6.80% did not receive formal Chinese instruction.

All the participants had no history of any known neurological language impairments, and at least had one parent who was a native speaker of Mandarin. The parental report of the Chinese Exposure age was from 0 to 6 months ($M = 0.11$, $SD = 0.795$). The mean starting age of English Daycare was 27.33 months ($SD = 14.02$, $range = 0 - 48$), but 6 out of 57 children did not go to a Daycare center. Their age of school onset was from 4 to 7 years old, the majority of them went to school at 5 years old and only 6 out of 57 children had home school instead.

Measures

Language Background and Use Questionnaire. The participants' parents filled out an extensive Language Background and Use (LBU) questionnaire (Kovelman et al., 2008a, 2008b, 2009), which measures the history of children's language development.

Chinese vocabulary. Children took the Picture Identification task to measure their verbal awareness of Chinese (Cheung, Lee & Lee, 1997). After hearing a Chinese word, the children selected the best match picture out of four. There were 64 items in total. For more details, see Cheung et al. (1997).

Chinese Reading. Children took the Character Recognition task, which was used in an article (Li, et al, 2012) to measure children's reading skills. Children were asked to identify and pronounce given Chinese characters. There were a total of 100 characters. For more details about the procedure, see the article (Li et al. 2012).

English vocabulary. Participants took vocabulary subset of the Kaufman Brief Intelligence Test, Second Edition (KBIT-2), which is a standardized test used to measure the verbal awareness (Kaufman & Kaufman, 2004). After hearing a word or a phrase, the

participants' task was to select the most appropriate picture out of four. There were 60 items in total. For further information about the test reliability and administration procedures, see Kaufman & Kaufman (2004).

English reading. Participants completed the Woodcock Reading Mastery Tests – Revised/Normative Update, Word Identification subtest, which is a standardized test of children's English reading skill. Children were presented with 106 English words and were asked to pronounce and identify each word. For more details, see Woodcock (1998).

Procedure

Participants were recruited in Michigan State. While recruiting, participants were told that the purpose of the study was to study the bilingual language development. On the test day, one parent filled out the questionnaire for child's language development history. Meanwhile, children were assessed by reading and vocabulary tasks in both languages. The tasks approximately took two hours in total. Participants were tested in a quiet child playroom at the University of Michigan with trained testers. All the testers were native speakers of either English or Chinese. After the tests, participants received a small gift and monetary compensation. At the beginning of the recruiting process, we did not implement the English reading tasks. Thus, some children did not have English reading scores.

Results

Descriptive

Frequency of book reading activities. The frequency of book reading activities at home were measured on a scale from 1 to 5, (1 = never, 5 = always). The reported frequency of reading Chinese to their children ranged from 0 to 5 ($M = 3.02$, $SD = 0.99$), similarly the

frequency of reading English to their children also ranged from 0 to 5 ($M = 3.53$, $SD = 1.09$).

Most parents read to their children in both languages. Additionally, we did not find a correlation between the frequency of English book reading activities and Chinese book reading activities, $r(56) = .10$, $p = .46$. Moreover, parents read English books to their child more often than Chinese books, $t(59) = 24.88$, $p < .01$.

Frequency of conversational activities. The frequency of parent-child conversational activities were measured on a scale from 1 to 5, (1 = never, 5 = always). The mean frequency of the parents speaking Chinese to their children was 4.11 ($SD = .92$, $range = 1 - 5$), while the mean of speaking English to their children was 3.20 ($SD = .94$, $range = 2 - 5$). In addition, the more parents spoke Chinese to their children, the less they spoke English to their children, $r(56) = -.63$, $p < .01$. Also, parents spoke Chinese at home more often than English, $t(58) = 34.51$, $p < .01$.

Age/context of exposure to Chinese. According to parental report, participants received systematic exposure to Chinese at birth. At least one of the children's parents was a recent immigrant from China, and thus all Children received exposure to Chinese at home from birth.

Age/context of exposure to English. Two indexes were considered for assessing children's first age first exposure to English: whether or not children had a parent who was a native speaker of English, and the age at which children entered an English-speaking daycare. If one of the child's parents was a monolingual native speaker of English, "birth" was considered the child's age of English exposure. For all other children, age of entry of an English-speaking daycare was taken as age of first systematic exposure to English and it

ranged from birth to 48 months.

Correlations

Table 1 is a summary of all the correlation coefficients showing the effects of HLE and the age of L2 acquisition on vocabulary development and reading acquisition in both languages.

Parent-child reading activities. Partial correlations (controlling testing age) were used to evaluate how well the frequency of parent-child reading activities predicted the bilingual children's vocabulary awareness and reading acquisition.

