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Author(s)	He, Sun & Ee, Lynn Ng

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Home and School Factors in Early English Language Development

He SUN

National Institute of Education, Nanyang Technological University

EeLynn Ng

National Institute of Education, Nanyang Technological University

Corresponding author: He Sun

National Institute of Education, Nanyang Technological University

1 Nanyang Walk, 637616, Singapore

he.sun@nie.edu.sg

Abstract

The current study explored the home and school factors for 1440 Singaporean pre-schoolers' early English development from K1 to P1. Language input quantity and quality factors at home (e.g., number of English books,) and at school (e.g., instructional support in class) were used to predict children's English vocabulary and word reading development using linear mixed-effects models. Children's internal factors (e.g., non-verbal reasoning) were controlled. The results revealed that children who had more English input and higher input quality at home demonstrated faster receptive vocabulary growth. Children's word reading skill was more influenced by the English input quality at home. The children that were frequently read English books demonstrated faster development in word reading competence. Mother's educational level also mattered: the higher the mother's education was, the faster the child's reading skill developed. The length of time children stayed at school and teachers' qualification also significantly and positively associated with children's English learning. These findings indicate the substantial contribution of home literacy environment to Singaporean children's early English language development, compared to the quality of teacher-child interactions in preschool. The necessity of more parental involvement in early English language learning at home is discussed under the realm of usage-based theory.

Keywords: early English language education, input quantity, input quality, home language environment, teacher qualification, instructional quality, used based theory.

Introduction

Early language development plays a fundamental role in children's cognitive development, social-emotional wellbeing, and academic performance (Dickinson & McCabe, 2001; Sun, 2019; Sun, Yussof, Mohamed, Rahim, Cheung, Cheong, & Bull, 2018; Sun, Yussof, Vijayakumar, Lai, O'Brien, & Ong, 2020). In Singapore, the Ministry of Education considers it as one of the six major areas of development in pre-schoolers (Ministry of Education, 2013). Children's early language development is influenced by various cognitive and environmental factors (Paradis, 2011). Among these, the environmental factors related to home and school are found to play a fundamental role in the language acquisition (of monolinguals, Hoff, 2006; of bilinguals, Sun, Ng, O'Brien, & Fritzsche, 2020), as children witness and practice the language(s) for communicative purposes in these settings. From the usage-based perspective (e.g., usage-based theory, emergentism), children's language development is holistically driven by input properties, communicative interactions, and domain-general cognitive skills, with input properties addressed by most of the studies (Paradis, Rusk, Sorenson Duncan, & Govindarajan, 2017). The current paper follows the approach taken by the studies under the usage-based framework (Ambridge & Lieven, 2011; Paradis, 2011; Sun, Yin, Amsah, & O'Brien, 2018), to examine children's differences in home and school English environment as predictors of bilingual children's English development in Singapore. The following sections summarize the significant environmental factors on bilingual children's English language development found by previous studies.

Home Factors

Language input quantity. It is widely acknowledged that language input is "a multi-layered construct comprised of not only basic frequency of exposure but also interactional, qualitative factors" (Grüter & Paradis, 2014, p.12). Input quantity can be generally defined as the amount of the target language spoken by the caregivers to children, and the amount of the input varies substantially across households (Sun, Steinkrauss, Tendeiro, & de Bot, 2016). The influence of the relative language input quantity on bilingual children's language development has been widely observed: bilingual children's language proficiency is proportionally related to their relative language input quantity at home (Sun, Yin, et al., 2018).

Input quality at home, which can generally be defined as authenticity and richness of language exposure, has also been found to influence bilingual children's language development

(Jia & Fuse, 2007; Sun, Yin, et al., 2018). Among the quality factors, children's reading activities are assumed to play a critical role in early language development, probably because of the complexity of the book language and caregiver interaction during shared book reading (Sun, 2019). Book reading has been found to explain approximately 8% of the variance of children's later language and reading comprehension (Bus, van IJzendoorn, & Pellegrini, 1995), and 12% of children's differences in oral language skills (Mol & Bus, 2011). The current study would assess the impact of children's weekly reading frequency and English reading materials on children's English development.

Language output quantity. Bilingual children's own language output has been found to influence their language development on top of their input quantity and quality (Hoff, 2020). The more children use the target language, the better this language develops, probably because language output enables children to "pilot" their language and reflect on their own language behaviors (Bohman, Bedore, Pena, Mendez-Perez, & Gillam, 2010; Rojas et al., 2016). If we borrow an insight from Swain's Output Hypothesis (2008), we could assume that bilingual children's language output makes children better aware of their language limits and allows them to contemplate their own and others' language behavior in communication. Bilingual children's language output could be assessed with their onset age of speaking the language (i.e., cumulative language output) or the amount of language they use at home per week (i.e., current language output). We investigate the impact of children's cumulative language output on their English development in the current study.

Family socioeconomic status (SES). SES is another well-accepted home factor that potentially affects early language development. Hart and Risley's classical study (1995) indicated that monolingual American children's English input gap in words could be as large as 30 million words between high-SES (professionals) and low-SES (on public assistance) families in the early years. Such language discrepancy was related to children's differences in language proficiency and academic performances at the age of eight. The significant impact of SES on language learning has also been observed in bilingual children (e.g., Sun, Yin, et al., 2018). Moreover, SES may influence the amount of time and resources that parents invest in their children's language learning, and influence children's language outcomes eventually (Dickinson & Tabors, 2001). In the current study, we measure children's family SES via maternal educational level and family income.

School Factors

Input quantity at preschool. Language input at school is often decontextualized, helping children establish reasoning and classifying skills using academic language. In contrast, the input at home is often related to the here and now, focusing on children's labeling and description abilities (Hoff, 2006; Sun, Toh, & Steinkrauss, 2020). Therefore, children's early language development can be simultaneously influenced by school and home factors. Children who have attended school longer were found to use more diverse vocabulary and complex sentences in English storytelling (Sorenson Duncan & Paradis, 2020). In the current study, we followed the approaches that were used in the literature (e.g., Sun, Steinkrauss, Wieling & de Bot, 2018) and estimate children's English input quantity at school with their time spent at preschool.

