Intergenerational transmission of literacy skills among Filipino families

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Research Highlights

- The joint influence of home literacy environment (HLE) and parent's reading skills on Filipino children's literacy skills was investigated in a low- to middle-income sample.

- Storybook reading and direct literacy instruction at home correlated with child's literacy skills, but there was no clear distinction between informal and formal HLE.

- Parent's reading skills, in addition to parent's education and home literacy activities, were significantly related to child's oral and print skills.

- Contrary to previous studies, parent's reading skills did not attenuate the relationship between conventional home literacy environment factors and child's literacy skills.

Abstract

We examined the joint role of parental word reading skills and conventional home literacy environment measures among 320 Filipino low- to- middle-income families in Cebu City, Philippines with children aged 5 to 8 years old. A ranking of parent-reported ratings of their frequency of engaging in home literacy activities and adult literacy practices revealed that book-related behaviors were less frequently practiced in this sample, and mean ratings on the home literacy resources scale suggested a relatively print-poor environment. Nevertheless, scale items about book reading and direct literacy instruction at home correlated with child's literacy skills. Structural equation modeling showed that parent's education and frequency of engaging in home literacy activities uniquely accounted for variance in child's oral and print skills. In a second model, parent's word reading skills were significantly related to child's skills, but did not eliminate or attenuate influences from parent's education and home literacy activities. Results are important in relation to theories on the intergenerational transmission of literacy skills and the generalizability of findings from developed countries to developing country contexts.

Keywords: Philippines, word reading, early literacy, oral language, home literacy environment, gene-environment

Intergenerational Transmission of Literacy Skills among Filipino Families

Variations in children's literacy skills could be a product of multiple family-related influences; that is, children whose parents are good readers tend to be good readers themselves, and children who grow up in homes that provide many opportunities to interact with print tend to demonstrate a strong set of oral and written language abilities as well (Friend et al., 2009; Sénéchal & Lefevre, 2002). Studies on these topics typically originate from developed countries, with a tendency towards the recruitment of samples with middle- to high-income profiles. Less is known about how these factors are relevant in low- to middle-income families living in developing countries such as the Philippines. This study aims to characterize family-related factors that could be associated with Filipino children's literacy skills; namely, the home literacy environment (HLE) and directly-measured parental skills, with particular attention to how findings in this sample converge with or diverge from previous findings due to socioeconomic and cultural differences in this particular context.

**Home Literacy Environment across Countries**

The home literacy environment is comprised of adult-child interactions around print, access to print materials, and adults' own literacy-related behaviors at home (Sénéchal et al., 1998). Indexes of family socioeconomic status (SES), including parental education, income, and occupation, and aspects of the home literacy environment (e.g., shared book reading, parental teaching) were typically used to describe the child's overall family context (Aikens & Barbarin, 2008; Inoue, Georgiou, Parrila, & Kirby, 2018; Niklas & Schneider, 2013). The general consensus is that favorable home literacy environments support children's literacy development throughout the years (Kluczniok, Lehrl, Kuger, & Rossbach, 2013; Niklas, Nguyen, Cloney, Tayler, & Adams, 2016; Niklas & Schneider, 2017; Park, 2008). Sénéchal et al. (1998), in what

was eventually described as the Home Literacy Model, distinguished between two types of home literacy environment interactions: *informal*, wherein parent-child interactions involved print, but print itself was not the central focus (e.g., storybook reading, going to the library), and *formal*, wherein parent-child interactions focused on the teaching of reading and writing. This distinction was supported by non-significant correlations between the two types of HLE interactions (Sénéchal & Lefevre, 2002) and good-fitting confirmatory factor analysis models that specified informal HLE, formal HLE, and SES as distinct latent factors (Inoue et al., 2018). Furthermore, differential associations with children's skills were found, such that informal HLE was related to the development of children's oral language skills and formal HLE was related to the development of children's emergent literacy skills, such as letter knowledge and awareness of print concepts, all of which were associated with children's reading outcomes (Inoue et al., 2018; Sénéchal & Lefevre, 2002).

Whereas studies originating from low- to middle-income countries generally agreed with studies from high-income countries on the importance of HLE in supporting children's literacy development, additional consideration was given to a wider array of reading materials apart from books (e.g., newspapers, religious texts) and culturally-relevant practices (e.g., oral storytelling) in these relatively resource-poor environments (Nag, Vagh, Dulay, & Snowling, 2019). At the same time, quantitative and qualitative studies from these contexts presented both barriers (e.g., disconnections between home and school environments) and opportunities (e.g., participation in family-based interventions) to provide a stimulating home literacy environment to young children (Nag, Chiat, Torgerson, & Snowling, 2014; Nag, Snowling, & Asfaha, 2016). In focus group discussions among low-literacy parents from urban poor communities in the Philippines, parents expressed a desire to help children with their literacy development; however, they were

unsure about how to conduct home literacy activities such as reading a story, teaching beginning reading, helping with homework, and communicating with teachers (Pado, 2006).

There are a handful of quantitative studies that examined HLE in the Philippines. In a survey among Grade 2 students, around 70% of mothers and fathers were reported to be literate, approximately 40% of students reported receiving help from their parents with reading at home, and nearly 50% of students reported that they had other books aside from textbooks at home (Education Development Center, 2015). Parents of 4- to 6-year-old daycare students in Manila reported high levels of involvement ('almost always practiced') in school-related tasks such as attending parent-teacher meetings, asking children about what happened in school, and reminding children of the importance of school; in contrast, storybook reading at home was rated as 'sometimes practiced' (Tabbada-Rungduin, Abulon, Fetalvero, & Suatengco, 2014). However, parental involvement and children's skills were weakly correlated in this sample. In the earliest time point of the overall project that the current study was based on, socioeconomic status was associated with 3-, 4-, and 5-year-old Filipino children's vocabulary skills (Dulay, Cheung, & McBride, 2018a). However, associations between HLE measures and Filipino children's skills were more variable. Relationships between HLE and 3- and 4-year-old children's skills were non-significant, whereas the number of literacy resources at home were associated with 5-year-old children's vocabulary skills. Nevertheless, a home-based intervention that involved either shared storybook reading or early literacy games was effective in boosting 3- to 5-year-old children's skills after 12 weeks (Dulay, Cheung, Reyes, & McBride, 2019).

One emerging observation from these studies is that HLE among Filipino families is oriented towards academic achievement; hence, it is possible that associations between HLE and children's skills are more evident once they are required to go to school. In the Philippines,

kindergarten is mandatory at 5 years old and children enter primary school at 6 years old. In Cebu, this is set against a recent transition to a mother tongue-based education policy in 2009, which has faced challenges due to the lack of appropriate written materials in the mother tongue (Tupas & Martin, 2016). Hence, there is a need to re-examine the general picture of HLE among 5- to 8-year-olds in Cebu, and if distinct informal and formal dimensions of HLE are evident in this sample.