The frequency of parent-child reading activities in Chinese did not impact the child's Chinese vocabulary development, $r(56) = -.02, p = .89$ and Chinese reading acquisition, $r(56) = .01, p = .92$. Also, it did not have an influence on the child's English vocabulary development, $r(56) = -.21, p = .12$ and English reading acquisition, $r(49) = -.14, p = .34$.

The frequency of reading English to children at home did not have an impact on the child's Chinese vocabulary development $r(56) = -.17, p = .22$ and Chinese reading acquisition $r(56) = -.16, p = .24$. In addition, the frequencies of parental reading in English did not influence the children's English vocabulary development $r(56) = .15, p = .26$, but the more parents read with a child in English, the better was the child's reading acquisition in English $r(49) = .31, p < .05$.

Parent-child conversational activities. Partial correlations (controlling testing age) were conducted to test how well the frequency of parent-child conversational language use predicted the children's Chinese and English language awareness.

The more parents talked to their children in Chinese, the better was the child's Chinese

vocabulary development, $r(56) = .45, p < .01$, but the Chinese conversational use at home did not have an impact on the child's Chinese reading acquisition, $r(56) = .11, p = .42$. In addition, although we found a trend that the more parents talked to their child in Chinese, the worse was the child's English vocabulary development, $r(56) = -.26, p = .05$, Chinese usage at home did not influence the child's English reading acquisition, $r(49) = .04, p = .78$.

The more parents used English at home, the worse was the child's Chinese vocabulary development, $r(56) = -.44, p < .01$, but English usage at home did not impact the Chinese reading acquisition, $r(56) = -.13, p = .33$. In addition, the more parents talked to their child in English, the better was the Child's English vocabulary development, $r(56) = .39, p < .01$, and we found a trend that the more parents talked to their child in English, the better was the Child's English reading acquisition, $r(49) = .26, p = .07$.

Age of L2 acquisition. Partial correlation analyses (controlling testing age) were conducted to evaluate how well the age of exposure to English predicted the bilingual children's vocabulary awareness and reading acquisition.

The age of bilingual exposure to English did not have effects on the child's English vocabulary development, $r(50) = -.10, p = .53$ and English reading acquisition, $r(44) = .13, p = .39$. The English age of exposure did not impact the child's Chinese vocabulary development, $r(50) = -.04, p = .77$, and Chinese reading acquisition, $r(50) = -.1, p = .50$ as well.

Discussion

In this study, we investigated language and reading development in young heritage Chinese speakers raised in the English-speaking environment. In particular, we explored the

relationship between parent-child reading activities, the parent-child conversational activities and age of bilingual exposure on bilingual children's vocabulary development and reading acquisition in English and Chinese languages.

Parent-child Book Reading Activities

We investigated how the frequency of parent-child reading activities might impact the bilingual children's vocabulary development and reading acquisition.

Book reading activities in Chinese. As far as our knowledge, no similar previous studies have been done for Chinese-English bilinguals. Because of the within language and cross language transfer effects, our hypotheses were that book read activities in Chinese could benefit bilingual children's language and reading development in both languages. In contrast with our hypotheses, we did not find any significant effects of parent-child book reading activities on children's vocabulary and reading development. The reason for our results might be that compared to reading activities in English, parents generally read Chinese less often to their children. Therefore, Chinese book reading activities might not be frequent enough to reach significant results.

Book reading activities in English. For English monolinguals, previous findings have shown that generally parental-child reading activities can benefit vocabulary development and reading acquisition (e.g. Farrant & Zubrick, 2011 & Bus, van Ijzendoorn, & Pellergrini, 1995). Our hypotheses were that because of the positive transfer effect, parental-child book reading activities could benefit children's language and reading development in both Chinese and English. In fact, we only found that the higher frequency of parental-child reading in English predicted the better English reading acquisition. The reason for the results maybe

because English and Chinese are structurally different, and orthographically different, and thus cross-linguistic transfer is limited (Keung & Ho, 2009).

Parent-child Conversational Activities

We were also interested in how the frequency of parent-child conversational language usage might play a role on children's vocabulary development and reading acquisition in both English and Chinese.

Conversational activities in Chinese. As far as our knowledge, limited previous studies have focused on the impacts of Chinese conversational activities on Chinese-English bilinguals. However, previous findings have found that parental-child conversational activities can predict children's vocabulary development in Spanish-English bilinguals (e.g. Pearson et al., 1997). Due to the positive transfer within and between languages, our hypotheses were that parental-child conversational language activities in Chinese can benefit the children's vocabulary development and reading acquisition in both languages. Our findings were different from our hypotheses. We found that the higher frequency of Chinese use at home predicted the better Chinese vocabulary scores, but it also predicted the worse English vocabulary scores. The negative relationship between Chinese use and English vocabulary may be because that the more parents speak Chinese to their children, the less they speak English to their children. In addition, we did not find the link between Chinese conversational activities and reading development in both languages. This might be due to the fact that as a non-alphabet language, Chinese vocabulary and reading knowledge cannot be transferred.