Input quality at preschool. Teachers' background (e.g., qualification and teaching experience) has been found to affect early language learning (Druten-Frietman, Denessen, Gijsel, & Verhoeven, 2015; Gerde & Powell, 2009). For instance, Sun, Toh, and Steinkrauss (2020) followed 37 kindergarten teachers and 440 4- to 5-year-old kindergartners' English interaction in their shared book reading, and those teachers with more years of teaching experience were found to use significantly more medium cognitive loading questions and comments (e.g., recall, definition, expansion), which in turn promoted children's English vocabulary and word reading over the academic year in Singapore. Apart from teachers' qualification and teaching experience, the quality of their interactions with children might affect early language development. The Teaching through Interactions framework of effective teaching (Hamre & Pianta, 2007) posits that three broad domains of teacher-child interactions (Emotional Support, Classroom Organisation, and Instructional Support) provide the key mechanisms through which children learn and develop cognitive and language skills (Pianta & Hamre, 2009). Emotional Support refers to the extent to which teachers create a sensitive and warm learning environment supportive of children's learning and engagement in classroom activities. Classroom Organisation focuses on how teachers manage children's behavior and attention to maximize student engagement. Instructional Support focuses on teachers' use of effective strategies (e.g., questioning, scaffolding, provision of feedback) to improve children's higher-order thinking and language skills. Several studies have found that high quality Instructional Support positively correlated with children's language and literacy development in the areas of receptive and

expressive language, writing, and letter naming (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Downer, López, Grimm, Hamagami, Pianta, & Howes, 2012; Howes, Burchinal, Pianta, Bryant, Early, Clifford, & Barbarin, 2008; Leyva, Weiland, Barata, Yoshikawa, Snow, Treviño, & Rolla, 2015). Some studies also found that children in more emotionally supportive and better organized classrooms showed significantly greater gains in language and literacy skills (Curby, Brock, & Hamre, 2013; Downer et al., 2012). However, it should be noted that two recent meta-analysis of American (Perlman et al., 2016) and European studies (Ulferts, Wolf, & Anders, 2019) revealed weak to null associations between these domains of teacher-child interactions and measures of children's language and literacy skills.

Other Influential Internal Factors

Bilingual children's internal factors, such as age, gender, the linguistic distance between the two languages, and domain-general skills (i.e., non-verbal reasoning and working memory) also influence their English language learning (Paradis, 2011). Age can generally indicate children's cognitive maturation, and the older children are, the faster they are supposed to develop their language skills (Muñoz, 2008). Research on gender revealed equivocal findings: some studies found girls are learning languages faster than boys during the early years (e.g., Bornstein, Haynes, & Painter, 1998), while others demonstrated no consistent differences (e.g., Sun, Yin, et al., 2018). We explore the impact of gender in the current study. Aside from age and gender, the linguistic distance between the two languages might be related to bilingual children's English language learning, probably because of the presence of language transfer (Paradis, 2011). In a recent study by Floccia et al. (2018), 430 bilingual toddlers were assessed on their vocabulary size, and the linguistic distances between English and 13 mother tongue languages (e.g., Mandarin) were estimated with phonological similarity, word order typology, and morphological complexity. The results indicated that similar word order and morphology between English and mother tongue language can promote children's receptive vocabulary learning. Lastly, domain-general skills were found to affect children's language learning ability. For instance, better non-verbal reasoning allows children to infer and reorganize patterns and schemas from the language input more effectively (Hakuta & Diaz, 1985; Daller & Ongun, 2017), and better non-verbal reasoning has been found to relate to children's better learning outcomes (Paradis, 2011; Sun et al., 2016; Sun, Yin, et al., 2018). The current study took these

influential factors as control variables, to tease apart their impact on children's early language development from the effects of home and school factors.

The Current Study

This study focuses on Singapore, a multilingual and multi-ethnic society, where English is the official majority language and plays a critical role in government administration, education, business, and inter-ethnic communication (Dixon, 2011; Sun et al., 2018). Children need to have a good command of English since young, as English is important for their education and communication. Despite its importance, recent studies reveal that children have huge differences in their early English proficiency. To ensure all children have a good language start, we need to specify the environmental factors that may greatly promote the speed and quality of their language acquisition (De Houwer, 2017; Sun, Steinkrauss, et al., 2016). In the current study, we focus on children's development in receptive vocabulary and word reading from the first year of kindergarten (K1) to the first year of primary school (P1). Specifically, we would like to explore to what extent the home environment and school environment are associated with children's learning speed of English vocabulary and word reading.

Methods

Participants

The data in the current study is part of a large-scale longitudinal study on Singaporean kindergarteners' development in language, numeracy, social-emotional wellbeing, motor skills, and other domains. Participants' home environment was assessed with parental questionnaires and the quality of teacher-child interactions in the first year of preschool was evaluated using the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008). There were 1537 children who have participated in some or all waves of data collection. We removed the data of children with atypical development and those whose ethnicity is neither Chinese nor Malay or Indian, as these children's language input quantity and quality might be significantly different from the rest of the sample. The final sample comprised 1440 children from 80 centres, with nearly balanced gender distribution (i.e., 722 boys and 718 girls). The instructions in these centres were guided by the Nurturing Early Learners framework outlined by the Singapore Ministry of Education (2013). Common activities in the English classes include shared book reading, games, and vocabulary learning.

Data collection and Instruments

Children were tested at K1, K2, and P1 four times with the same English tests and we focused on the three waves of the data that were collected with approximately one academic year in between. Parents and teachers were asked to fill in the questionnaires on home and school details in K1. Parents reported their background information (e.g., education and income) and home language and literacy activities, while teachers reported background information such as teaching experience, qualification, and teaching practices and beliefs on early education. Teachers were also observed at K1 for the quality of their teacher-child interactions using the CLASS.

English receptive vocabulary. The Bilingual Language Assessment Battery (BLAB; Rickard Liow, Sze & Lee, 2013) was used to assess children's English receptive vocabulary skills. BLAB is a standardized receptive picture vocabulary task developed in Singapore. It was adapted from the Peabody Picture Vocabulary Test II (Dunn & Dunn 1997). In each trial, children listened to an audio-recorded English word and selected one of four picture options that best corresponded to the word. Children first completed three practice trials, followed by 80 test trials. The dependent measure was the total number of correct responses on the test trials. Higher scores reflect better receptive vocabulary skills. The BLAB has demonstrated strong reliability in the context of Singapore within the original norming sample (alphas of .75 –.77).

English word reading skills. The Word Reading subtest (Blue form) of the Wide Range Achievement Test, 4th edition (WRAT-4; Wilkinson & Robertson, 2006) was used to assess children's English word reading skills. This subtest, which comprised Letter Reading (15 items) and Word Reading (55 items), required children to read the letters and words aloud. Test items were scored as "1" if children read the letter/word correctly. Only the Word Reading component had a discontinue rule, whereby test administration was terminated after ten consecutive incorrect responses. The dependent measure for this subtest was the total number of correct responses on letter and word reading. Higher scores reflect better word reading skills. The split-half reliability of the Word Reading subtest is .98, and the validity (median correlation with other measures of word recognition) is .71, according to the WRAT-4 manual.