**What Happens when Parental Skills are Accounted for?**

Despite widespread acceptance of the Home Literacy Model, two recent studies drew on behavioral genetics literature to suggest that the relationship between HLE and children's literacy skills might not represent a 'true' effect of environment via cultural transmission, but a masked genetic effect (Puglisi, Hulme, Hamilton, & Snowling, 2017; van Bergen, van Zuijen, Bishop, & de Jong, 2017). They argued that parent's word reading skills represented an overall 'familial effect'; in effect, a combined influence wherein parents transmitted both genetic predispositions to literacy skills and an environment that encouraged their development. Following this reasoning, if the home literacy environment was still significantly associated with children's literacy skills after familial effects were accounted for, then it supported a 'cultural transmission' explanation for HLE, wherein manipulations in the environment (e.g., providing more books at home) had direct influences on children's skills, as opposed to the 'passive gene-environment correlation' account, wherein the link between what happened at home and children's skills were due to the genetic link between parents and their offspring.

In the two studies, authors found that parents' directly-measured literacy skills attenuated or eliminated significant relationships between home literacy environment measures and children's skills. In the study by van Bergen et al. (2017), reading fluency and HLE data were

collected from mothers, fathers, and 7- to 17-year-old children in the Netherlands. Children's word reading fluency was significantly correlated with their mother's ($r = .29$) and father's ($r = .32$) reading fluency; in contrast, mother's and father's reading scores were not significantly correlated with each other ($r = .10$). When parental reading skills were added in regression models, no significant relationships were found between children's reading skills with parents' education and parents' reading frequency. In contrast, the relationship between the number of books at home and children's reading skills was significant. The authors then concluded that books at home might represent a true environmental effect on children's reading; whereas parental education and reading behaviors could be proxies for parent's own reading abilities. Whereas this study accounted for the additive influences of reading ability from both biological parents, the study did not measure the frequency of parent-child home literacy activities in terms of informal and formal HLE.

In contrast, the study by Puglisi et al. (2017) measured SES and both informal (storybook exposure, books at home) and formal (direct literacy instruction) aspects of HLE on a sample of children in the United Kingdom who were assessed at 3 time points from 3- to 5-years-old. Maternal skills were measured using language and phonology measures and were examined alongside children's language and reading/spelling outcomes. Results of structural equation modelling revealed consistency with the Home Literacy Model, in that storybook exposure predicted both children's language and reading/spelling skills, and direct instruction predicted children's reading/spelling skills. Once maternal skills were accounted for, storybook exposure was not a direct or indirect predictor of children's language and reading/spelling skills; in contrast, direct literacy instruction was a significant predictor of children's reading/spelling skills. Furthermore, maternal language skills were directly related to children's vocabulary and

maternal phonology skills were directly related to children's reading/spelling skills. The authors suggested that informal HLE was less of a direct environmental influence, but was more likely a proxy for mother's language skills; whereas formal HLE could be less related to parent's skills, but more related to their own values.

In the two studies, the samples were recruited in developed countries and demonstrated a skew towards high-SES backgrounds. It was suggested that socioeconomic disadvantage could suppress genetic effects on cognition, at least in countries with relatively high social inequality (Tucker-Drob, Briley, & Harden, 2013). Considering that children from developing countries are exposed to higher degrees of environmental risk such as poverty, malnutrition, low parental education, and lack of cognitively stimulating environments (Grantham-McGregor et al., 2007; Walker et al., 2011), it is possible that relationships between HLE factors (and SES) and children's skills would remain evident after accounting for parental literacy skills. If this is the case, then it is consistent with the idea that socioeconomic disadvantage constrains the assumed transmission of literacy skills through a passive gene-environment correlation.

**The Current Study**

To summarize, the present study examined the following research questions:

(1) How do we characterize the home literacy environment for 5- to 8-year-old Filipino children from low- to middle-income backgrounds in terms of the frequency of engaging in activities, resources available, and the latent structure of HLE measures?

(2) How strong is the relationship between the literacy skills of children and their parents? Could home literacy environment variables account for children's literacy skills over and above parental word reading skills, in contrast to the results found by van Bergen et al. (2017) and Puglisi et al. (2017)?

## Method

### Participants

The Philippines is a linguistically diverse country, with over 100 languages spoken across different regions (Gonzalez, 1998). The current educational system uses a transitional model wherein children are initially taught to read in the mother tongue (Cebuano in the current sample) before introducing Filipino (the national language) and English within the first three grades (Tupas & Martin, 2016). Although the specifics of educational policy and its implementation have changed over the previous decades, a literate person in Cebu is generally expected to demonstrate proficiency in Cebuano, Filipino, and English. Nevertheless, English is a prestigious language that dominates business settings and higher-grade instruction in science, mathematics, and tertiary education (Bernardo, 2004). Similar to Filipino (Dulay & Hanley, 2015; Estrera & Uno, 2017), Cebuano has a relatively transparent alphabetic orthography.

Participants were children and their families who participated in Time 5 of a 2.5-year longitudinal study in Cebu City, Philippines from November-December 2017 and January-March 2018. Families were recruited from four adjacent communities and had a low- to middle-income profile. The original Time 1 sample (June-July 2015) comprised 673 children aged 2.75 to 5.92 years ($M = 4.26$, $SD = 0.84$, 53% boys).

At Time 5, 407 families were successfully contacted and assessed. Caregiver respondents were mothers (75%), fathers (8%), aunts or uncles (7%), grandparents (6%), siblings and cousins (3%), and guardians (1%). After excluding non-parental caregivers to suit the aims of the current study, 339 families remained, with a further 19 parents excluded for declining to accomplish the parental word reading measure. Among the parents who provided a reason for refusal, 3 said that they were preoccupied with other tasks, 4 mentioned that they could not read, and 2 cited eyesight problems. Hence, 320 families comprised the final sample. Parents in the final sample

were aged 21 to 54 years old ($M$ = 33.07, $SD$ = 6.80, 89% female). Children in the final sample were 5.08 to 8.33 years old ($M$ = 6.65 years, $SD$ = 0.86, 51% girls). In this sample, 41% of children were in preschool or daycare, 31% were in grade 1, and 27% were in grades 2 or 3, and 1% did not go to school or had dropped out. Compared to children who had dropped out of the study between Times 1 and 4, the Time 5 sample was not systematically different in terms of previously administered measures of children's literacy skills and the home literacy environment based on $t$-tests.

**Measures**

Children were assessed on oral language and print knowledge skills; at the same time, the participating parent (either the child's mother or father) completed an English word reading fluency measure and a parent survey for demographic information (see Table 1) and aspects of the home literacy environment (see Table 2 for the full list of items).