Conversational activities in English. Previous studies found that the amount of parental

language input is positively associated with the rate of vocabulary growth in young English monolingual children (e.g. Huttenlocher et al., 1991). Because of the positive transfer within and cross languages, our hypotheses were that parental-child English conversational language activities can benefit the children's vocabulary development and reading acquisition in both languages. Consistent with the hypotheses, our studies found that the higher frequency of English use at home predicted the better English vocabulary scores. However, the more parents spoke to their children in English, the worse the children's Chinese vocabulary development would be. Again, it might be explained by the fact that more often parents spoke English to their child, the less often they spoke Chinese to their child. In terms of reading acquisition, we only found a trend indicating that the more parents talked with their children in English, the better was their English reading acquisition. However, we did not find a correlation between English conversational activities and Chinese reading development. This might be due to the fact that as an alphabet language, English vocabulary can positively transfer to reading; whereas in Chinese vocabulary and reading knowledge cannot be transferred.

Age of L2 Acquisition

We were interested in how well the age of English exposure might influence the child's language and reading development. Previous studies have found that the earlier the exposure to L2, the better the child's vocabulary development and reading acquisition was, but those studies were done with older children (e.g. John & Newport, 1989). Our hypothesis was that the earlier the age of L2 acquisition, the better their language and reading development would be. However, our results showed that the age of L2 exposure did not have an impact on the

bilingual children's vocabulary development and reading acquisition in both English and Chinese. One possible explanation would be that we had children learning English within the first 2-3 years of life, meaning that the children this young were still within the optimal sensitive period for language acquisition. Also, regardless of the age of first entry to English daycare, most children are born in the US and are thus exposed to English (even if minimally) from birth.

There were some limitations of our study. First of all, Chinese culture is academic-achievement oriented and Chinese writing system is very different from alphabet languages. Hence, we could not apply our findings to other bilingual children such as Spanish-English bilinguals. Secondly, there were more females than males in our sample. It might bias the research finding. We could have obtained a more gender balanced sample to improve the external validity of the study. In addition, this study was a correlational study, so we cannot conclude a causal relationship of our results. In the future, well-designed experiments are needed for casual conclusions.

Despite the limitations, results of this study provided evidences on how the HLE and age of L2 acquisition impacted the bilingual children's vocabulary development and reading acquisition. First, the results suggest that the more often the parents read with a child in English, the better was the child's reading development in English. No such relationship was found for Chinese-language literacy. Secondly, our study suggested that the more parents talked with a child in Chinese at home, the better was the child's vocabulary in Chinese, but the worse was the child's English vocabulary. In addition, the more parents talked with a child in English, the better was the child's vocabulary and reading in English, but then also,

the worse was the child's Chinese vocabulary development. Finally, at young ages (before three) the age of L2 exposure did not have a significant influence on language and reading development.

Our findings have educational implications for parents of Chinese-English bilinguals. Compared to the parent-child reading activities and the age of L2 acquisition, the parent-child conversational activities have larger impacts on the children's vocabulary development. Moreover, although both Chinese and English reading and conversational activities influence the children's vocabulary development, activities related to Chinese have a greater influence (greater r values). This might be because that bilinguals can learn English outside of home such as from peers, schools and TV programs, but activities with parents are usually their main resources for Chinese learning.

Reference

- Birdsong D. (1999). Second language acquisition and the critical period hypothesis. Mahwas, NJ: Lawrence Erlbaum Associates.
- Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65, 1-21.
- Cheung, P. S. P., Lee, K. Y. S. and Lee, L. W. T. (1997). The development of the 'Cantonese Receptive Vocabulary Test' for children aged 2–6 in Hong Kong. *International Journal of Language & Communication Disorders*, 32, 127-138.
- Chow, B., W., & McBride-Chang, C. (2003). Promoting Language and Literacy Development through Parent-Child Reading in Hong Kong Preschoolers. *Early Education & Development*, 14(2), 233-248.
- Chow, B. W., & McBride-Chang, C., & Cheung, H. (2010). Parent-child reading in English as a second language: Effect on language and literacy development of Chinese kindergarteners. *Journal of Research in Reading*, 33(3), 284-301.
- Collins, M. F., (2005). ESL preschoolers' English vocabulary from storybook reading. *Reading Research Quarterly*, 40, 406-408.
- DeTemple, J., & Snow, C. E. (2003). Learning words from books. In A. van Kleeck, S.A. Stahl & E.B. Bauer (Eds.), *On reading books to children: Parents and teachers*. (pp. 16-36). Mahwah, NJ: Lawrence Erlbaum Associates
- Farrant, M. B., & Zubrick, R. S. (2011). Early vocabulary development: The importance of joint attention and parent-child book reading. *First Language*, 32(3), 343-364.