Questionnaires and survey. Individual differences in family factors were assessed using a parental questionnaire. The questionnaire was adapted from studies that discussed different factors of home language environment (Bedore et al. 2012; Farver et al. 2006; Phillips &

Lonigan 2009) and was given to parents in their preferred language. Parents completed items about children's language input quantity, quality and output at home. Language input quantity was estimated based on the extent of English dominance at home, with higher scores reflecting higher frequency and quantity of English use in the family (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Often, 4 = Always). Children's English home literacy environment was estimated based on the frequency of reading English books per week and the number of English books at home, using scales ranging from 0 to 7 days and 0 to 6 (0 = None, 1 = 1-10, 2 = 10-30, 3 = 30-60, 4 = 60-90, 5 = 90-120, 6 = More), respectively. Demographic information (e.g., gender and mother's educational level) was also collected using another short survey. Mother's educational level refers to the highest educational qualification obtained, ranging from no qualification to doctorate degree. Monthly household income ranges from "Below 1000" to "10,000 and above", with S$500 increment for each higher level. Teachers completed a survey to provide information about the number of years of kindergarten teaching experience and their educational qualifications, ranging from "Certificate in Preschool Teaching" to "Doctorate Degree Specific to Early Childhood".

Quality of teacher-child interactions. The Classroom Assessment Scoring System (CLASS; Pianta et al., 2008) was used to measure the quality of teacher-child interactions in three domains (Emotional Support, Classroom Organisation and Instructional Support). Each domain comprised three to four dimensions (10 dimensions in total) assessing interactions, each with specific behavioural markers serving as examples of the dimensions. Trained staff videotaped classrooms during the first three to four hours of a typical day. From each classroom's video-recording, between four to seven 20-minute observation cycles were drawn to cover a variety of activities (e.g., whole group, small group, learning centres) throughout the day. Trained CLASS coders assigned scores on all CLASS dimensions for each cycle. Each dimension was scored using a 7-point Likert scale, with 1-2 indicating low quality, 3-5 indicating mid-range quality, and 6-7 indicating high quality. To ensure reliability, 20% of the cycles within each classroom were double-coded and consensus discussions were held to resolve differences between coder pairs. The average inter-rater reliability (before consensus) was 84%. Following standard CLASS procedures, dimension scores were averaged across cycles and consolidated to generate three domain scores for each classroom. Higher scores indicate better quality.

Non-verbal reasoning. The Raven's Colored Progressive Matrices (CPM) (Raven and Rust, 2004) was used to assess children's non-verbal reasoning skills, as it has been extensively used across a variety of settings worldwide as a culture-neutral measure of non-verbal reasoning skills. The task comprised three sets of 12 items (Sets A, AB, and B). In each item, a pattern with a missing element was presented in matrix format (either 2x2, 3x3, 4x4, or 6x6). Children were instructed to select one element that completed the pattern from a set of alternatives. Administration of each set was terminated after four consecutive incorrect responses. The dependent measure was the total number of correct responses across all three sets. Higher scores indicated higher non-verbal reasoning skills.

Working memory. A computerised version of the Backward Digit Recall (BDR) task was used to assess children's working memory capacity (modified from Pickering & Gathercole, 2001). After being taught the concepts of counting "forward" (e.g., 1, 2, 3, 4, 5) and "backwards" (e.g., 5, 4, 3, 2, 1), children listened to a series of numbers (e.g., 1, 2) and recalled the numbers in backward order (e.g., 2, 1). The task consisted of six blocks (six trials each), which progressed from a block with two numbers (span of 2) to a block with seven numbers (span of 7). Within each span, the task automatically advanced to the next span if four out of six trials were answered correctly. The task was discontinued if there were four or more incorrect answers within the active span. The dependent measure was the total number of correct trials. Higher scores indicate better working memory skills.

Linguistic distance. The linguistic distance for each language pair (i.e., English-Mandarin, English-Malay, and English-Tamil) was estimated with Floccia et al.'s (2018) approach (Sun, Ng, et al., 2020). In terms of word order (VO vs. VO/OV vs. OV), Tamil was assigned a '3' for its OV order, while Mandarin and Malay obtained a '1' for their English alike VO orders. In terms of morphological complexity (Analytical vs. Fusional vs. Agglutinative), Malay and Tamil were given a '3' as both are agglutinative languages, while Mandarin got a '1' because its analytic nature is similar to English. Combined the values of word order and morphological complexity, English and Mandarin were assumed to have the shortest linguistic distance among the three pairs, while English and Tamil have the longest distance.

Data analysis

Linear mixed-effects models in R (LMEM; version 3.4.1; R Core Team, 2017) with the lme4 package (version 1.1.13; Bates, Maechler, Bolker, & Walker, 2015) were used to analyse

our data. In the current study, there are missing values in many variables due to parents' or teachers' overlooking of certain items in the questionnaires or children's absence of tests. LMEM is better than traditional regression approaches in this case, as it is more appropriate to handle datasets with missing values (Baayen, 2008, Chapter 7; Jaeger, 2008). Moreover, LMEM allowed us to take into account the random structural variation at class and school levels.

Results

Descriptive statistics

The descriptive statistics of the predictors (i.e., control, home, school factors) and outcomes (i.e., children's English vocabulary and word reading scores from K1 to P1) are summarized in Table 1. On average, children have been tested at the age of 4;9 years old, 5;10 years old, and 6;9 years old across the three waves of data collection. They demonstrated substantial individual differences in terms of cognitive abilities and English learning environment. The majority of students were brought up in an English dominant environment at home: among those who answered the questions on home language dominance, 55.8% of the caregivers indicated that English was the primarily language used at home, and another 19% of the participants demonstrated that they used English often in the home setting. Although English was widely used in many households, children varied in their English usage and literacy environment. Some children started to speak English since was born, while others only started to speak it after attending preschool (English Speaking Age (in years): M=2.15, SD=1.05). Based on the 1225 answers on weekly home English book reading frequency, 5.1% of the children were found to receive no English reading at all, while 14.1% of the children were read to in English every day (English Book Number: M=3.6, SD=2.05). There were 51.6% of the families owning 31-60 English books or more. In terms of SES, many mothers obtained a bachelor degree and their family income was about S$6000-6500 per month.

Similar to home factors, children were also exposed to different school environments. In general, children had been enrolled at preschool for 3 months (School Time: M=3.4, SD=1.73) when tested at K1, for 15 months at K2 (School Time: M=15.8, SD=1.45), and for 27 months at P1 (School Time: M=26.98, SD=1.29). The quality of teacher-child interactions at K1 was in the mid-range quality for Emotional Support and Classroom Organisation, and low quality for Instructional Support. The average child-teacher ratio was 12 (M=11.72, SD=3.34). Their

English teachers had about 7 years of experience at preschool (*M*=7.35, *SD*=5.98), and the majority held a diploma in early education.