**Child's oral language skills.** Vocabulary skills were assessed in Cebuano and in English. The 30-item Cebuano Vocabulary task had a 20-item receptive vocabulary subtask, wherein each child heard a stimulus word and were asked to point at the picture that corresponded to the word, and a 10-item expressive vocabulary subtask, wherein the child was shown line drawings and was asked to verbally identify what was depicted. The 25-item English Vocabulary task had a 15-item receptive vocabulary subtask and a 10-item expressive vocabulary subtask, with identical instructions as the Cebuano vocabulary measure. In the expressive vocabulary subtask of both languages, children were prompted to respond in the target language and were scored as follows: one point for a correct response in the target language (Cebuano or English), 0.5 points for an equivalent response in a non-target language (Filipino and English for the Cebuano task; Cebuano and Filipino for the English task), and no points for incorrect responses.

In the 12-item Syllable Deletion task, children were instructed to repeat two- to three-syllable Cebuano words without the first, last, or middle syllable. In the 12-item Phoneme Isolation task, children were instructed to produce the first, last, or middle phoneme of two- to three-syllable Cebuano words. Trial items were provided in both phonological awareness measures. In the Phoneme Isolation task, children who produced syllable-level responses in the trial items were encouraged to produce a 'smaller' sound.

**Child's print knowledge.** In both the Letter Name Knowledge and Letter Sound Knowledge tasks (56 points each), children were presented with the 28-letter Filipino alphabet in uppercase and in lowercase formats, and in a pseudorandom order that changed across tasks and formats. Children were asked to identify the letters by their names and the sounds that they produced. In the scoring of phoneme isolation and letter sound responses, children were observed to produce syllabic responses, for example, *da* for the first phoneme in *duwa* and for the letter sound of *d*. This could in part reflect variations in local instructional methods, which may emphasize syllable-focused (Cartilla) as opposed to a phoneme-focused (Marungko) approaches (Bustos-Orosa & Ferrer, 2013). Hence, 0.5 points were given if the child produced a syllabic response that contained the target phoneme.

The 12-point Print/Word Awareness task was a locally adapted version of a task that tested children's awareness of print conventions and features such as the book cover, left-to-right directionality, and identifying the first letter on a page (Justice & Ezell, 2001). A locally produced children's storybook was used for the task and the protocol was standardized to ensure that questions were asked in relation to specific pages of the book.

The Cebuano Word Reading task was a single word reading measure with 20 Cebuano words in total. Words were generally short, with 1-3 syllables and 2-9 letters each, and were

relatively easy to read using a letter-sound decoding strategy. However, bisyllabic and multisyllabic words in Cebuano could follow varying lexical stress assignment patterns, similar to what was observed in Filipino word reading (Dulay & Hanley, 2015). Hence, one point was awarded when children provided an oral response that reflected an accurate pronunciation of the word (e.g., *dakô*), 0.5 when children partially decoded the word (e.g. *bako*) or applied incorrect lexical stress (e.g., *dako*), and 0 when children did not decode any of the component phonemes of the word or provided no response. English word reading skills were also assessed; however, this measure demonstrated extreme floor effects given that English reading instruction was not yet introduced in school for most of the children in the study.

 **Parent's word reading.** The participating parent's reading skills were assessed using an English silent word reading fluency measure that was highly correlated ($r = .78$) with a conventional single-word English reading task (Kalindi et al., 2015). In Part A of the task (*individual word reading*), parents were presented with 25 strings of unrelated English words with no spaces between them, and were asked to segment the strings by encircling individual words within 4 minutes. In the next 4 minutes, parents completed Part B (*contextualized word reading*), wherein parents were presented with 20 English sentences with no spaces between words and were asked to segment the sentences into individual words as well. In both parts, one point was given for each word that was correctly segmented. The task was chosen as an available and easy-to-administer alternative to a conventional single word reading measure. An English measure was chosen because Cebuano and Filipino are highly transparent languages; hence, they might not be sensitive indexes of word reading skills among Filipino adults who were expected to have developed proficiency in Cebuano, Filipino, and English.

**Home literacy environment.** In two of the home literacy environment scales, parents rated items based on how frequently they engaged in certain home literacy behaviors with their children (Home Literacy Activities) and for their own leisure (Adult Literacy Practices) on a 6-point Likert scale (1 = never, 2 = rarely, 3 = once a week, 4 = several times a week, 5 = once a day, 6 = several times a day). In the Home Literacy Resources scale, parents used a 5-point scale to indicate the number of children's literacy workbooks, children's storybooks, and adult books (1 = none, 2 = 1-9, 3 = 10-29, 4 = 30-49, 5 = 50 or more) and literacy-related educational materials and educational games (1 = none, 2 = 1-3 sets, 3 = 4-6 sets, 4 = 7-9 sets, 5 = 10 sets or more) that were available at home.

## Procedure

Ethics approval for the longitudinal study was provided by the Survey and Behavioural Research Ethics committee of The Chinese University of Hong Kong. Parents signed consent forms for their and their child's participation in the study. Tests were administered in the families' homes for an average duration of one hour, with measures that were not included in this study. Children were assessed individually by trained Cebuano-speaking data collectors with undergraduate psychology degrees. Given logistics and security considerations within the communities, data collectors were accompanied by teachers of a collaborating non-government organization that operated in the communities. The teachers were trained to explain the instructions of the parental word reading fluency measure, to time the tests, and to read out parent survey items to parents upon request or in cases of low literacy.

## Results

Because families in the sample took part in an intervention program for numeracy, language, and literacy two years prior to this assessment, a preliminary analysis was conducted

to examine remaining intervention effects as well as potential clustering effects by the schools that children were indicated to attend at the currently reported time point. No systematic differences in children's skills were found, hence enabling an analysis of participants as individual cases. More details are available in the Appendix.

The means, standard deviations, ranges for scores and reliability indexes on demographic, child and parental literacy, and home literacy environment measures are reported in Table 1. Missing data on demographic and HLE variables were minimal (e.g., unreported age and education information for one parent, unreported family income for two families, and some overlooked items from the three home literacy environment scales from 1-3 parents). In this analysis, family income information ($M = 9452.54$, $SD = 8019.22$) was transformed into a 9-point scale ($M = 2.39$, $SD = 1.29$) to resolve model convergence issues in structural equation modelling (see Table 1 for corresponding scale interpretations).

**Descriptive and Correlational Data on HLE, Child's Skills, and Parent's Skills**

The means, standard deviations, and correlations of individual items of the HLE scales with the child and parent literacy measures are reported in Table 2 and are rank ordered from the largest to smallest group means per scale. At this stage, the homework help item was dropped from the analysis given that a significant proportion of participants were not yet in primary school.