- Hart, B., & Risley, T. (1995). *Before Headstart: Differences in the family experiences of 1 and 2-year-old children*. Baltimore, MD: Paul H. Brookes.
- Hood, M., Conlon, E. & Andrews, G. (2008). Preschool home literacy practices and children's literacy development: A longitudinal analysis. *Journal of Educational Psychology*, 100, 252-271.
- Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*. 27, 236-248.
- Johnson, S. J., & Newport, L. E. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*. 21(1), 60-99.
- Juhasz, B. J. (2005). Age of acquisition effects in word and picture identification. *Psychological Bulletin*, 131, 684-712.
- Kaufman, A. S. (2004). Kaufman Assessment Battery for Children, (KABC-II). Circle Pines, MN: AGS Publishing.
- Keung, Y. & Ho, S. C. (2009). Transfer of reading-related cognitive skills in learning to read Chinese (L1) and English (L2) among Chinese elementary school children. *Contemporary Educational Psychology*. 34(1), 103-112.
- Kovelman, I., & Baker, S. A., & Petitto L. (2008). Age of first bilingual language exposure as a new window into bilingual reading development. *Bilingualism: Language and Cognition*, 11(2), 203-223.
- Kovelman, I., & Baker, S. A., & Petitto L. (2008). Bilingual and monolingual brains compared: A functional magnetic resonance imaging investigation of syntactic

- processing and a possible “neural signature” of bilingualism. *The Journal of Cognitive Neuroscience*, 20, 153-169.
- Li, H., Shu, H., McBride-Chang, C., Liu, H. and Peng, H. (2012). Chinese children's character recognition: Visuo-orthographic, phonological processing and morphological skills. *Journal of Research in Reading*, 35, 287–307.
- Patterson, J. L. (2002). Relationships of expressive vocabulary to frequency of reading and television experience among bilingual toddlers. *Applied Psycholinguistics*, 23, 493-508.
- Pearson, Z. B., Fernandez, V. L., & Oller, K. (1997). The relation of input factors to lexical learning by bilingual infants. *Applied Psycholinguistics*, 18, 41-58.
- Peeters, M., & Verhoeven, L., & Moor, J. D., & Balkom, H. V., & Leeuwe, J. V. (2009). Home Literacy Predictors of Early Reading Development in Children with Cerebral Palsy. *Research in Developmental Disabilities*, 30(3), 445-461.
- Perani, D., Abualebi, J., Paulesu, E., Brambati, S., Scifo, P. & Cappa, S. F. (2003). The role of age of acquisition and language usage in early, high-proficient bilinguals: An fMRI study during verbal fluency. *Human Brain Mapping*, 19(3), 170-182.
- Shin, H. B., & Bruno, R. (2003). Language Use and English-speaking Ability: 2000. Census 2000 Brief.
- Woodcock, R. W. *Woodcock Reading Mastery Tests, Revised, Examiner's Manual*. American Guidance Service, 1998.
- Vygotsky, D. (1974). *Mind in society*, Cambridge: Harvard.

Table 1

Correlations between HLE & age of L2 exposure and task scores

| | Chinese | | English | |
|-------------------------|-------------|------------|-------------|------------|
| | Vocab | Reading | Vocab | Reading |
| Reading (English) | -0.17 | -0.16 | 0.15 | 0.31* |
| | $p = 0.22$ | $p = 0.24$ | $p = 0.26$ | $p = 0.03$ |
| Reading (Chinese) | -0.02 | 0.01 | -0.21 | -0.14 |
| | $p = 0.89$ | $p = 0.92$ | $p = 0.12$ | $p = 0.34$ |
| Conversation (English) | -0.44*** | -0.13 | 0.39** | 0.26 |
| | $p < 0.001$ | $p = 0.33$ | $p = 0.002$ | $p = 0.07$ |
| Conversation (Chinese) | 0.45*** | 0.11 | -0.26 | 0.04 |
| | $p < 0.001$ | $p = 0.42$ | $p = 0.05$ | $p = 0.78$ |
| Age of English Exposure | -0.04 | -0.10 | -0.10 | 0.13 |
| | $p = 0.77$ | $p = 0.50$ | $p = 0.53$ | $p = 0.39$ |

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.