Children's English receptive vocabulary and word reading skills advanced steadily in general. At K1, children could recognize 36 English words on average (*M*=35.63, *SD*=8.78), and the number increased to 43 at K2 (*M*=42.96, *SD*=8.41), and 50 at P1 (*M*=49.71, *SD*=9.11). The same has been found with children's English word reading ability: at K1, children could read about 15 English words on average (*M*=15.40, *SD*=5.92), and the number increased to 22 words at K2 (*M*=22.17, *SD*=7.39), and 30 words at P1 (*M*=29.71, *SD*=7.97). Despite the general increasing tendency, there was variation in their developmental rate, and such heterogeneity has been demonstrated in Figure 1.

<Insert Figure 1 here>

The predictors were assessed for skewness and the values were all within the acceptable range of ±2 (Field, 2009). Besides, the correlations of the factors were examined to avoid multicollinearity. Only age and school time were found to be highly correlated, and the former was excluded from the mixed effects modeling analysis. The predictors with centred values were added in groups to the mixed-effects models in the following order: control factors related to children's internal characteristics (i.e., gender, language distance between English and children's mother tongue, non-verbal reasoning, and working memory), home factors (i.e., English dominance, English speaking age, English reading days per week, the number of books in English, mother's education level, and household income), and school factors (i.e., the months that children spent at school at each wave of testing, teachers' interactional quality indicated by the three aspects of CLASS observation: emotional support, classroom organization, and instructional support; teacher-children ratio in class; teacher's work experience, educational level). Model fits were assessed with the changes of AICs, and a lower AIC (>=2) implies that the more complicated model is warranted because of a better model fit. Besides the AIC changes, we also examined the residuals of our models and ensured that they followed a normal distribution.

<Insert Table 1 here>

Home and school factors in children's English receptive vocabulary development

The model with all the predictors (i.e., Model 3a) (including random intercepts for child and school, and a random slope for child and time) explained 74% of the variance in children's

development of receptive vocabulary size from K1 to P1, of which 45% was attributable to the fixed-effects only (see Table 2). The inclusion of home- and school-oriented factors in sequence led to better model fit. Three home factors (i.e., English dominance, English speaking age, and the number of English books at home) and one school factor (i.e., the months that children spent at school at each wave of testing) significantly predicted children's English receptive vocabulary development. Specifically, more frequent use of English at home (B=1.13, SE=0.25, t=4.55, p<.0001), starting to use English at a younger age (B=-0.78, SE=0.21, t=-3.63, p<.001), more English reading materials at home (B=0.59, SE=0.18, t=3.3, p<.0001), and a longer period of staying at school (B=0.56, SE=0.02, t=29.5, p<.0001) are significantly related to faster development in receptive vocabulary from K1 to P1. The control factors also explained children's individual differences in their learning speed of receptive vocabulary. Girls (B=1.22, SE=0.43, t=2.83, p<.0001) developed their vocabulary faster than boys. Moreover, children with better non-verbal reasoning (B=0.47, SE=0.05, t=10.11, p<.0001) and working memory (B=0.19, SE=0.04, t=4.64, p<.0001) demonstrated faster speed in vocabulary learning. The linguistic distance was negatively and significantly related to children's English vocabulary growth when only internal factors were included, indicating that if children's mother tongue language is similar to the English language in word order and morphology, their language background may promote their receptive vocabulary learning. Nevertheless, the effect of language distance became non-significant when the home factors and the school factors were added into the model subsequently.

<Insert Table 2 here>

Home and school factors in children's English word reading development

In terms of children's development of word reading in English, the model with all the factors (i.e., Model 3b) (including random intercepts for child and school, and a random slope for child and time) explained 85% of the variance in children's developmental speed from K1 to P1, of which 59% was attributable to the fixed-effects only (see Table 3). Similar to the vocabulary models, including the home- and school-oriented factors subsequently improved the model fit. Children's home literacy environment and SES mattered. The more frequently children were read English books at home per week (B=0.34, SE=0.1, t=3.26, p=.001), the faster their word reading skills developed. Children with higher educated mothers (B=0.37, SE=0.1, t=3.77, p<.0001) were also found to increase their word reading skills quicker. Furthermore, the total

time that children spent in school (B=0.58, SE=0.01, t=47.15, p<.0001) and teachers' educational level (B=0.43, SE=0.20, t=2.16, p=0.03) were significantly and positively associated with children's development in word reading skills from K1 to P1. Last, children with better non-verbal reasoning (B=0.3, SE=0.04, t=7.37, p<.0001) and working memory (B=0.13, SE=0.03, t=4.85, p<.0001) were found to develop their word reading skills faster.

<Insert Table 3 here>

Discussion

The current study intends to identify significant home and school factors that contribute to the development of children's English receptive vocabulary and word reading skills from K1 to P1. The results might assist parents, teachers, and policymakers for specific home language policy and language education plans at school. The LMEMs reveal that both language input quantity and quality significantly affect the speed of children's English development in Singapore. In the following sections, we provide a discussion on these factors against the backdrop of a broader literature.

Home factors in early English vocabulary and reading development

The results indicate that children's early receptive vocabulary development might be influenced by both the quantity and quality of home English exposure. In terms of the quantity of English input and output, the more English had been used at home, the earlier children started to speak English, the faster children developed their vocabulary. Our finding is in line with the literature (e.g., Bohman et al., 2010; Grüter & Paradis, 2014; Sun, Yin, et al., 2018) and usage-based theory, implying that more language input and output may facilitate bilingual children's meaning-extraction and semantic entrenchment. Quality-wise, more English reading materials available at home was found to be positively and significantly associated with children's development of English vocabulary. Compared to daily conversation, children's books contain more diverse and sophisticated words (Montag, Jones, & Smith, 2015), and caregivers also tended to use more complex words and syntactic structures in the reading (Weizman & Snow, 2001, Hoff, 2006). Thus book reading offers children rich exemplars to expand their vocabulary.