Parents used media and technology by themselves or with their children once a week or more; for example, watching videos of children's songs and stories (rank 1/11 in the activities scale, $M = 3.95$, $SD = 1.70$) and text messaging and posting on social media (rank 1/7, $M = 3.59$, $SD = 1.92$, and 2/7, $M = 2.89$, $SD = 1.82$ respectively in the adult literacy scale). In contrast, book-related behaviors had low rank-orders within their respective scales, indicating a frequency

rating ranging from 'rarely' to 'once a week', such as reading storybooks with children (activities rank: 8/11, $M = 3.32$, $SD = 1.67$), visiting the library and attending plays or storytelling activities (activities rank: 11/11, $M = 2.46$, $SD = 1.52$), and reading pocketbooks/novels (adult literacy rank: 7/7, $M = 1.94$, $SD = 1.36$).

No ranking was performed on the items of the resources scale due to the non-equivalence of qualitative interpretations across items. Mean item scores were generally low (on a 5-point scale), e.g., educational materials ($M = 2.50$, $SD = 1.24$, 1-3 to 4-6 sets), educational materials ($M = 2.43$, $SD = 1.25$, 1-3 sets), letter/word exercise books ($M = 2.37$, $SD = 1.06$, 1-9 books), children's books ($M = 2.18$, $SD = 0.95$, 1-9 books), and books for adults ($M = 2.18$, $SD = 1.19$, 1-9 books), suggesting that children live in relatively print-poor environments in this sample.

Correlations of individual HLE items with child's and parent's literacy skills (Table 2) suggest the following trends. Parent's word reading scores had weak but significant correlations with 9 out of 11 home literacy activities ($r$s = .10-.17). The frequency of reading storybooks was significantly associated with most of the 8 child literacy measures ($r$s = .12-.17) except Cebuano vocabulary and phoneme isolation. Furthermore, direct instruction practices such as simple writing activities, pointing at words/letters while reading, and introducing new words and definitions were significantly correlated with at least 5 out of 8 child literacy measures ($r$s = .11-.17). On the item level, most correlations with the resources and adult literacy practices scales were non-significant. Notable exceptions were the number of children's storybooks at home, which significantly correlated with 6 out of 8 child literacy measures ($r$s = .11-.19), and the parent's technologically-mediated literacy practices (sending text messages, writing posts on social media), which correlated with parent's reading scores ($r$s = .22-.27).

As seen in Table 3, which reports the full correlation table among study variables, both parent's education ($r$s = .12-.25) and parent's word reading scores significantly correlated with all child literacy measures ($r$ = .15-.36).

**Factor Structure of HLE and Literacy Measures**

Both data-driven and theory-driven approaches were used to analyze the factor structure of the various study measures. Latent factors were extracted from PASW 18.0 (SPSS Inc., 2009) using principal components analysis with promax rotation and validated using confirmatory factor analysis (CFA) on Mplus 7.0 (Muthén & Muthén, 2012). In all analysis conducted using MPlus, the following fit indices were used to evaluate good model fit: CFI ≥ .90-.95, TLI ≥ .90-.95, RMSEA ≤ .06, and SRMR ≤ .08 (Hu & Bentler, 1999).

Principal components analysis (PCA) supported a one-factor structure for the Home Literacy Activities (61% of variance in items explained) and Home Literacy Resources (72% of variance explained) scales and a two-factor structure for the Adult Literacy Practices scales (factor 1: 43%, factor 2: 16% of variance explained). The second factor extracted from the Adult Literacy Practices was interpreted as digitally mediated practices (two items: text messaging, posting on social media) and the first factor was labelled as analog practices (the other five items). A theory-driven approach to CFA was attempted for items of the activities scale, wherein 6 items were identified as *informal HLE* (e.g., reading storybooks, watching videos) and 5 items were identified as *formal HLE* items (e.g., helping to read words, identifying letter names/sounds). The two-factor model had significantly worse fit than the one-factor model, $\chi^2(1)$ = 5.72, $p$ < .05; furthermore, the correlation between the two factors was close to one ($r$ = .98). Therefore, the results did not support a distinction between informal and formal HLE in this sample. The final measurement model for HLE factors had 4 factors (home literacy activities,

home literacy resources, adult literacy practices – analog, adult literacy practices – digital), with individual items as indicators. This model fit well to the data according to most indices, CFI = .93, TLI = .92, RMSEA = .07, and SRMR = .05.

Measures of child's skills were fit into a two-factor model for oral language skills (Cebuano vocabulary, English vocabulary, syllable deletion, and phoneme isolation) and print knowledge (letter name knowledge, letter sound knowledge, print/word awareness, and Cebuano word reading). The model satisfied most model fit indices, CFI = .98, TLI = .97, RMSEA = .08, and SRMR = .02. The latent factor for parental word reading skills had only two indicators (Part A and Part B of the English silent word reading measure); therefore, a model fit evaluation was not performed on this construct.

Given the wide age range of the sample, multi-group analysis was conducted separately on the measurement models for home literacy activities, home literacy resources, adult literacy practices (two factors), and child's skills (two factors) across the different grade levels (preschool, grade 1, and grades 2-3). Fit indices and Chi-square difference tests between models with freely estimated parameters and constrained factor loadings were used to evaluate configural and measurement invariance across subgroups. Configural invariance was established in all models, with fit indices falling within acceptable ranges, indicating that the same factor structure applied across different grades. However, measurement invariance was established only for home literacy activities, $\chi^2(22) = 19.14$, $p > .05$. This indicates that means between grade levels cannot be compared using multi-group analysis.

**Structural Equation Models**

Given that configural invariance was established across latent factors, and in order to accommodate the large number of indicator variables in the models, structural equation

modelling was performed on the entire sample of children, with child's gender, grade, and age entered as control variables. A graphical inspection of Q-Q plots suggested non-normal distributions for the following measures of child's literacy: phoneme isolation, letter name knowledge, letter sound knowledge, and Cebuano word reading. To account for both missing data points and non-normality of data, analysis was performed using full maximum likelihood estimation with robust standard errors (MLR).

The first model (Figure 1) is a conventional home environment model that examines the associations of home environment factors (home literacy activities, home literacy resources, adult literacy practices – analog, and adult literacy practices – digital) with child's oral language and print knowledge skills. Additionally, parent's education and family income were included as observed SES indicators. In this model, parent's education was positively related with oral language skills (standardized coefficient = .33) and print knowledge (standardized coefficient = .28). Home literacy activities were predictive of oral skills (standardized coefficient = .13) and print skills (standardized coefficient = .17) as well. The model demonstrated good fit to the data, with CFI = .92, TLI = .91, RMSEA = .05, and SRMR = .06.

To then test the possible attenuation of home environment influences due to intergenerational transmission processes, a second model was tested with the addition of parent's word reading skills (Figure 2). Contrary to previous studies, parent's word reading skills, parent's education, and home literacy activities were all significantly associated with child's oral language and print knowledge skills. Path coefficients to oral language were relatively larger in magnitude from parent's education (standardized coefficient = .28) compared to home literacy activities (standardized coefficient = .21) and parent's word reading (standardized coefficient = .19). Path coefficients to print knowledge, on the other hand, were larger in magnitude from

parent's word reading (standardized coefficient = .26) and home literacy activities (standardized coefficient = .25) compared to parent's education (standardized coefficient = .20). Furthermore, the home literacy activities and parent's word reading factors were significantly correlated with each other ($r$ = .13). The model demonstrated good fit, CFI = .91, TLI = .90, RMSEA = .05., and SRMR = .06. In both models, child's age, but not grade or gender, had strong associations with child's skills. Based on $R^2$ statistics, the proportion of variance explained for the latent outcomes was 52% for oral language and 51% for print knowledge skills in both models.

## Discussion

This study attempted to characterize the home literacy environment in a low- to middle-income sample in the Philippines and to assess the joint role of home literacy environment and parental word reading skills in explaining children's literacy skills. Results both converged with and diverged from results of previous work on HLE and parent's skills conducted in developed countries. This highlights how ongoing theoretical discussions on these topics could be informed by results from relatively understudied cultural and socioeconomic contexts such as the Philippines.

### Home Literacy Environment in Cebu

The home literacy environment of low- to middle-income Filipino families in Cebu is characterized by a relatively print-poor environment, a relatively low frequency of engaging in book-related behaviors, and higher levels of media and technology use for parent-child and parent's own activities. In contrast, significant correlations were found between number of books, frequency of book reading, and frequency of direct literacy instruction at home, on the one hand, and children's oral and print skills, on the other hand. However, these correlations were generally weak in magnitude compared to the correlation between home literacy factors and

children's skills found across different countries (Park, 2008; Puglisi et al., 2017; van Bergen et al., 2017).

Furthermore, a clear distinction between informal and formal HLE was not found in this study, contrary to expectations of the Home Literacy Model (Sénéchal & Lefevre, 2002). It is possible that Filipino families' ability to foster a rich home literacy environment is limited by their access to literacy resources, as indicated by mean scores on the home literacy resources scale, and the predominantly low- to middle-income profile of this sample. It appears that in this sample, parents are broadly involved or uninvolved in conducting home literacy activities with their children; hence, parents who read books with their children are more likely to provide direct tutoring of literacy skills, and vice versa.

However, the measures have likely missed other relevant aspects that could help draw out distinct dimensions of the HLE. Children from 5- to 8-years-old may be reading books independently, with similar-aged peers, or with their siblings, hence pulling down the rank of shared storybook reading with parents relative to other activities. Moreover, a qualitative study of three urban poor families in Manila described the use of oral storytelling and unconventional reading materials (e.g., tarpaulins, political ads, snacks and candy wrappers) to compensate for the print-poor environment (Tatel-Suatengco & Florida, 2018).

Nevertheless, significant structural paths from home literacy activities to children's literacy development indicate that what parents expose children to at home matters for these 5- to 8-year-old children. Moreover, digital media-related literacy practices, as opposed to traditional print-based behaviors, were both more frequently practiced and more strongly related with parent's word reading skills. This suggests that technological forms of engaging with literacy are relatively accessible to families in this sample. The addition of more activities centered around

the use of technology could highlight a potential HLE dimension that is relevant to Filipino families. The qualitative study of families in Metro Manila mentioned children's technology use (e.g., playing online games, accessing Facebook), although this was regulated by families as it was considered detrimental to children's academic achievement (Tatel-Suatengco & Florida, 2018).

**The Joint Role of HLE and Parental Skills**

However, we explored the possibility that these associations between HLE and child's skills are eliminated or attenuated when parent's skills (as a proxy for genetic influences) are accounted for. Similar to results in the studies by van Bergen et al. (2017) and Puglisi et al. (2017), parent's directly measured literacy abilities were a significant predictor of children's skills. However, in contrast to the two studies, accounting for parent's skills did not eliminate or attenuate the significant associations that existed between home literacy activities and children's oral and print skills. Interestingly, the magnitude of path coefficients between home literacy activities and children's skills was even bigger, rather than smaller, in the model with parent's word reading compared to the one without. Whereas the explanation for this specific observation is unclear, results of the current study are consistent with the expectation that in highly disadvantaged contexts, there is a lack of opportunity to seek out environments that are consistent with one's genetic predispositions (Tucker-Drob et al., 2013). Thus, the extent to which the relationship between the home literacy environment and child's skills could represent masked genetic effects is lower than what you might find in high-opportunity settings.

**Limitations and Future Directions**

One limitation of the current study is that parental skills are measured in only one biological parent instead of both. In the study by van Bergen et al. (2016), correlations between

mother's and father's reading fluency were small and non-significant and both parents' reading skills were significant predictors of children's reading fluency, suggesting an additive effect of parental word reading on children's skills. If a similar trend is also present in this sample, it is possible that accounting for the other parent's reading skills could influence the strength of relationships between HLE and children's skills.

Another limitation is the nature of assessments presented in this study, which are comprised of researcher-designed measures and parent self-reports. There is a notable lack of sensitive assessment tools in languages spoken in developing countries (Nag et al., 2014), a fundamental gap that requires extensive psychometric work. For example, the study did not measure children's general cognitive abilities (e.g., intelligence), which could be a relevant control variable in this sample. Improvements in assessment design could also enable subgroup analysis by age or grade level in the future. Moreover, future investigations in the Philippines might reveal aspects of the HLE that are distinct from direct home literacy instruction, such as technologically mediated behaviors and oral storytelling practices. However, alternatives to parent self-reports, such as direct observations of home literacy interactions, could more accurately assess the nature of home environments that children are exposed to.

Finally, the 'true environmental effect' of the home literacy environment could not be captured through parent-child interactions alone. In the Philippines and in other low- to middle-income countries, the task of providing literacy activities to young children is taken on by siblings (Education Development Center, 2015; Nag et al., 2019) and potentially shared across multiple generations that share a single household (Tatel-Suatengco & Florida, 2018). Furthermore, a checklist-based observation of available print materials and media at home, and in what language, could provide more detail into the resources available to children in these

contexts. This makes the assessment of home literacy environments more challenging, as multiple informants and intensive home visits appear necessary to capture the full extent of stimulation provided at home. Researchers who are interested in similar contexts should adjust their assessment methods to account for this reality.

**Conclusion**

In summary, the study provides both converging and diverging evidence for the role of the home literacy environment in accounting for children's literacy skills in a Filipino sample. Although home literacy activities are related to children's skills, typical indicators of the home literacy environment in developed countries (e.g., books, library visits) are not as prominent in this sample; furthermore, the dimensions of HLE that are relevant to low- to middle-income urban communities in the Philippines should be explored further. This is also, to our knowledge, the first study to investigate the joint role of home literacy environment and parental skills in a developing country context. Traditional HLE correlates, such as parent's education and home literacy activities, were significant predictors of children's literacy skills even after parent's reading skills were accounted for. Overall, this work highlights the importance of investigating low- to middle-income, developing country contexts as a further examination of theories and findings based on samples in developed countries.