In contrast to the findings for receptive vocabulary development, only quality factors but not quantity factors at home have been found to significantly relate to children's word reading development. Those children who were read to in English more often and those whose mothers

had higher educational qualifications were found to develop their English word reading faster. Our results imply that conversational exchanges may have a limited contribution to bilingual children's development in English word recognition, but more literacy activities may enhance the speed of acquisition. This is probably due to the nature of word reading, as the development of this skill requires children to have a decent knowledge of phonological awareness, decoding, and sight recognition of high-frequency words. In particular, children must command the alphabetic principle and letter-sound correspondences to decode words (Boyer & Ehri, 2011). Frequent literacy activities, especially with parental instruction, may promote children's reflection on the connections between speech and print and facilitate children's word reading. For those words that do not follow common letter-sound correspondences but frequently appear in children's language exposure (e.g., once), children may encounter these words from wide and frequent reading and gradually develop automaticity of the sight words. Besides reading frequency, mothers' educational level, an indicator of family SES, has also been found to relate to children's developmental speed of word reading. The existing studies (e.g., Dickinson & Tabors, 2001) demonstrated that parents of higher SES families would invest more time and resources on children's language and literacy learning. In the current study, mothers' educational level was significantly correlated to reading frequency (r=.28) and the number of English books (r=.34), implying that mothers with higher educational qualifications may spend more time on the instruction of word recognition and thus promote their children's development in word reading.

School factors in early English vocabulary and reading development

In terms of school factors, the number of months that children spent at preschool at each wave of testing was positively and significantly related to bilingual children's development in English vocabulary and word reading, indicating the crucial role that cumulative exposure of school instruction plays in children's early English learning. At school, teachers may frequently use academic language (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002) to conduct both decoding related activities and meaning-focused activities via book reading and other class routines (Sun et al., 2016; Sun, Toh, & Steinkrauss, 2020). These activities may promote children's knowledge in semantics, phonological awareness, and regular and irregular letter-sound correspondences, which in turn speeds up children's development in receptive vocabulary and word reading. Besides input quantity at school, the teacher's educational qualifications have

been found to be positively and significantly related to children's development in word reading, indicating the importance of teacher's qualification in early literacy instruction.

It is rather surprising that all the other teacher-related factors (e.g., Instructional Support) were not found to contribute to children's English language development. This might be due to how the teacher variables were measured, e.g., focusing on global assessments of interactional quality (i.e., CLASS), rather than domain-specific assessments of interactional quality (e.g., teachers' and children's lexical and syntactic complexity). Some studies found that the latter might be more influential in promoting children's early language growth, as they would exert an immediate impact on children's participation and production (Sun, de Bot, & Steinkrauss, 2015). More recently, Ulferts et al. (2019) found that both global and domain-specific processes quality matter to children's language and literacy outcomes. Future investigations may consider including these global and specifc measures of interactional quality to tease apart their contributions to children's vocabulary and reading development.

The non-significant influence of CLASS interactional quality on child outcomes may also be due to the low to mid-range levels of quality observed in this study. It has been proposed that associations between interactional quality and child outcomes are stronger at higher levels of quality (e.g., Hatfield, Burchinal, Pianta, & Sideris, 2016). Hatfield et al. (2016) found that the associations between quality and phonological awareness skills were greater when CLASS Emotional Support was rated higher (i.e., six or above). Similarly, associations between quality and literacy skills were greater in classrooms with Classroom Organisation scores of six or higher. Future studies may consider including a broader sample of preschool classrooms representing more varied levels of interactional quality.

Other internal factors in early English vocabulary and reading development

Domain general factors (i.e., non-verbal reasoning and working memory) were found to influence children's development in both English vocabulary and word reading. As predicted by usage-based theory, reasoning and memory play a crucial role when children process the ambient language input from the environment. In terms of gender, it was only significantly related to children's development in receptive vocabulary but not in word reading, demonstrating its differential effects on different language domains. Specifically, girls have been found to develop their vocabulary faster than boys, but the advantage was not transferred to early literacy skills, such as word reading in the current study. Future studies might employ more domains of

language and literacy to investigate the potentially varied effects of gender and the related mechanism.

Limitations and Implications

The current study has several limitations. First and foremost, this is a correlational study despite its longitudinal data collection, therefore the findings should be cautiously interpreted from the perspective of prediction. Future studies might conduct experiments to examine the significant factors identified in the current study to better inform educational practices at home and at school. Secondly, the variability in CLASS domain scores was low, and it is probably partially due to the study's sampling strategy, which targeted preschool centres whose fees were affordable to the majority of local families in Singapore. Future studies might include more private preschools charging high fees to comprehensively examine preschool teachers' and children' interactional quality in Singapore. On top of the global measures of the interaction, domain specific measures on teacher-child interactions in English classes should be adopted, as they might be more sensitive to teachers' variation in instructional quality in different class activities. Furthermore, teachers' and children's utterances should be sampled and transcribed to investigate their lexical and syntactic complexity, as the micro-level analysis has been proved to be effective in differentiating teaching quality at preschool (Dickinson, 2011; Huttenlocher et al., 2002; Sun, Toh, et al., 2020; Sun & Verspoor, 2020). The measure of input quantity at school could be improved by using exact hours of English instruction per week, to tease apart the contribution of cognitive maturation on children's early language learning. Despite the limitations, our results reveal that home environment and school instruction are important to children's development in vocabulary and word reading. Specifically, parents should be informed about the importance of the home literacy environment as it might have a lasting effect on children's language and literacy development as demonstrated in the current study. Caregivers should be encouraged to read more often to the children at home with proper strategies (e.g., on decoding). They should also be encouraged to visit the public library more often to enrich children's reading exposure in terms of book genre and language difficulties (Sun, 2019).

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References

Ambridge, B., & Lieven, E. (2011). *Child Language Acquisition: Contrasting Theoretical Approaches.* Cambridge: Cambridge University Press. doi:10.1017/CBO9780511975073

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Baayen, R. H. (2008). *Analyzing Linguistic Data: A Practical Introduction to Statistics using R.* Cambridge University Press.

Bedore, L. M., Peña, E. D., Summers, C. L., Boerger, K. M., Resendiz, M. D., Greene, K. A. I., Bohman, T. M., & Gillam, R. B. (2012). The measure matters: Language dominance profiles across measures in Spanish–English young DLLs. *Bilingualism: Language and Cognition, 15*(3), 616-629. https://doi.org/10.1017/S1366728912000090

Bohman, T. M., Bedore, L. M., Pena, E. D., Mendez-Perez, A., & Gillam, R. B. (2010). What you hear and what you say: Language performance in Spanish-English bilinguals. *International Journal of Bilingual Education and Bilingualism, 13*(3), 325-344. https://doi.org/10.1080/13670050903342019

Bornstein, M. H., Haynes, M., & Painter, K. (1998). Sources of child vocabulary competence: a multivariate model. *Journal of Child Language, 25*(2), 367–393. https://doi.org/10.1017/S0305000998003456

Boyer, N., & Ehri, L. (2011). Contribution of phonemic segmentation instruction with letters and articulation pictures to word reading and spelling in beginners. *Scientific Studies of Reading, 15*(5), 440-470. https://doi.org/10.1080/10888438.2010.520778