**Data Availability Statement**

The data that support the findings of this study are available from the corresponding author, Catherine McBride (cmcbride@psy.cuhk.edu.hk), Brain and Mind Institute (BMI) and Department of Psychology, 3/F Sino Building, Chinese University of Hong Kong, Sha Tin, New Territories, Hong Kong upon reasonable request.

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Table 1. Descriptive Statistics of Demographic, Literacy, and Home Literacy Environment Measures

| Variable (unit/max. score) | *M* | *SD* | Min | Max | Reliability |
|---|---|---|---|---|---|
| **Demographic Measures** | | | | | |
| Child's age (in years) | 6.65 | 0.86 | 5.08 | 8.33 | -- |
| Parent's age (in years) | 33.07 | 6.80 | 21 | 54 | -- |
| Parent's education[a] (8) | 3.64 | 1.52 | 1 | 8 | -- |
| Family income[b] (monthly) | 2.39 | 1.29 | 1 | 9 | -- |
| **Child's and Parent's Literacy Skills** | | | | | |
| Child's Cebuano vocabulary (30) | 19.76 | 3.65 | 0 | 28.50 | .71[c] |
| Child's English vocabulary (25) | 11.93 | 3.45 | 0 | 25 | .74[c] |
| Child's syllable deletion (12) | 5.91 | 4.36 | 0 | 12 | .97[c] |
| Child's phoneme isolation (12) | 2.67 | 2.92 | 0 | 12 | .97[c] |
| Child's letter name knowledge (56) | 31.19 | 20.84 | 0 | 56 | .99[c] |
| Child's letter sound knowledge (56) | 18.92 | 19.58 | 0 | 56 | .99[c] |
| Child's print/word awareness (12) | 6.70 | 3.24 | 0 | 12 | .83[c] |
| Child's Cebuano word reading (20) | 6.99 | 8.15 | 0 | 20 | .99[c] |
| Parent's English word reading fluency: Part A (314) | 78.88 | 46.18 | 0 | 207 | .98[c] |
| Parent's English word reading fluency: Part B (208) | 82.60 | 45.50 | 0 | 189 | .99[c] |
| **Home Literacy Environment** | | | | | |
| Home literacy activities (6) | 3.46 | 1.28 | 1 | 6 | .95[d] |
| Home literacy resources (5) | 2.33 | 0.97 | 1 | 5 | .93[d] |
| Adult literacy practices (6) | 2.56 | 1.02 | 1 | 6 | .82[d] |

Note. *** $p < .001$ ** $p < .01$ * $p < .05$. [a] Parent's education level: 1 = primary school level, 2 = primary school graduate, 3 = high school level, 4 = high school graduate, 5 = vocational level, 6 = college level, 7 = college graduate, 8 = postgraduate/professional degree. [b] In Philippine Pesos (₱), 1 = 0-4999, 2 = 5000-9999, 3 = 10000-14999, 4 = 15000-19999, 5 = 20000-24999, 6 = 25000-29999, 7 = 30000-39999, 8 = 40000-49999, 9 = 50000 and above, [c] Split-half reliability (Spearman-Brown formula) [d] Cronbach's alpha.

Table 2. Rank-Ordering of Home Literacy Environment Items and Correlations with Child's and Parent's Literacy Skills

| Rank | Item | M | SD | Correlations with child's and parent's literacy skills | | | | | | | | | |
|------|------|---|----|------|------|------|------|------|------|------|------|------|------|
| | | | | CV | EV | SD | PI | LNK | LSK | PWA | CWR | PEWRA | PEWRB |
| | **Home Literacy Activities** | | | | | | | | | | | | |
| 1 | Watching videos of children's songs and stories | 3.95 | 1.70 | -.01 | .08 | .12* | .02 | .07 | .09 | .04 | .05 | .18** | .17** |
| 2 | Singing the alphabet song | 3.76 | 1.63 | .06 | .10 | .13* | .00 | .13* | .12* | .07 | .05 | .17** | .16** |
| 3 | Simple writing activities (e.g., child's name) | 3.71 | 1.67 | .02 | .16** | .15** | -.01 | .16** | .16** | .11* | .11* | .18** | .10* |
| 4 | Pointing at words/letters when we read | 3.69 | 1.63 | .05 | .14* | .14* | .06 | .09 | .17** | .12* | .13* | .12* | .10* |
| 5 | Identifying letter names/sounds | 3.66 | 1.69 | .06 | .10 | .13* | .03 | .14* | .14* | .11 | .09 | .13* | .14** |
| 6 | Helping him/her to read words | 3.56 | 1.59 | .05 | .14* | .13* | .04 | .13* | .16** | .09 | .12* | .18** | .14** |
| 7 | Introducing new words and their definitions | 3.50 | 1.61 | .06 | .17** | .12* | .11* | .12* | .21*** | .12* | .12* | .12* | .12* |
| 8 | Reading storybooks | 3.32 | 1.67 | .07 | .14* | .17** | .08 | .15** | .16** | .12* | .13* | .14** | .12* |
| 9 | Talking about words/letters in everyday activities | 3.19 | 1.60 | .05 | .09 | .12* | .03 | .07 | .11 | .12* | .08 | .12* | .11* |
| 10 | Playing rhyming and word games | 3.10 | 1.63 | .03 | .08 | .08 | -.01 | .05 | .07 | .06 | .05 | .08 | .06 |
| 11 | Visiting the library or attending plays and storytelling activities | 2.46 | 1.52 | .09 | .04 | .06 | .08 | .02 | .06 | .08 | .06 | -.05 | -.02 |

| | | Mean | SD | CV | EV | SD | PI | LNK | LSK | PWA | CWR | PEWRA | PEWRB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Home Literacy Resources** | | | | | | | | | | | | | |
| N/A | Educational materials (e.g., alphabet charts) | 2.50 | 1.24 | .06 | .08 | .08 | .08 | .05 | .06 | .05 | .11 | .07 | .08 |
| N/A | Educational games (e.g., literacy computer games) | 2.43 | 1.25 | -.01 | .03 | .04 | .04 | .01 | .01 | .01 | .04 | .04 | .05 |
| N/A | Letter/word exercise books | 2.37 | 1.06 | .09 | .12* | .13* | .10 | .17** | .10 | .06 | .14* | .13* | .12* |
| N/A | Children's storybooks | 2.18 | 0.95 | .12* | .12* | .13* | .19** | .10 | .11* | .05 | .11* | .01 | .06 |
| N/A | Adult books | 2.18 | 1.19 | .00 | .01 | -.02 | .05 | -.03 | .01 | -.06 | -.01 | -.01 | .00 |
| **Adult Literacy Practices** | | | | | | | | | | | | | |
| 1 | Sending text messages | 3.59 | 1.92 | .08 | .08 | .12* | .05 | .09 | .08 | .14* | .09 | .24*** | .22*** |
| 2 | Writing posts on social media | 2.89 | 1.82 | .01 | .09 | .10 | .08 | .09 | .08 | .10 | .10 | .27*** | .26*** |
| 3 | Reading the newspaper | 2.83 | 1.57 | -.05 | -.02 | -.02 | -.08 | .00 | -.05 | -.02 | -.02 | .07 | .11 |
| 4 | Completing word puzzles | 2.34 | 1.48 | .03 | .05 | .02 | .03 | .00 | .03 | .03 | .06 | .03 | .12* |
| 5 | Reading religious texts | 2.32 | 1.27 | .10 | .09 | .05 | .04 | .04 | .02 | .04 | .07 | -.04 | .00 |
| 6 | Sending letters or emails | 2.03 | 1.50 | -.01 | .04 | -.02 | .03 | -.01 | -.02 | .03 | .04 | .03 | .01 |
| 7 | Reading pocketbooks/novels | 1.94 | 1.36 | -.08 | -.11 | -.05 | .00 | -.09 | -.09 | -.02 | -.01 | -.09 | .01 |

Note: Items on the Home Literacy Activities and Adult Literacy Practices are rated on a 6-point scale: 1 = never, 2 = rarely, 3 = once a week, 4 = several times a week, 5 = once a day, 6 = several times a day. Items on the Home Literacy Resources scale are rated on a 5-point scale (1 = none, 2 = 1-9, 3 = 10-29, 4 = 30-49, 5 = 50 or more / 1 = none, 2 = 1-3 sets, 3 = 4-6 sets, 4 = 7-9 sets, 5 = 10 sets or more). CV = Cebuano vocabulary, EV = English vocabulary, SD = syllable deletion, PI = phoneme isolation, LNK = letter name knowledge, LSK = letter sound knowledge, PWA = print/word awareness, CWR = Cebuano word reading, PEWRA = Parent's English word reading fluency: Part A, PEWRB = Parent's English word reading fluency: Part B. *** $p < .001$ ** $p < .01$ * $p < .05$.

Table 3. Correlations Among Study Variables

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Child's gender | 1 | | | | | | | | | | | | | | | | | |
| 2 | Child's age | .02 | 1 | | | | | | | | | | | | | | | | |
| 3 | Child's grade | .05 | .80*** | 1 | | | | | | | | | | | | | | | |
| 4 | Parent's age | .00 | .02 | .05 | 1 | | | | | | | | | | | | | | |
| 5 | Parent's education | -.05 | -.13* | -.07 | .10 | 1 | | | | | | | | | | | | | |
| 6 | Family income (monthly) | -.04 | -.11 | -.12* | -.04 | .23*** | 1 | | | | | | | | | | | | |
| 7 | Home literacy activities | .01 | -.01 | .01 | -.09 | .14* | .01 | 1 | | | | | | | | | | | |
| 8 | Home literacy resources | .06 | .10 | .10 | -.04 | .11* | .03 | .33*** | 1 | | | | | | | | | | |
| 9 | Adult literacy practices | -.02 | .01 | .04 | -.12* | .19** | -.03 | .58*** | .22*** | 1 | | | | | | | | | |
| 10 | Child's Cebuano vocabulary | -.04 | .49*** | .43*** | .01 | .12* | .03 | .06 | .06 | .02 | 1 | | | | | | | | |
| 11 | Child's English vocabulary | -.12 | .35*** | .30*** | .07 | .25*** | .11 | .15** | .08 | .06 | .58*** | 1 | | | | | | | |
| 12 | Child's syllable deletion | -.06 | .45*** | .39*** | -.09 | .19*** | -.05 | .15** | .08 | .06 | .55*** | .52*** | 1 | | | | | | |
| 13 | Child's phoneme isolation | .04 | .35*** | .35*** | .00 | .24*** | .02 | .05 | .10 | .03 | .44*** | .47*** | .53*** | 1 | | | | | |
| 14 | Child's letter name knowledge | .08 | .45*** | .43*** | -.02 | .20*** | -.11 | .13 | .07 | .04 | .55*** | .51*** | .60*** | .52*** | 1 | | | | |
| 15 | Child's letter sound knowledge | .06 | .32*** | .27*** | -.04 | .24*** | -.01 | .17 | .06 | .02 | .47*** | .53*** | .60*** | .65*** | .72*** | 1 | | | |
| 16 | Child's print/word awareness | .06 | .52*** | .48*** | -.02 | .13* | -.04 | .12* | .03 | .08 | .58*** | .53*** | .62*** | .53*** | .64*** | .61*** | 1 | | |
| 17 | Child's Cebuano word reading | .06 | .58*** | .54*** | -.02 | .12* | -.07 | .11* | .09 | .08 | .47*** | .46*** | .57*** | .59*** | .68*** | .69*** | .72*** | 1 | |
| 18 | Parent's English word reading fluency: Part A | .01 | .04 | .04 | -.10 | .36*** | .07 | .12* | .06 | .14 | .15** | .22*** | .25*** | .20*** | .36*** | .29*** | .21*** | .23*** | 1 |
| 19 | Parent's English word reading fluency: Part B | -.03 | .02 | .02 | -.15** | .45*** | .15 | .10 | .07 | .18** | .18** | .24*** | .27*** | .24*** | .30*** | .29*** | .22*** | .21*** | .74*** |