Burchinal, M., Vandergrift, N., Pianta, R., & Mashburn, A. (2010). Threshold analysis of association between child care quality and child outcomes for low-income children in pre-kindergarten programs. *Early Childhood Research Quarterly*, *25*(2), 166-176. https://doi.org/10.1016/j.ecresq.2009.10.004

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), 1-21. https://doi.org/10.3102/00346543065001001

Curby, T. W., Brock, L. L., & Hamre, B. K. (2013). Teachers' emotional support consistency predicts children's achievement gains and social skills. *Early Education and Development*, *24*(3), 292-309. https://doi.org/10.1080/10409289.2012.665760

Daller, M., & Ongun, Z. (2017). The threshold hypothesis revisited: Bilingual lexical knowledge and nonverbal IQ development. *International Journal of Bilingualism.* doi: 10.1177/1367006917690835

De Houwer, A. (2017). Bilingual language input environments, intake, maturity and practice. *Bilingualism: Language and Cognition, 20*(1), 19-20. https://doi.org/10.1017/S1366728916000298

Dickinson, D. K. (2011). Teachers' language practices and academic outcomes of preschool children. *Science, 333*(6045), 964-967. https://doi.org/10.1126/science.1204526

Dickinson, D. K., & McCabe, A. (2001). Bringing it all together: The multiple origins, skills, and environmental supports of early literacy. *Learning Disabilities Research and Practice, 16,* 186–202.

Dickinson, D. K., & Tabors, P.O. (2001). *Beginning literacy with language: Young children learning at home and school.* Brookes Publishing Company.

Dixon, L. (2011). The role of home and school factors in predicting English vocabulary among bilingual kindergarten children in Singapore. *Applied Psycholinguistics, 32*(1), 141-168. https://doi.org/10.1017/S0142716410000329

Downer, J. T., López, M. L., Grimm, K. J., Hamagami, A., Pianta, R. C., & Howes, C. (2012). Observations of teacher–child interactions in classrooms serving Latinos and dual language learners: Applicability of the Classroom Assessment Scoring System in diverse settings. *Early Childhood Research Quarterly*, *27*(1), 21-32. https://doi.org/10.1016/j.ecresq.2011.07.005

Druten-Frietman, L. V., Denessen, E., Gijsel, M., & Verhoeven, L. (2015). Child, home and institutional predictors of preschool vocabulary growth. *Learning and Individual Differences*, *43*, 92–99. https://doi.org/10.1016/j.lindif.2015.08.032

Dunn, M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test—3.* AGS. https://doi.org/10.1037/t15145-000

Farver, J. A. M., Xu, Y., Eppe, S., & Lonigan, C. J. (2006). Home environments and young Latino children's school readiness. *Early Childhood Research Quarterly, 21*(2), 196-212. https://doi.org/10.1016/j.ecresq.2006.04.008

Field, A. (2009). *Discovering Sstatistics using SPSS* (3rd ed.). SAGE.

Floccia, C., Sambrook, T. D., Delle Luche, C., Kwok, R., Goslin, J., White, L., Plunkett, K. (n.d.). Vocabulary of 2-Year-Olds Learning English and an Additional Language: Norms and Effects of Linguistic Distance. *Monographs of the Society for Research in Child Development, 83*(1), 7–108.

Gerde, H. K., & Powell, D. R. (2009). Teacher education, book-reading practices, and children's language growth across one year of Head Start. *Early Education and Development*, *20*(2), 211–237. https://doi.org/10.1080/10409280802595417

Grüter, T., & Paradis, J. (2014). *Input and Experience in Bilingual Development.* John Benjamins. https://doi.org/10.1075/tilar.13

Hakuta, I. C, & Diaz, R. M. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data. In K E. Nelson (Ed.), *Children's language* (pp. 319-344). Lawrence Erlbaum Associates.

Hamre, B. K., & Pianta, R. C. (2007). Learning opportunities in preschool and early elementary classrooms. In R. C. Pianta, M. J. Cox, & K. Snow (Eds.), *School readiness and the transition to kindergarten in the era of accountability* (pp. 49-84). Brookers.

Hart, B., & Risley, T. R. (1995). Meaningful differences in the everyday experience of young American children. Paul H Brookes Publishing.

Hatfield, B. E., Burchinal, M. R., Pianta, R. C., & Sideris, J. (2016). Thresholds in the association between quality of teacher-child interactions and preschool children's school readiness skills. *Early Childhood Research Quarterly*, *36*, 561-571. http://doi.org/10.1016/j.ecresq.2015.09.005

Hoff, E. (2006). How social contexts support and shape language development. *Developmental Review, 26*(1), 55-88. https://doi.org/10.1016/j.dr.2005.11.002.

Hoff, E. 2020. Lessons from the study of input effects on bilingual development. *International Journal of Bilingualism, 24*(1), 82-88. doi:10.1177/1367006918768370

Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. (2008). Ready to learn? Children's pre-academic achievement in pre-kindergarten programs. *Early Childhood Research Quarterly*, *23*(1), 27-50. https://doi.org/10.1016/j.ecresq.2007.05.002

Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). Language input and child syntax. *Cognitive Psychology, 45*(3), 337-374. https://doi.org/10.1016/S0010-0285(02)00500-5

Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, *59*(4), 434–446. https://doi.org/10.1016/j.jml.2007.11.007

Jia, G., & Fuse, A. (2007). Acquisition of English Grammatical Morphology by Native Mandarin-Speaking Children and Adolescents: Age-Related Differences. *Journal of Speech, Language, and Hearing Research, 50*(5), 1280-1299. https://doi.org/10.1044/1092-4388(2007/090)

Leyva, D., Weiland, C., Barata, M., Yoshikawa, H., Snow, C., Treviño, E., & Rolla, A. (2015). Teacher–child interactions in Chile and their associations with prekindergarten outcomes. *Child Development, 86*(3), 781-799. https://doi.org/10.1111/cdev.12342

Mol, S. E., & Bus, A. G. (2011). To read or not to read: A meta-analysis of print exposure from infancy to early adulthood. *Psychological Bulletin, 137*(2), 267-296. https://doi.org/10.1037/a0021890

Montag, J. L., Jones, M. N., and Smith, L. B. (2015). The words children hear: Picture books and the statistics for language learning. *Psychological Science,* 26(9), 1489-1496. https://doi.org/10.1177/0956797615594361

Ministry of Education. (2013). *Framework for Mother Tongue Languages*. https://www.nel.sg/nel/slot/u566/Resources/Downloadable/pdf/nel-framework/nel-framework-for-mtls.pdf

Muñoz, C. (2008). Symmetries and asymmetries of age effects in naturalistic and instructed L2 learning. *Applied Linguistics, 29,* 578–596.