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

*** INSERT FIGURE 1 ***
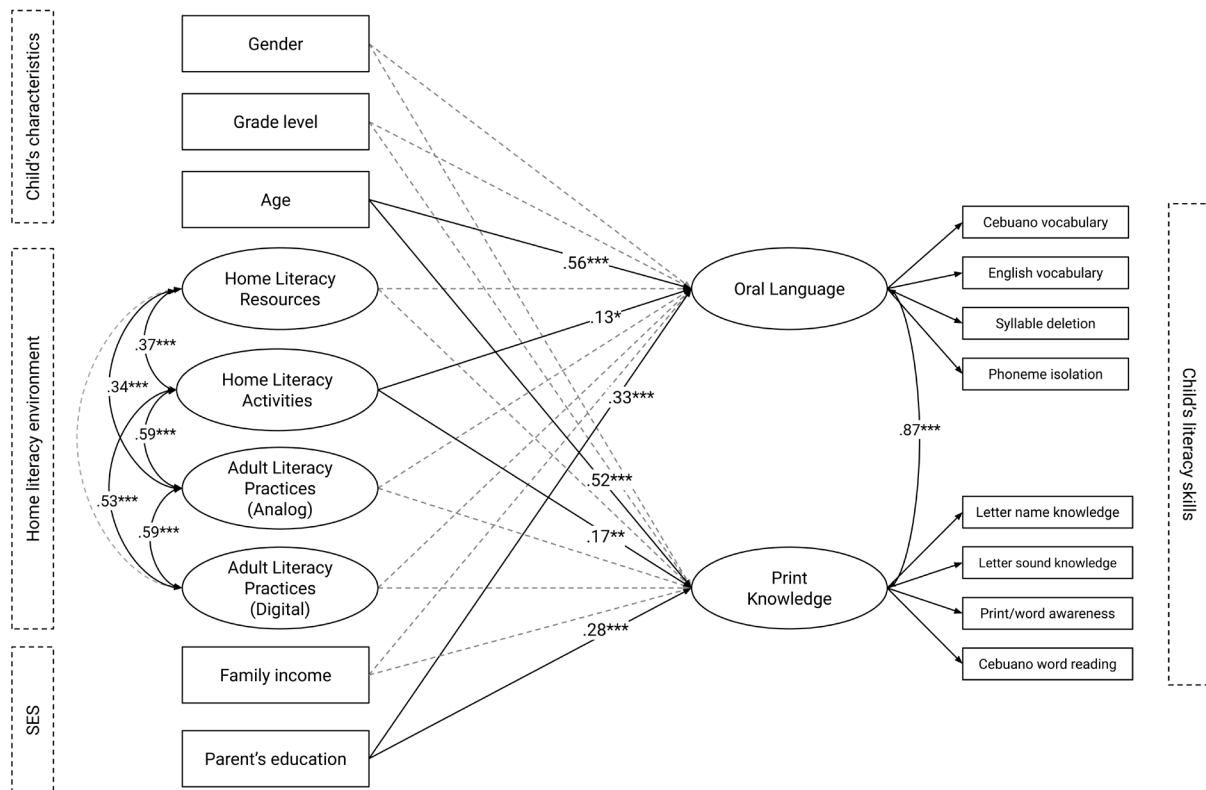
*** INSERT FIGURE 2 ***
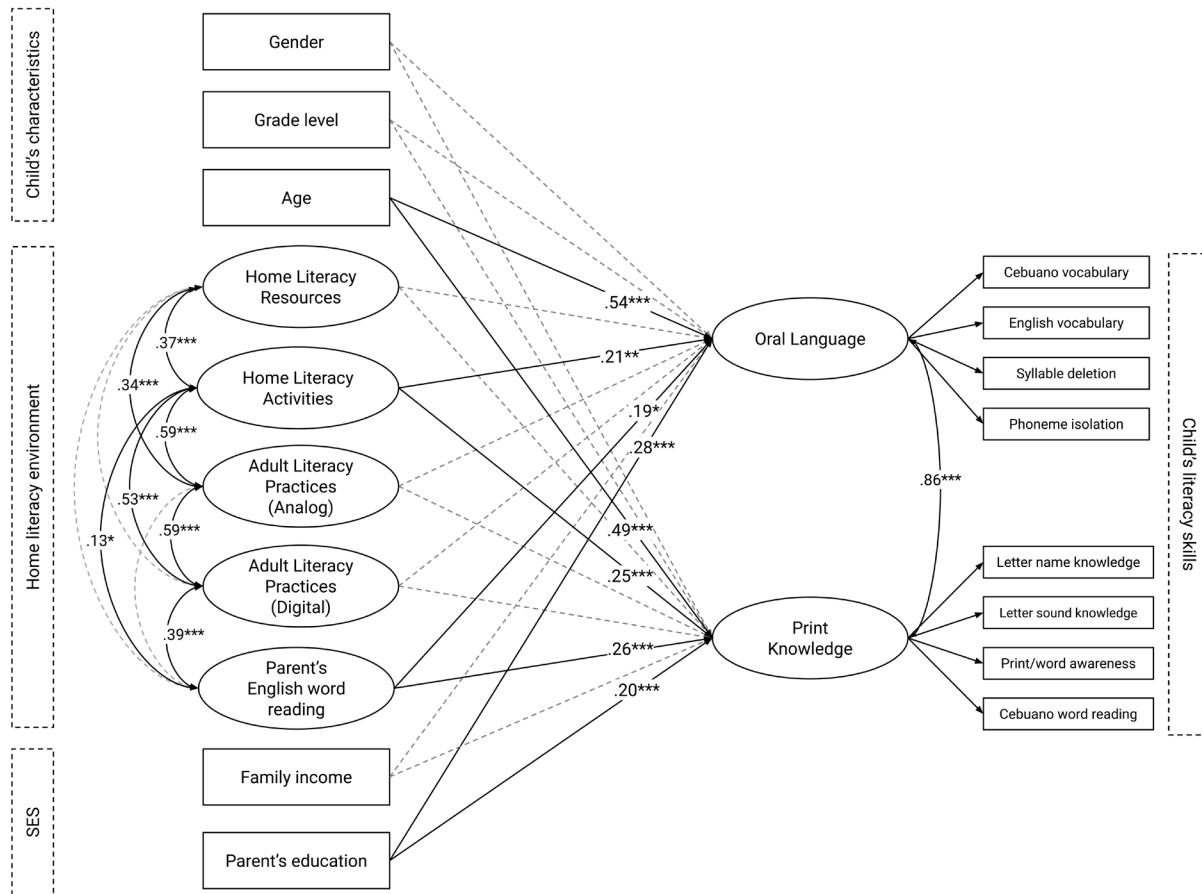
Appendix

Analysis of Clustering Effects

Results presented in the current study represent data from Time 5 of a larger longitudinal study (Cheung, Yang, Dulay, & McBride, 2017; Dulay et al., 2018a; Dulay et al., 2019). This included a 12-week intervention program for numeracy, dialogic reading, and early literacy skills, with an untrained control group, between Time 1 and Time 2. Significant group differences in numeracy, language, and literacy skills were found immediately after the intervention (Dulay et al., 2019), and a general pattern of fade-out effects were found in Time 3 and Time 4 (Dulay et al., 2018b).

Time 1 data collection was from June-July 2015 (pretest), Time 2 was from November-December 2015 (posttest), Time 3 was in May 2016 (6-month follow-up), Time 4 was from November-December 2016 (12-month follow-up), and Time 5 was from November-December 2017 (24-month follow-up), with additional assessments conducted between January-March 2018. Hence, a period of 2 years had elapsed since the intervention program was implemented. Furthermore, the children lived in adjacent communities, making it more likely that they attended the same schools.

To verify that an analysis on Time 5 data was appropriate for this sample, linear mixed models were specified to look at potential systematic differences among children in the following Time 5 measures: Cebuano vocabulary, English vocabulary, syllable deletion, phoneme isolation, letter name knowledge, letter sound knowledge, print/word awareness, and Cebuano word reading. Fixed effects (intervention group membership) and random effect intercepts (school name) with a variance components covariance structure were specified in the

models. No significant results were found in any of the measures analyzed, indicating complete

fade-out of intervention effects and no evidence of significant school effects.