Paradis, J. (2011). Individual differences in child English second language acquisition: Comparing child-internal and child external factors. *Linguistic Approaches to Bilingualism, 1*(3), 213–237. https://doi.org/10.1075/lab.1.3.01par

Paradis, J., Nicoladis, E., Crago, M., and Genesee, F. (2011). Bilingual children's acquisition of the past tense: A usage-based approach. *Journal of Child Language, 38*(3), 554-578. https://doi.org/10.1017/S0305000910000218

Paradis, J., Rusk, B., Sorenson Duncan, T., & Govindarajan, K. (2017). Children's second language acquisition of English complex syntax: The role of age, input and cognitive factors. *Annual Review of Applied Linguistics, 37,* 1-20. https://doi.org/10.1017/S0267190517000022

Perlman, M., Falenchuk, O., Fletcher, B., McMullen, E., Beyene, J., & Shah, P. S. (2016). A systematic review and meta-analysis of a measure of staff/child interaction quality (the Classroom Assessment Scoring System) in early childhood education and care settings and child outcomes. *PloS one, 11*(12), 1-33. https://doi.org/10.1371/journal.pone.0167660

Phillips, B. M., & Lonigan, C. L. (2009). Variations in the home literacy environment of preschool children: A cluster analytic approach. *Scientific Studies of Reading, 13(*2), 146–174. https://doi.org/10.1080/10888430902769533

Pianta, R. C., & Hamre, B. K. (2009). Conceptualization, measurement, and improvement of classroom processes: Standardized observation can leverage capacity. *Educational Researcher, 38*(2), 109-119. https://doi.org/10.3102/0013189X09332374

Pianta, R. C., La Paro, K. M., & Hamre, B. K. (2008). *Classroom Assessment Scoring System (CLASS) manual, Pre-K*. Paul H. Brookes.

Pickering, S., & Gathercole, S. (2001). *Working Memory Test Battery for Children (WMTB-C) manual.* The Psychological Corporation.

R Core Team. (2017). *R: A language and environment for statistical computing*. https://www.R-project.org/

Raven, J., and Rust, J. (2004). *Coloured Progressive Matrices and Crichton Vocabulary Scale.* Pearson.

Rickard-Liow, S. J., Sze, W. P., and Lee, L. C. (2013). *Bilingual Language Assessment Battery (BLAB) Manual (Unpublished measure).* Singapore: National University of Singapore, Department of Psychology and Division of Graduate Medical Studies.

Rojas, R., Iglesias, A., Bunta, F., Goldstein, B., Goldenberg, C., & Reese, L. (2016). Interlocutor differential effects on the expressive language skills of Spanish-speaking English learners. *International Journal of Speech-Language Pathology, 18*(2), 166–177. https://doi.org/10.3109/17549507.2015.1081290

Sorenson Duncan, T., & Paradis, J. (2020). How does maternal education influence the linguistic environment supporting bilingual language development in child second language learners of English? *International Journal of Bilingualism, 24,* 1–16.

Sun, H. (2019). Bilingual children's Mandarin language and literacy environment at home and their Mandarin language and social-emotional skills: one stone for two birds? *Frontier in Psychology*, *16,* 1-13. https://doi.org/10.3389/fpsyg.2019.01640

Sun, H., de Bot, K., & Steinkrauss, R. (2015). A multiple case study on the effects of temperamental traits in Chinese preschoolers learning English. *The International Journal of Bilingualism, 19*(6), 703-725. https://doi.org/10.1177/1367006914534332

Sun, H., Ng, S. C., O'Brien, B. A., & Fritzsche, T. (2020). Child, family, and school factors in bilingual preschoolers' vocabulary development in heritage languages. *Journal of Child Language, 47*(4), 817-843. https://doi:10.1017/S0305000919000904

Sun, H., Steinkrauss, R., Tendeiro, J., & de Bot, K. (2016). Individual differences in very young children's English acquisition in China: Internal and external factors. *Bilingualism: Language and Cognition, 19*(3), 550-566. https://doi.org/10.1017/S1366728915000243

Sun, H., Steinkrauss, R., Wieling, M., & de Bot, K. (2018). Individual differences in very young Chinese children's English vocabulary breadth and semantic depth: Internal and external factors. *International Journal of Bilingual Education and Bilingualism, 21*(4), 405-425. https://doi:10.1080/13670050.2016.1178706

Sun, H., & Verspoor, M. (2020). *Mandarin vocabulary growth, teacher qualification and teacher talk in bilingual kindergartners.* [Manuscript submitted for publication]. National Institute of Education, Nanyang Technological University.

Sun, H., Toh, W. M., & Steinkrauss, R. (2020). Instructional strategies and linguistic features of kindergarten teachers' shared book reading: The case of Singapore. *Applied Psycholinguistics, 41*(2), 427-456. https://doi.org/10.1017/S0142716420000053

Sun, H., Yin, B., Amsah, F., & O'Brien, B. A. (2018). Differential effects of internal and external factors in early bilingual vocabulary learning: The case of Singapore. *Applied Psycholinguistics, 39*(2), 383-411. https://doi.org/10.1017/S014271641700039X

Sun, H., Yussof, N., Mohamed, M., Rahim, A., Cheung, W. L., Cheong, S. A., & Bull, R. (2018). Bilingual language experience and social-emotional wellbeing: A cross-sectional study of Singapore pre-schoolers. *International Journal of Bilingual Education and Bilingualism.* https://doi.org/10.1080/13670050.2018.1461802

Sun, H., Yussof, N., Vijayakumar, P., Lai, G., O'Brien, B. A., & Ong, Q.H. (2020). Teacher's code-switching and bilingual children's heritage language learning and cognitive switching flexibility. *Journal of Child Language, 47*(2), 309-336. https://doi.org/10.1017/S030500091900059X

Swain, M. (2008). The output hypothesis: Its history and its future. *Foreign Language Teaching and Research, 40*(1), 45-50.

Ulferts, H., Wolf, K. M., & Anders, Y. (2019). Impact of process quality in early childhood education and care on academic outcomes: Longitudinal meta-analysis. *Child Development, 90*(5), 1474-1489. https://doi.org/10.1111/cdev.13296

Weizman, Z. O., and Snow, C. E. (2001). Lexical output as related to children's vocabulary acquisition: Effects of sophisticated exposure and support for meaning. *Developmental Psychology, 37*(2), 265-279. https://doi.org/10.1037/0012-1649.37.2.265

Wilkinson, G. S., & Robertson, G.J. (2006). *Wide Range Achievement Test* (4th ed.). Psychological Assessment Resources.

Tables

Table 1

Descriptive statistics of the independent factors (control, home, school) and the outcome factors

		N	*M*	*SD*	*Range*
Control factors	Age (in months).K1	1158	57.31	3.89	49-66
	Age (in months).K2	1308	69.76	3.78	62-80
	Age (in months).P1	1227	80.91	3.72	73-90
	Non-verbal Reasoning	1357	15.76	5.21	0-35
	Working Memory.K1	1126	2.54	3.33	0-18
	Working Memory.K2	1293	5.19	4.44	0-23
	Working Memory.P1	1215	8.07	4.98	0-28
Home factors	English Dominance	1236	4.23	0.97	1-5
	English Speaking Age (in years)	1181	2.15	1.05	1-6
	English Reading Days (in days)	1225	3.60	2.05	0-7
	English Book Number	1234	3.81	1.49	1-7
	Mother Education	1315	7.24	2.50	0-11
	Family Income	1335	11.93	5.97	0-19
School factors	School Time (in months).K1	1158	3.40	1.73	1-7
	School Time (in months).K2	1308	15.80	1.45	12-19
	School Time (in months).P1	1227	26.98	1.29	25-31
	Emotional Support (CLASS).K1	1129	4.70	0.50	3.4-5.79
	Classroom Organization (CLASS).K1	1129	4.37	0.55	2.78-5.5
	Instructional Support (CLASS).K1	1129	2.19	0.64	1-4.11
	Teacher-Child Ratio.K1	1129	11.72	3.34	2.71-21.5
	Teacher Experience	1405	7.35	5.98	0-25
	Teacher Qualification	1388	2.72	1.03	1-5
Outcome factors	English Receptive Vocabulary.K1	1280	35.63	8.78	12-66
	English Receptive Vocabulary.K2	1068	42.96	8.41	9-68
	English Receptive Vocabulary.P1	1162	49.71	9.11	21-80
	English Word Reading.K1	1140	15.40	5.92	0-40
	English Word Reading.K2	1297	22.17	7.39	0-56
	English Word Reading.P1	1222	29.71	7.97	15-65

Table 2

The Control, Home and School Factors in Children's Development in English Receptive Vocabulary

	Baseline	Internal Factors	External-Home	External-School
(Intercept)	41.92 ***	42.20 ***	41.94 ***	42.70 ***
	(0.38)	(0.35)	(0.29)	(0.31)
Gender		0.54	0.81 *	1.22 **
		(0.37)	(0.39)	(0.43)
Language Distance		-0.66 *	-0.44	-0.28
		(0.27)	(0.28)	(0.3)
Non-verbal Reasoning		0.39 ***	0.36 ***	0.47 ***
		(0.04)	(0.04)	(0.05)
Working Memory		0.75 ***	0.68 ***	0.19 ***
		(0.04)	(0.04)	(0.04)
English Dominance			1.33 ***	1.12 ***
			(0.22)	(0.25)
English Speaking Age			-0.67 ***	-0.78 ***
			(0.2)	(0.21)
English Reading Days			0.23 *	0.21
			(0.11)	(0.12)
English Book Number			0.52 **	0.59 ***
			(0.16)	(0.18)
Mother Education			0.08	0.11
			(0.1)	(0.11)
Family Income			0.01	0.07
			(0.04)	(0.05)
School Time (in months)				0.56 ***
				(0.02)
Emotional Support				1.05
				(0.59)
Classroom Organisation				-0.31
				(0.56)
Instructional Support				-0.23
				(0.4)
Teacher-Child Ratio				0.03
				(0.07)
Teacher Experience				0.02
				(0.04)
Teacher Qualification				0.4
				(0.22)
AIC	25892.75	20924.28	16698.43	12509.02
BIC	25929.73	20984.04	16790.53	12635.86
Log Likelihood	-12940.37	-10452.14	-8333.22	-6231.51
Num. obs.	3510	2911	2335	1835
Num. groups: ChiID	1413	1210	959	741
Num. groups: SchoolID	80	79	78	70
Var: ChiID (Intercept)	224.04	123.85	111.45	33.16
Var: ChiID*Year	54.32	30.16	31.52	6.38
Cov: ChiID (Intercept)*Year	-101.8	-56.09	-54.85	-9.67
Var: SchoolID (Intercept)	7.64	3.13	0.43	0.05
Var: Residual	34.2	40.36	39.83	32.5

Table 3

The Control, Home, and School Factors in Children's Development in English Word Reading

	Baseline	Internal Factors	External-Home	External-School
(Intercept)	17.77 ***	19.17 ***	19.52 ***	22.53 ***
	(0.31)	(0.31)	(0.29)	(0.29)
Gender		-0.01	0.01	0.37
		(0.31)	(0.33)	(0.38)
Language Distance		0.04	0.08	0.3
		(0.23)	(0.25)	(0.27)
Non-verbal Reasoning		0.33 ***	0.27 ***	0.30 ***
		(0.03)	(0.04)	(0.04)
Working Memory		0.42 ***	0.39 ***	0.13 ***
		(0.02)	(0.03)	(0.03)
English Dominance			0.27	0.25
			(0.19)	(0.21)
English Speaking Age			-0.22	-0.35
			(0.17)	(0.19)
English Reading Days			0.37 ***	0.34 **
			(0.09)	(0.1)
English Book Number			0.08	0.13
			(0.14)	(0.15)
Mother Education			0.41 ***	0.37 ***
			(0.09)	(0.1)
Family Income			0.03	0.08
			(0.04)	(0.04)
School Time (in months)				0.58 ***
				(0.01)
Emotional Support				0.26
				(0.53)
Classroom Organisation				0.01
				(0.5)
Instructional Support				-0.64
				(0.36)
Teacher-Child Ratio				0.07
				(0.07)
Teacher Experience				0.02
				(0.04)
Teacher Qualification				0.43 *
				(0.2)
AIC	24817.81	21307.32	17098.68	12315.27
BIC	24855.04	21368.02	17192.32	12444.26
Log Likelihood	-12402.91	-10643.66	-8533.34	-6134.63
Num. obs.	3659	3197	2571	2015
Num. groups: ChiID	1412	1222	967	749
Num. groups: SchoolID	80	79	78	70
Var: ChiID (Intercept)	114.8	89.5	97.44	18.08
Var: ChiID *Year	54.88	39.32	41.59	4.74
Cov: ChiID (Intercept)*Year	-69.61	-52.51	-57.7	-2.96
Var: SchoolID (Intercept)	4.76	2.72	1.56	0.41
Var: Residual	9.73	11.9	11.98	10.65

Figures

Figure 1

Children's English vocabulary (a) and word reading (b) at K1, K2, and P1